MANAGERIAL ECONOMICS

A Problem-Solving Approach

Froeb / McCann

2nd Edition

Managerial Economics

A Problem Solving Approach

SECOND EDITION

LUKE M. FROEB
Vanderbilt University

BRIAN T. McCANN
Vanderbilt University

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Luke M. Froeb, Brian T. McCann

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For Lisa, Halley, Jake, and Chris

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PREFACE

Teaching Students to Solve Problems

by Luke Froeb

When I began teaching at a business school, I taught economics as I had learned it, using formal models and public policy applications. My students could not see its relevance to business, and our late dean, Marty Geisel, threatened to fire me unless customer satisfaction increased.

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

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

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

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

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

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

[1]The art of business is to find an asset in a lower-valued use and figure out how to profitably move it to higher-valued use.
[2]Michael Jensen and William Meckling, *A Theory of the Firm: Governance, Residual Claims and Organizational Forms* (Cambridge, MA: Harvard University Press, 2000); and James Brickley, Clifford Smith, and Jerold Zimmerman, *Managerial Economics and Organizational Architecture* (Chicago: Irwin, 1997).

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

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

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

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

[3]Charles C. Schroeder, "New Students—New Learning Styles," *Change* 25, no. 5 (September 1993): 21.
[4]http://hadm.sph.sc.edu/Courses/Econ/Tutorials.html

companies. The group problems are less effective for students with less work experience, so I use them sparingly, or not at all, in the regular MBA program.

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

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

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

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

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

Thanks to everyone who contributed, knowingly or not, to the book. I owe intellectual debts to former colleagues at the U.S. Department of Justice (among them, Cindy Alexander, Tim Brennan, Ken Heyer, Kevin James, Bruce Kobayahsi, and Greg Werden); to former colleagues at the Federal Trade Commission (among them Bill Blumenthal, Bob Brogan, Jerry Butters, Liz Callison, James Cooper, Susan Creighton, Pat DeGraba, Tim Deyak, Jeff Fischer, Mark Frankena, Hadeishi Hajime, Dan Hosken, David Hyman, Pauline Ippolito, Jim Lacko, Bill Kovacic, Tom Krattenmaker, Rob McMillan, Joe Mulholland, Tim Muris, Dan O'Brien, Maureen Ohlhausen, Jan Pappalardo, John Parisi, Lydia Parnes, Paul Pautler, Lee Peeler, Dave Schmidt, Joel Schrag, Lou Silvia, Chris Taylor, Steve Tenn, Randy Tritell, and Mike Vita); to colleagues at Vanderbilt (among them, Germain Boer, Jim Bradford, Bill Christie, Mark Cohen, Myeong Chang, Craig Lewis, Doug Meeks, Rick Oliver, David Rados, Steven Tschantz, David Scheffman, Mikhael Shor, and Bart Victor); and to numerous friends and colleagues who offered suggestions, problems, and anecdotes for the book, among them,

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[5]Armen Alchian and William Allen, *Exchange and Production*, 3rd ed. (Belmont, CA: Wadsworth, 1983).
[6]Henry Hazlitt, *Economics in One Lesson* (New York: Crown, 1979).
[7]Shlomo Maital, *Executive Economics: Ten Essential Tools for Managers* (New York: Free Press, 1994).
[8]John McMillan, *Games, Strategies, and Managers* (Oxford: Oxford University Press, 1992).
[9]Steven Landsburg, *The Armchair Economist: Economics and Everyday Life* (New York: Free Press, 1993).
[10]Ivan Png, *Managerial Economics* (Malden, MA: Blackwell, 1998).
[11]http://www.mbaprimer.com
[12]Michael Jensen and William Meckling, *A Theory of the Firm: Governance, Residual Claims and Organizational Forms* (Cambridge, MA: Harvard University Press, 2000).
[13]James Brickley, Clifford Smith, and Jerold Zimmerman, *Managerial Economics and Organizational Architecture* (Chicago: Irwin, 1997).

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SECTION I

Problem Solving and Decision Making

CHAPTER 1

Introduction: What This Book Is About

In 1992, a young geologist was preparing a bid recommendation for an oil tract on the outer continental shelf in the Gulf of Mexico. He suspected that this new tract of land contained a large accumulation of oil because the adjacent tract contained several productive wells—wells that his company, Oil Ventures International (OVI), already owned. The geologist estimated both the amount of oil the tract was likely to contain and what competitors were likely to bid; then, given these estimates, he recommended a bid of $5 million. No competitors had neighboring tracts, so none suspected a large accumulation of oil.

Surprisingly, OVI's senior management ignored the recommendation and submitted a bid of $20 million, and the company won the tract—over the next-highest bid of $750,000.

If the board of directors hired you as a management consultant 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, if not openly hostile. No one likes to be singled out for bidding $19 million more than necessary to win. Likewise, our junior geologist would be reluctant to criticize his superiors. You might be able to rely on your experience—provided that you had ever run into a similar problem. But when you have no experience or when you face novel problems, you'd be lost.

Our goal in this book is to give you the tools you need to complete an assignment like this one.

PROBLEM SOLVING

To solve a problem like OVI's, you have to figure out what's wrong, and then you have to figure out how to fix it. Here, you'd begin by determining whether the $20 million bid was too high at the time it was made, not just in retrospect. Next, if the bid was too high at the time it was made, you'd have to figure out why the senior managers overbid and find ways to make sure they don't do it again.

Both steps require that you predict how people are likely to behave in different circumstances—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, this paradigm says that people act rationally, optimally, and self-interestedly. The paradigm not only helps you figure out why people behave the way they do but also suggests how to motivate them to change. To change behavior, you have to change people's self-interests; you can do that by changing incentives.

Let's go back to OVI's story. 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 then the company drilled a well that was essentially dry. Furthermore, the company could access what little oil there was in the new tract through existing wells, so the acquisition did nothing to increase the size of the company's oil reserves. Our geologist reevaluated the reservoir map and then reduced the reserve estimate by two-thirds. Senior management, however, rejected the revised 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 and added "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 bonus plan is the key piece of evidence that ties all the evidence together. You can see that both the overbidding and the effort to inflate the reserve estimate were rational, self-interested responses to incentives. 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 better way to align the managers' incentives with company goals. You want to find a way to reward management for increasing profitability, not 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 measurement subjectively, with annual performance reviews, or objectively, using company earnings or stock price appreciation as performance metrics. Each performance measure has problems, as we'll see in later chapters.

In general, rational, self-interested actors make mistakes for one of two reasons. Either they do not have enough information to make good decisions, or they lack incentives to do so. Accordingly, when you're using the rational-actor paradigm to find the cause of a problem, you need to ask only three questions:

- Who is making the bad decision?
- Does the decision maker have enough information to make a good decision?
- Does the decision maker have the incentives to make a good decision?

Answers to these three questions will immediately suggest ways to fix the problem by

- letting someone else make the decision,
- giving more information to the decision maker, or
- changing the 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. These answers suggest changing incentives as one potential way to fix the problem.

When reading about various business mistakes in this book, you should ask yourself these three questions to see if you can diagnose and fix the problems before reading the answers. By the time you finish the book, this kind of analysis should become second nature.

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 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.

Often, these kinds of debates are really debates about value systems, between deontology and consequentialism. Deontologists judge actions as good or ethical by whether they conform

[1]Amitai Etzioni, "When It Comes to Ethics, B-Schools Get an F," *Washington Post*, August 4, 2002.

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 views, consider this story about price gouging during periods of high demand.[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 travelers only $129 a night on non-football 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 Jesuits, 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 Jesuit 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.

Ethicists like Professor Holt would object to the practice of raising prices in times of shortage based on principle.[3] We might label one such principle, the *Spider Man principle:* With great power comes great responsibility. The laws of capitalist systems 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, gives us an ethical 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. 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. Also, without the ability to earn additional profit during times of scarcity, hotels would have smaller incentives to build additional rooms, which would make the problem even worse!

[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.

Versions of this debate—between those who take a principled approach to business 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 political 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 Jesuit 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.

-----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 asked the following, using 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?!!!)

-----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...

-----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?

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.

CHAPTER 2

The One Lesson of Business

Recently, both Beth Israel Deaconess Medical Center (affiliated with Harvard Medical School) and New York University Hospital refused to perform kidney transplants for two seriously ill patients.[1] The reason? The kidneys were "directed donations" from strangers rather than anonymous donor organs or kidneys from close relatives. A number of hospitals refuse to support such directed donation programs. They hold this position despite the fact that more than 66,000 Americans are on the waiting list for kidney donations, and some 40,000 of those have been waiting for more than a year to receive a kidney. Unfortunately, "the most common way to get off the list is to die."[2] The problem afflicts rich and poor alike because it's illegal to buy or sell human kidneys in the United States, although a black market flourishes.

Let's start this chapter by asking the following question: Why is buying or selling human kidneys in the United States illegal? Here are some common, and conflicting, views on the question. Choose the answer that best reflects your views.

A. Trafficking in body parts is morally abhorrent and should be condemned as such. Only libertarians and investment bankers would trust markets to make such life-and-death decisions.
B. Do-gooders and religious leaders don't understand that outlawing kidney sales reduces the quantity of kidneys available for transplant. I hold them responsible for the thousands of patients who die each year waiting for donated kidneys.
C. Who cares why it's illegal? If I can borrow $100 million at 20% interest, I can buy a hospital ship, anchor it in international waters, and begin selling kidneys. I can set up a database to match donors to recipients, broker sales, and fly in experienced transplant teams. If I charge $200,000 and earn 10% on each transaction, the break-even quantity is just 1,000 transplants each year. This represents about 1% of the potential demand in the United States alone.

If you're like most people, you answered A. If you paid attention during your economics class, you have the analytical tools to know that B is correct. But rather than wading into the

[1] See Virginia Postrel, "'Unfair' Kidney Donations," *Forbes*, June 5, 2006.
[2] Ibid.

ethical debate[3] between A and B, we want to show you how to solve the problem profitably (answer C). Those of you starting at B have a slight edge, but getting to C requires as much creativity and imagination as analytic ability.

Students who've had some economics training will find the material in this chapter especially useful because it shows how *managerial economics* differs from its public policy cousin, microeconomics, or equivalently, how business differs from economics.

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 the amount of money he or she is willing to pay for it.[4] This willingness requires both desire for the good and the ability to pay for it.[5] 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."

[3]Response from a Methodist theologian:

1. A principle derived from biblical and church traditions is that what is necessary for life should not be a commodity (or exhaustively a commodity).
2. Are you sure there is such a thing as a pure market that does not manipulate? Aren't most persons who would sell one of their own kidneys under the duress of poverty?
3. A second kidney—one of a pair—may be somewhat different from other vital organs, but the loss of a kidney does put one in greater jeopardy. We do our best to block other markets that decrease the health prospects of persons.
4. The tradition offers many reservations not only against selling a person (an embodied spirit) but also a part of this embodiedness.
5. Why has the mystery of giving one's life for the sake of another life become such an aporia for us?

[4]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. Although capitalism is concerned with making the proverbial "pie" as large as possible, Socialism and Communism are concerned more about how to slice up that pie.

[5]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.

The biggest advantage of capitalism is that it creates wealth by letting a person follow his or her self-interest.[6] 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 $130,000 and a seller at $120,000. If they can agree on a price—say, $128,000—the seller receives $8,000 more than the price at which she's willing to sell it for. The difference between the agreed-on price and the seller's value is called **seller surplus**. Likewise, the buyer receives an item worth $2,000 more than he is willing to pay; his **buyer surplus** is equal to his value minus the price. The total surplus or *gains from trade* created by the transaction is the sum of buyer and seller surplus ($10,000), the difference between the buyer's and the seller's values.

The following are examples of wealth-creating, voluntary transactions:

- Internet auctions, like those on eBay, have replaced traditional selling mechanisms (like garage sales and newspaper classified ads) because Internet auctions are much better at matching buyers and sellers. An enthusiastic collector in Boise can now buy an item that a Shreveport resident might have otherwise relegated to the trash heap for lack of local interest.[7]
- Corporate raiders buy up companies and sell off their component pieces. They earn money only if the value of the sum of the pieces is higher than the value of the company as a whole.
- 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.
- 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.

[6]This is the idea behind the French phrase *laissez-faire* (leave them alone).

[7]Because of Internet technology, auctions are being used to trade more and different types of goods than ever before. According to a *New York Times* article, less than 10% of the sellers are responsible for more than 80% of the sales. "Power sellers" sell items like collectible dolls, cards and coins, jewelry, and overstocked clothing. See, for example, Lisa Guernsey, "The Power behind the Auctions," *New York Times*, August 20, 2000, section 3, 1; David Lucking-Reiley, "Auctions on the Internet: What's Being Auctioned, and How?" *Journal of Industrial Economics* 48, no. 3 (September 2000): 227–252; and Miriam Herschlag and Rami Zwick, "Internet Auctions—A Popular and Professional Literature Review," *Quarterly Journal of Electronic Commerce* 1, no. 2 (2000): 161–186.

- AIDS patients will often 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.

Our biggest and most valuable assets are corporations, so it is not surprising that a lot of firms try to find higher-valued uses for entire companies. 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, lease payments doubled. Soon, the 59-year-old retailer went out of business, throwing 30,000 employees out of work.

So why is this a wealth-creating transaction? Because the real estate eventually found its way to a higher-valued use. Charging market rates to the retailer uncovered the real source of Mervyn's profit, its real estate. It also exposed the retail operation as a money-losing entity. So the private equity group made money by moving real estate to a higher-valued use and by shutting down a money-losing operation.

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. They do not understand that the voluntary nature of trade ensures that both parties gain. This is such a common mistake that it even has a name, the "zero sum fallacy." Policy makers invoke this fallacy to justify limits on pay, profitability, or prices. They do not seem to understand that their policies often hurt the very people they are designed to help.

DO MERGERS MOVE ASSETS TO HIGHER-VALUED USES?

In 2006, Dell purchased Alienware, a manufacturer of liquid-cooled, high-end gaming computers. Dell planned to leave the design, sales, marketing, and support of Alienware computers under the control of a separate division, run by the acquired firm's management team; however, Dell planned to take control of their manufacture. By plugging Alienware into the Dell supply chain, Dell hoped to be able to manufacture Alienware computers much faster and at lower cost than Alienware. For this reason, the acquired company was worth more to Dell than it was to Alienware's shareholders. In other words, the acquisition moved the assets of Alienware to a *higher-valued use*.

For most mergers, however, the value creation is not nearly so obvious. Following announcement of a merger, the stock price of the acquired firm typically increases, but the stock price of the acquiring firm simultaneously decreases. And more often than not, the fall in value of the acquiring firm is bigger than the increase in value of the acquired firm, so that the merger appears to be destroying value, or moving assets to *lower-valued uses*.

This observation corresponds to the experience of regulators who enforce the antitrust laws that prevent anticompetitive mergers. The internal documents of the merging firms rarely articulate the value-creating purpose of the merger. Instead, the internal merger memos say only that the acquired firm is unusually profitable or has a large market share.[8]

But profit or share is worth just as much to the acquired company's shareholders as it is to the acquiring firm, so this motivation is not a good reason to transact. Unless there is some synergy—like that between Dell and Alienware—which makes the acquired firm more valuable to the buyer than it is to the seller, the assets are not necessarily moving to a higher-valued use.

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.[9] Wealth-creating transactions are more likely to occur when sellers and buyers can keep the gains from trade. The U.S. legal system, with its protections for private property, is designed to secure the gains from trade and is responsible for our nation's enormous wealth-creating ability.[10]

Conversely, the absence of property rights contributes to poverty. People living in countries with little economic freedom had an average per-capita income of just $2,560 and an average *negative* economic growth rate of 0.9%.[11] In countries that enjoy a higher level of economic freedom, income and growth are much higher, averaging $23,450 and 2.6%, respectively.[12] The reasons are simple: Without private property and contract enforcement, wealth-creating transactions are less likely to occur[13] 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

[8]Luke Froeb, "If Merger Is the Answer, What Is the Question?," *M&A Journal* (March 2006).

[9]"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.

[10]Tom Bethell, *The Noblest Triumph: Property and Prosperity through the Ages* (New York: St. Martin's Press, 1995).

[11]Similar findings are in Lee Hoskins and Ana I. Eiras, "Property Rights: The Key to Economic Growth," in *2002 Index of Economic Freedom*, ed. Gerald P. O'Driscoll Jr., Kim R. Holmes, and Mary Anastasia O'Grady (Washington, DC: Heritage Foundation and Dow Jones, 2002).

[12]James Gwartney and Robert Lawson, *The Economic Freedom of the World: 2002 Annual Report* (Vancouver: Fraser Institute , 2002).

[13]"The inherent vice of capitalism is the unequal sharing of blessings; the inherent virtue of socialism is the equal sharing of miseries" (Winston Churchill).

longer (to 70 instead of 50).[14] In other words, if you give people ownership to their property, they take care of it, invest in it, and keep it clean.

Peruvian economist Hernando de Soto is trying hard to convince Third World governments to try this approach to fighting poverty.

> *"Imagine a country," de Soto says, "where nobody can identify who owns what, addresses cannot be verified and the rules that govern property vary from neighborhood to neighborhood, or even from street to street." This is what life is like, he says, for 80% of the people in the developing world and the former communist countries.*[15]

Without title to the property, not only do people find it difficult to get credit, but they have to spend an enormous amount of time protecting their property—often from the government itself. All of this makes it much more difficult to rise out of poverty.

Professor de Soto has encouraged governments to fight poverty with legal systems that protect private property and encourage transactions. Fortunately, his ideas are gaining credence in the world community, if only because most other approaches to fighting poverty have failed.[16]

ECONOMICS VERSUS BUSINESS

Economics is useful to business because it shows us how to spot money-making opportunities (assets in lower-valued uses). However, economics is not easy to learn because it is taught on a very abstract level, often using complex models. Fortunately, the most useful ideas in economics are not that difficult. In this section we teach the ideas of economics that are most useful to business.

We begin with efficiency, the Holy Grail of 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 to higher-valued uses 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:[17]

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[14]Seth Norton, "Property Rights, the Environment, and Economic Well-Being," in *Who Owns the Environment?* ed. Peter J. Hill and Roger E. Meiners (Lanham, MD: Rowman and Littlefield, 1998).

[15]Matthew Miller, "The Poor Man's Capitalist: Hernando de Soto," *New York Times Magazine*, July 1, 2001.

[16]Interview with Hernando de Soto by Dario Fernandez-Morera at *Reason Online*, http://reason.com/DeSoto.shtml

[17]Henry Hazlitt, *Economics in One Lesson* (New York: Crown, 1979).

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.[18]

For example, recent proposals to prevent lenders from foreclosing on houses will benefit the delinquent homeowners, but the policy will also raise the costs of lending to new homeowners. And as Steven Landsburg has noted, "one man's foreclosure is another man's joy."[19] The houses don't disappear; they simply change hands. Determining whether the policy improves efficiency requires that we look not only the sad faces of the family moving out, but also the happy faces of the family moving in.

In our analysis of the prohibition on selling kidneys, well-intentioned legislators were probably trying to stop what they considered immoral trade in human flesh. The one lesson of economics tells them to consider that their policy also reduced the incentive to donate kidneys. This means fewer kidneys available to save people and, consequently, more deaths. We call the policy inefficient because some current kidney owners would willingly sell their organs to recipients who would gladly pay.

Having identified inefficiency—an asset in a lower-valued use—economists will argue for changes in public policy to eliminate the inefficiency. It is here that business parts ways with economics. Although economists see inefficiency as a threat, and something to be eliminated, businesspeople see inefficiency as an opportunity, and something to be exploited. They realize that inefficiencies (including those created by public policy) give them an opportunity 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 puts 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

[18]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.

[19]Steven Lansburg, "The Case for Foreclosure," *Slate*, March 3, 2008, http://www.slate.com/id/2185303/

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.[20]

In the following examples, we want you to first apply the "one lesson of economics" to each government policy to identify which assets end up in lower-valued uses. Next, think about applying the "one lesson of business" to devise a way to profitably move the assets to a higher-valued use.

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 10%, the tax has to be at least $12,000 because the price has to be above the seller's value ($120,000). Since the tax is more than the $10,000 surplus created by the transaction, the buyer and seller cannot find a mutually agreeable price that lets them pay the tax.[21]

First, apply the "one lesson of economics" to determine all of the consequences of the tax, both the intended and unintended ones. The intended effect of a tax is to raise revenue for the government, but the unintended consequence of a tax is that it stops some wealth-creating transactions. If too many transactions are deterred, then raising tax rates can actually reduce tax revenue. As John F. Kennedy said, "An economy hampered by restrictive tax rates will never produce enough revenues to balance our budget—just as it will never produce enough jobs or profits." To illustrate the transaction-deterring effect of taxes, we need only look at California, which has the highest combined income (10%) and sales (8%) tax rates in the country. These taxes reduce the incentive to work and to move assets to higher-valued uses. In addition, the wealthiest and most productive people are leaving the state. Both of these factors have contributed to a sharp drop in tax revenue. As this book goes to press, the state is on the verge of bankruptcy.

All of these unconsummated transactions represent money-making opportunities to a businessperson. To make money, figure out how they can be profitably consummated. Here's an 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.

[20]Jeneen Interlandi, "Not Just Urban Legend," *Newsweek*, January, 19, 2009.

[21]With a 10% tax, the seller receives 90% of the sales price. If her bottom line is $120,000, then the transaction price must be at least $133,333 = $120,000/0.9. If the tax is levied on the seller, her bottom-line price increases to $132,000, which is above the buyer's top dollar of $130,000. If the tax is levied on the buyer, his top dollar decreases to $118,182, which is below the seller's bottom line. The buyer is willing to pay only $130,000 after paying the tax; that is, $X(1.1) = \$130{,}000$ or $X = \$118{,}182$.

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?"[22]

He qualified mainly 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 turn to a simple example: 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. Is this a wealth-creating transaction? (Hint: Would you rather self-medicate and keep the $200 or visit the doctor?) If employees would rather suffer at home and keep the $200, then this subsidy destroys wealth.

Employers could profit by offering insurance that requires a deductible or copayment. These fees would stop low-value doctor visits and dramatically reduce the cost of insurance. Employers could keep the money or simply raise workers' wages (by the amount they save on insurance) to attract better workers.

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

[22]David Streitfeld and Gretchen Morgenson, "Building Flawed American Dreams," *New York Times*, October 18, 2008.

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.[23] In our kidney example, potential kidney sellers are deterred from selling because they can do so only at a price of zero.

Rent control in New York City is another example of a price ceiling. Potential tenants who are willing to pay more than the price ceiling and potential landlords who are willing to rent at prices above the ceiling are deterred from transacting. The price control destroys wealth by preventing the movement of apartments to higher-valued uses.

Price controls also create money-making opportunities. For example, the Federal Reserve's Regulation Q (enforced until the mid-1970s) placed a 5.25% price ceiling on interest rates that U. S. banks paid to depositors. This price control deterred wealth-creating transactions between consumers willing to lend at a rate higher than 5.25% and borrowers willing to borrow at a higher rate. As intermediaries between lenders and borrowers, banks had a big incentive to try to circumvent the regulation. U.S. banks began to offer nonprice incentives, like toasters, to attract additional deposits. And foreign banks, not subject to U.S. regulation, offered dollar-denominated savings accounts to U.S. depositors at higher interest rates. The success of these dollar-denominated savings accounts, called *eurodollars*, in attracting U.S. deposits eventually forced the Federal Reserve to abandon Regulation Q.

Many states have price-gouging laws that prevent stores from raising prices following a natural disaster. This inevitably leads to shortages, like those following Hurricane Katrina in Mississippi. John Shepperson, a Kentucky resident, recognized a money-making opportunity. He bought 19 electrical generators and drove 600 miles to Mississippi in a rented U-Haul, and began selling the generators for twice what he paid for them. He made money and his customers were thrilled to have power.

Unfortunately, Shepperson was arrested for price gouging, and thrown in jail. The Mississippi Attorney General confiscated the generators, and they remained in police custody until long after the emergency had passed.[24]

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

[23]Price floors below a seller's bottom line and price ceilings above a buyer's top dollar have no effect.
[24]Matt Zwolinski, "Price Gouging in a Free Market, *San Diego Union*, September 18, 2008.

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" 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.

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. This inefficiency implies a money-making opportunity.
- The art of business consists of identifying 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. Who is most likely to value a new pickup truck?
   a. A recent college graduate with a new child
   b. A financially comfortable construction manager
   c. A college student getting ready to move
   d. A wealthy Fortune 500 executive
2. Which of the following is not an example of the government's role in helping create wealth?
   a. Assessing property taxes
   b. Recording property transactions
   c. Providing federal courts to adjudicate contract disputes
   d. Assigning street addresses
3. When are parties likely to engage in transactions?
   a. If they both gain from the transaction
   b. If the sale price is above the seller's value and below the buyer's value
   c. When the total gains from trade are greater than zero
   d. All of the above

4. The existence of underemployed assets:
   a. is inefficient because not all assets are being put to their highest use.
   b. implies the potential for money-making opportunities.
   c. provides the opportunity for wealth-creating transactions.
   d. All of the above
5. In a transaction for a good valued at $100,000 by a buyer and $95,000 by a seller, what amount of tax would result in an unconsummated transaction?
   a. Any tax amount would result in an unconsummated transaction.
   b. A tax of $1,500
   c. A tax of $5,500
   d. It depends on how much the parties are willing to pay (and accept) for the good.

Individual Problems

2-1 Property Rights

Why are property rights so important in creating wealth?

2-2 Goal Alignment at a Small Manufacturing Company

The owners of a small manufacturing company have hired a manager to run the company with the expectation that he will buy the company after five years. Compensation of the new vice president is a flat salary plus 75% of the first $150,000 of profit and then 10% of profit over $150,000. Purchase price for the company is set as 4.5 times earnings (profit), computed as average annual profitability over the next five years. Does this contract align the incentives of the new vice president with the goals of the owners?

2-3 Rent Control

Figure out how to profitably consummate the unconsummated wealth-creating transaction created by rent control.

2-4 Price Ceilings

Defenders of Communist economic systems may point out that consumers pay lower prices for certain goods because the government imposes a limit on what producers may charge. Cite at least two other ways that consumers may be "paying" for these goods.

2-5 Taxes

Consider a seller who values a car at $9,500 and a buyer who values the same car at $10,000. What total surplus will result from a transaction between the two when the seller is faced with the following sales tax rates: 0%, 2%, 4%, 6%, and 8%?

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.

CHAPTER 3

Benefits, Costs, and Decisions

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

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

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

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

BACKGROUND: VARIABLE, FIXED, AND TOTAL COSTS

For decisions that affect output, knowing how costs vary with output will help you compute some of the costs associated with these decisions. To illustrate, suppose that you are the manager of a new candy factory. To produce candy, you have to build a factory, purchase ingredients, and hire employees to run it and to sell your product. Suppose your factory cost is $1 million, employees cost $50,000 total each, and ingredients cost $0.50/candy bar. If you decided to

produce 1,000 candy bars, you need to hire ten employees, but if you decide to produce 2,000 bars, you need 20 employees. For 2,000 bars, your production costs would be $1,500,500—$1 million for the factory, $500,000 in employee costs, and $500 in ingredient costs. If you decide to produce 2,000 bars, your costs would be $2,001,000—$1 million for the factory, $1 million in employee costs, and $1,000 in ingredients.

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

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

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

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

TABLE 3-1 Candy Factory Costs

	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

[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.

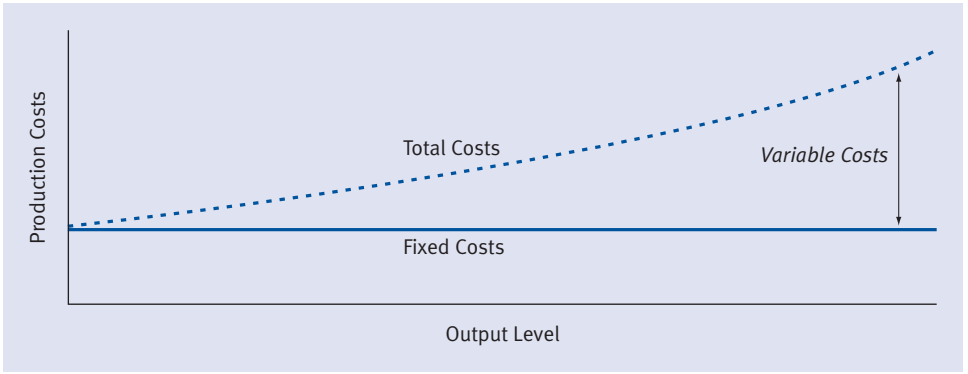

FIGURE 3-1 Cost Curves

- 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]

BACKGROUND: ACCOUNTING VERSUS ECONOMIC PROFIT

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

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

After EVA® adoption, Bombay's division saw a charge on its annual income statement equal to $600,000 (15% times $4,000,000—the value of the apartments).[3] To increase their division's EVA®, senior managers decided to sell the unused apartments. By charging each division for the

[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.

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

amount of capital it uses, the company gives managers incentives to abandon investments earning less than 15% and to undertake only those investments earning more than 15%.

The Bombay Cadbury managers likely had a very good sense of their factories' variable, fixed, and total costs. So why were they making bad decisions concerning the company-owned flats? To understand this problem, we must recognize another very important distinction: the difference between accounting and economic costs. Table 3-2 presents a recent annual income statement for Cadbury.[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, or approximately 6.4%. Expense categories include items like the following:

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

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

[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.

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

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

COSTS ARE WHAT YOU GIVE UP

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

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

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

To illustrate the link, consider the Cadbury managers' decision to hold onto the company-owned flats. Management could have sold them and used the capital to expand operations. In other words, the cost to the company of holding onto the apartments was the forgone opportunity to invest capital in the company's operations and earn a 15% return. Holding onto the flats cost the company $600,000 each year. Unless the benefits to the company of holding onto the apartments were at least $600,000, the capital was not employed in its highest-valued use.

Managers ignored the empty flats on the company's balance sheet because they had no incentive to do otherwise. To fix the problem, the company began rewarding managers for increasing EVA®—which is more closely associated with the profit that matters to the shareholders. The company-instituted change in measuring costs motivated the managers of the Bombay operation to move the capital tied up in the apartments to a higher-valued use.

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

FIXED- OR SUNK-COST FALLACY

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

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

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

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

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

One of the most frequent causes of the fixed-cost fallacy in business is the "overhead" allocated to various activities within a company. Because overhead is a fixed or sunk cost, it should not influence most business decisions within a company. If managers make decisions based on their overhead allocations, they commit the fixed-cost fallacy. Look back at the Table 3-2 income statement. Overhead costs appear in the line item of Selling, General, and Administrative Expense. An example of such an overhead expense would be costs associated with the corporate headquarters staff or with the sales force. These costs are considered fixed because output can be increased without the need to increase the corporate staff, like the CFO or CEO. Because these costs will not vary with decisions about changing output, they should be ignored in the decision-making process.

For example, suppose that you are in charge of a new products division, and are considering launching a product that you will be able to distribute through your existing sales force, without incurring extra expenses. However, if you launch the new product, your division will be forced to pay for a portion of the sales force. If this "overhead" charge is big enough to deter an otherwise profitable product launch, then you will commit the fixed-cost fallacy. Overhead expenses are analogous to a "tax" on launching a new product. In this case, the tax deters a profitable product launch.

Depreciation[5] often becomes another case of the fixed-cost fallacy. For example, in 1996, a washing machine firm considered outsourcing its plastic agitator production, rather than making them internally as had been done for several years. The firm received a bid of $0.70 per unit from a trusted supplier and compared this bid with its internal production costs. Play along and make your decision on the basis of Table 3-3.

The relevant comparison should neglect the costs of depreciation and overhead[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, they had incurred $1 million worth of tooling costs to make molds for the agitators. Following Generally Accepted Accounting Principles, they were charging themselves $100,000/year, over ten years, for the tooling cost. This is called "straight-line depreciation." But this also meant that there was still $400,000 worth of un-depreciated capital still on the company's balance sheet. Accountants at his firm told the manager that if he decided to outsource the agitator, these "assets" would

TABLE 3-3 Outsourcing a Washing Machine Agitator

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).

[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.

"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.

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

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

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

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

HIDDEN-COST FALLACY

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

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

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

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

[7]Taking a "charge" against profitability means that accounting profit would be reduced by the amount of the charge—in this case, $400,000.

Consider another example: Suppose that you wish to fire an employee. You estimate that the employee contributes $2,500 per month to the company and that his compensation package costs the company $1,900 per month. Should you fire the employee? How does your answer change if you can sublet his office for $800 per month?

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

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

> *Long Beach Financial was moving money out the door as fast as it could, few questions asked, in loans built to self-destruct. It specialized in asking homeowners with bad credit and no proof of income to put no money down and defer interest payments for as long as possible. In Bakersfield, California, a Mexican strawberry picker with an income of $14,000 and no English was lent every penny he needed to buy a house for $720,000.*[8]

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

ECONOMIC VALUE ADDED

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

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

$$[\text{EVA}^{®} = \text{NOPAT} - (\text{Cost of Capital} \times \text{Capital Utilized})].$$

[8]Michael Lewis and David Einhorn, "The End of the Financial World as We Know It," *New York Times*, January 3, 2009.

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

> *The capital charge is the most distinctive and important aspect of EVA®.*
>
> *Under conventional accounting, most companies appear profitable but many in fact are not. As Peter Drucker put the matter in a* Harvard Business Review *article, "Until a business returns a profit that is greater than its cost of capital, it operates at a loss. Never mind that it pays taxes as if it had a genuine profit. The enterprise still returns less to the economy than it devours in resources . . .: Until then it does not create wealth; it destroys it."*
>
> *EVA corrects this error by explicitly recognizing that when managers employ capital they must pay for it, just as if it were a wage.*
>
> *By taking all capital costs into account, including the cost of equity, EVA® shows the dollar amount of wealth a business has created or destroyed in each reporting period. In other words, EVA® is profit the way shareholders define it. If the shareholders expect, say, a 10% return on their investment, they "make money" only to the extent that their share of after-tax operating profit exceeds 10% of equity capital. Everything before that is just building up to the minimum acceptable compensation for investing in a risky enterprise.*[9]

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

DOES EVA® WORK?

By adopting EVA®, or a similar economic profit plan[10] (EPP), and linking pay to performance, firms reward managers for making good decisions—those that increase economic profit. If managers begin making better decisions, firms that adopt such plans should experience improved operating performance. Stern Stewart & Co. claims that "more than 300 client companies

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

[10]Other EPPs include earnings-based bonuses and stock ownership (including employee stock ownership plans, restricted stock, phantom stock, and stock options).

worldwide now use EVA®, and evidence shows that most of them significantly outperform other companies in their industries."

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

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

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

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

PSYCHOLOGICAL BIASES AND DECISION MAKING

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

[11]Chris Hogan and Craig Lewis, "Long-Run Investment Decisions: Operating Performance and Shareholder Value Creation of Firms Adopting Compensation Plans Based on Economic Profits," *Journal of Financial and Quantitative Analysis*, forthcoming.

[12]For an alternative view of the "fairness" of Lewis and Hogan's selection methodology, check out the Stern Stewart & Co. Web site. Lewis and Hogan reply, "After reading the attack of our work, we feel reassured knowing that a number of alternative selection techniques have been tried and yielded similar results. Why do we choose the one were report in the paper? Because academics have shown that it has the best statistical properties."

The *endowment effect* explains how the mere fact of taking ownership of an item increases the value that a person puts on the item. This effect is commonly shown in classroom settings by giving one-half of the class coffee mugs and then comparing the bottom line values of mug owners to the top-dollar values of non-mug owners. If the mugs are randomly distributed, the average of each group should be about the same. But, they're not. Typically, those with mugs value them twice as much as those without. Retailers are very aware of this bias – why do you think you so often see programs like "Buy now, pay later" or "Try it before you buy it?" The retailers want to get the product in your hands to increase its perceived value to you. This same bias makes it very difficult for managers to pull the plug on businesses or investments that they originally initiated. In making decisions, you should carefully think about how ownership might be affecting your valuation.

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

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

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

[13]Austan Goolsbee, "A Reality Check for Home Sellers," *New York Times*, September 23, 2007.

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

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

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

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

- Decision makers are subject to a number of psychological biases in evaluating costs and benefits. Be aware of these biases; take advantage of them when you can and consider how your own decisions might be affected.

Multiple-Choice Questions

1. A manufacturing company is considering purchasing a new machine that doubles capacity from 500 to 1,000 units per week. The machine will occupy approximately 500 square feet of vacant (unused) space on the factory floor. Which of the following costs are irrelevant in the decision to purchase this machine?
   a. The additional cost of utilities necessary to run the machine
   b. Monthly rental expense associated with the 10,000-square-foot factory
   c. Additional machinists who will need to be hired to run the machine
   d. Maintenance costs for regular repair and cleaning of the machine
2. A company manufactures both pens and pencils in the same facility. The firm's production capacity is shared between these two products. Due to a federal ruling requiring all elementary school students to use only pencils, the overall demand for pencils has shifted outward leading to an increase in pencil prices. Surprisingly, this has had no effect on pen demand. The firm will find in the short term that:
   a. the cost of producing pencils rises.
   b. the cost of producing pens falls.
   c. pencils are less profitable than pens.
   d. the cost of producing pens rises.
3. In comparing a firm's accounting costs with its economic costs, the accounting costs:
   a. are the same, if the firm is earning a normal rate of return.
   b. are larger.
   c. take account of the implicit cost of owned resources.
   d. are smaller.
4. The average capital invested in Firm X during the year is $20,000. During that same year, Firm X produces after-tax income of $3,200. If the firm's cost of capital is 12%, what is the economic profit?
   a. $0
   b. $800
   c. $1,200
   d. $3,200

5. Which of the following costs always must be considered relevant in decision making?
   a. Variable costs
   b. Avoidable costs
   c. Fixed costs
   d. Sunk costs

Individual Problems

3-1 Production Opportunity Cost

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

	Version X	Version Y	Version Z	Total
Net Can Sales	$180,000	$240,000	$105,000	$525,000
Variable Costs	105,000	135,000	82,500	322,500
Corporate Overhead	60,000	60,000	60,000	180,000
Contribution to Profit	15,000	45,000	37,500	22,500

3-2 Opportunity Cost of Renting

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

3-3 Opportunity Cost of Steel

Your firm usually uses about 200 to 300 tons of steel per year. Last year, you purchased 100 tons more steel than needed (at a price of $200 per ton). In the meantime, the price of steel jumped to $250 per ton delivered (which means that any firm selling the steel must pay any shipping costs), and the price has since stabilized at that price. The cost of shipping steel to

the nearest buyer would be $20 per ton. In the meantime, a business next door just went bankrupt, and the bank is offering a special deal where you can buy another 100 tons of steel for $180 per ton. Assume that the interest rate is 0%. Which of the following are correct?

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

3-4 Foreign Currency

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

3-5 Evaluating Performance in a Small Business

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

Group Problems

G3-1 Fixed-Cost Fallacy

Describe a decision made by your company that involved costs that should have been ignored. Why did your company make the decision? What should they have done? Compute the profit consequences of the change.

G3-2 Hidden-Cost Fallacy

Describe a decision that you or your company made that involved opportunity costs that should have been considered. Why did your company make the decision? What should they have done? Compute the profit consequences of the change.

G3-3 Hidden Cost of Capital

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

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

Does your company make decisions based on depreciation or overhead? If so, does this lead to bad decisions? What can be done to fix the problem? Compute the profit consequences of the change.

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. This occurred at the same time when mortgages were being packaged into securities that were sold to investors, thereby shifting the credit risk. If this risk had been recognized, investor demand for these mortgage-backed securities would have been low. Instead, the rating agencies—who were paid by the very parties who issued the securities—gave these securities AAA ratings. This increased demand for the securities, which encouraged lenders to make even more subprime loans.

The resulting credit "bubble" made a millionaire out of Sharman Lane, a high school dropout who had previously worked as a manicurist before joining subprime lender New Century Mortgage.[1] Ms. Lane bought loan applications from mortgage brokers on behalf of her lender. As the housing market heated up, competition for loans became so fierce that lenders were literally throwing themselves at brokers to get loans. Lane's unwillingness to do this cost her her business. "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."

Implicitly, mortgage brokers like Lane were deciding "how many" loans to make. If we want to understand how the mortgage crisis began, we need to examine the decision to extend credit to people like the Mexican strawberry picker in Bakersfield, California, who borrowed every dollar needed to buy a $720,000 house despite speaking no English and earning an annual income of only $14,000.[2]

He qualified because lenders like New Century had no incentive to deny him. They were rewarded for each loan they made, regardless of the risk. As a result they made too many loans. So part of the mortgage crisis can be blamed on lenders like New Century, whose incentives were not aligned with the profitability goals of the investors who eventually bought mortgage-backed securities. We could also point to the role of the credit-rating agencies in creating these perverse incentives.

[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/2008/11/11/The-End-of-Wall-Streets-Boom

In this chapter, we show you how to make profitable "extent" decisions 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 increase a service that was losing $700 every time the hospital delivered another baby.

As most of you will 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 are those that vary with the consequences of the decision. Instead of starting with the question—should we be delivering more babies?—he began with the costs. And since fixed costs do not vary with the decision to increase the number of deliveries, they are irrelevant to the profit calculus. Had the CEO ignored the fixed costs, he would have realized that increasing the number of deliveries would increase hospital profit.

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. Suppose that for 5,000 deliveries, Memorial Hospital had fixed costs of $1 million and variable costs of $3,000/delivery; total costs would equal $2.5 million ($1,000,000 + [$3,000 × 500]). Divided by the number of deliveries (Q), the average cost would be $5,000. 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. Formally, Marginal Cost = Total Cost_{Q+1} − Total Cost_{Q}. At Memorial Hospital, increasing output from 500 to 501 units raises total cost from $2,500,000 to $2,503,000, so the marginal cost is $3,000. Fixed costs do not change as output increases, so they do not factor into the profit calculus.

Note that marginal costs can be below or above average cost. It depends on whether the marginal cost is above or below the average. For example, consider a factory near capacity that wants to increase output. If workers run out of space, leading to lower productivity, the marginal will be above the average, so the average will increase.

[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.

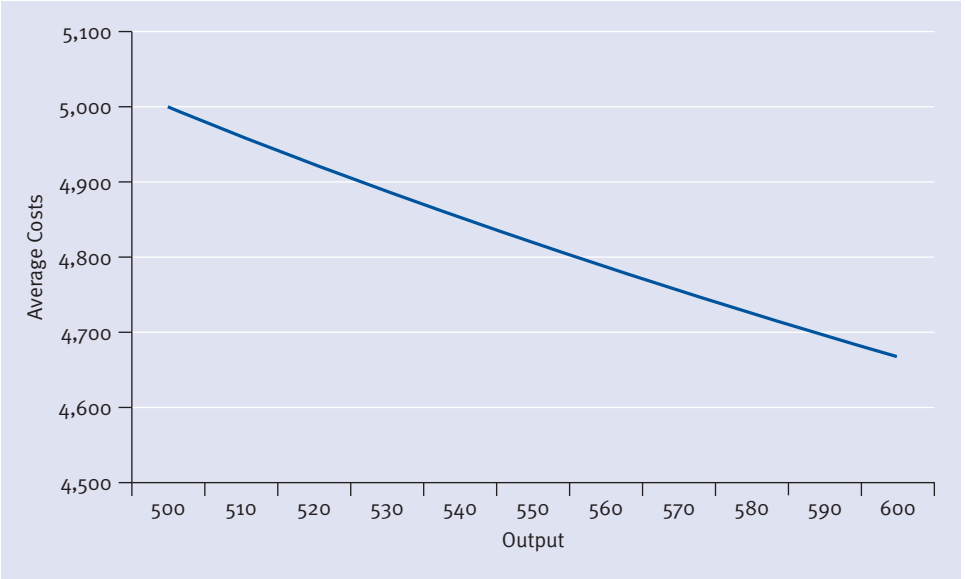

FIGURE 4-1 Average Cost Curve

MARGINAL ANALYSIS

To analyze extent decisions, we break down the decision into small steps and then compute the costs and benefits of taking another one of these steps. 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 common extent 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.

Returning to the example of Memorial Hospital, after a more detailed analysis, managers computed the *marginal* cost of a delivery at approximately $1,800, whereas marginal revenue

was around $5,000. The hospital was not delivering enough babies; that is, at the current output, MR > MC. 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 costs and benefits of additional steps. 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 data on a big jump ($50,000) but not on the little steps ($1) that make up the jump. The only available data correspond to the bigger change, so we do the best that we can. We estimate the marginal effect of another dollar of advertising by dividing the $50,000 by 1,000 customers to get $50 per customer, sometimes called the *customer acquisition cost*. This means that the marginal cost of acquiring another customer is $50.[4] 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. After taking a step, you have to re-compute marginal costs and benefits to see whether further steps are warranted.

We can also use marginal *analysis* to compare the relative effectiveness of two different extent decisions. 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 medium.

If you recently decreased your telephone solicitation budget and this saved $10,000, but you lost 100 customers, the marginal effectiveness of phone solicitation is one customer for $100 (alternatively, the marginal *customer acquisition cost* is $100). Note that we are implicitly assuming that you could get the customers back by restoring your telephone solicitation budget.

Since it is cheaper to gain *another* customer using TV advertising, increase TV advertising and spend less on telephone solicitation. Note that marginal analysis doesn't even require you to measure the marginal benefit of acquiring a customer. All it requires is that you measure the *marginal* effectiveness of each activity. If one activity has higher marginal effectiveness than the other, then increase that activity and reduce expenditures on the other. Then re-measure and decide whether to make further changes.

When you adjust your advertising expenditures, make the changes one at a time. Do not increase telephone solicitation at the same time you decrease TV advertising because you lose

[4]Or that the marginal benefit of $1 worth of advertising is 1/50 of a customer.

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 to see whether further changes are profitable.

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. In some instances, they might 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 it to help 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 Yucatán 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 Yucatán? 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 you start, it is always helpful to remind yourself of the mistakes that you can make. If the cost used to compute cost per SAH include overhead that cannot be avoided, then you won't save on overhead as you shift production—they are 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 for each SAH of output reduction in the Dominican Republic facility,

and make sure that you are incurring only about $20/SAH for each SAH of output increase in the Yucatán. 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 Yucatán. 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 re-measuring marginal costs to determine whether to take another step.

In this example, the Fortune 50 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, 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?

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. This gives him 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, he will end up cutting down all the trees.

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.[5] Consequently, the landowner will receive less money under a royalty contract because the logger will harvest only the pine trees. The royalty rate is analogous to a sales tax because it deters some wealth-creating transactions (i.e., the fir trees are not harvested).[6]

The same idea can be applied to the problem of motivating salespeople. For example, suppose you want to evaluate the incentive effects of two different incentive compensation schemes. One is based on a 10% commission rate, where the salesperson is paid 10% of all sales. The other compensation plan pays a 5% commission rate plus a $50,000 per year flat salary. Each year,

[5]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.

[6]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).

you expect salespeople to sell 100 units at a price of $10,000 per unit. Which incentive compensation scheme should you use?

As in our earlier example, the contracts have the same face value but 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 rate.

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.[7]

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 under 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 implicitly recognized that the usual accounting statements were inadequate for evaluating the COO's performance. The CEO and the COO both agreed that without much effort, the COO could earn[8] $150,000 each quarter. But earning an amount over $150,000 would take more effort. To reward the COO for exerting 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.

[7]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.

[8]*Earnings* refers to company profit.

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.

IF INCENTIVE PAY IS SO GOOD, WHY DON'T MORE COMPANIES USE IT?

Although the benefits of incentive pay seem clear, it is not a panacea—especially in cases where it is difficult to measure performance. Later on, as we develop more tools to analyze incentives, we will see that there are situations where incentive pay can be counterproductive. Its successful application "depends" on a number of factors.

Also, trying to implement incentive pay in an organization can be more difficult than turning a Communist country toward capitalism. Consider this 1998 reaction from a "faculty" member in the "corporate learning center" of a Fortune 50 company to a suggestion that the 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.
- Sell more if MR > MC; sell less if MR < MC. If MR = MC, you are selling the right amount (maximizing profit).
- 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.
- 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. A company is producing 1,000 units. At this output level, price is $1.50, and marginal revenue is $1.25. Average total cost is $1.10, and marginal cost is $1.40. What can we conclude from this information?
   a. The company is producing too much.
   b. The company should produce more.
   c. The company is maximizing profit at this output.
   d. Not possible to determine.

2. Sal's Pizza Shop has a unique recipe for pizza, and currently its optimal price is $20 per pizza at a quantity of 200 pizzas per week. Its marginal cost is $12 per pizza when it produces fewer than 180 pizzas per week. The marginal cost is $15 per pizza when it produces 180 to 210 pizzas per week. The marginal cost is $18 per pizza when it produces between 211 and 300 pizzas per week. The staff cannot produce more than 300 pizzas per week. Assuming that fixed costs are $300 per week, its marginal revenue from the 200th pizza sold this week is:
   a. $20
   b. $12
   c. $15
   d. $17.57

3. A sofa manufacturer can produce 10 sofas for $2,500 and 12 sofas for $2,760. What is the difference between the average cost per sofa for 12 sofas and the marginal cost of the 12th sofa?
   a. $100
   b. $130
   c. $230
   d. $260
4. A firm can hire 10 workers at a wage of $10 but has to pay a wage of $12 to get 11 workers. What is the marginal cost of the 11th worker?
   a. $12
   b. $32
   c. $100
   d. $132
5. Which of the following choices represents an extent decision?
   a. A firm is considering whether to enter a business.
   b. A firm is considering whether to leave a business.
   c. A firm is considering whether to sell a division.
   d. The human resources director is deciding how many employees to lay off.

Individual Problems

4-1 Zero Defects

Amazon's "autobot" recently recommended a book to one of us titled *Quality Maintenance: Zero Defects through Equipment Management*. The book's description is "Achieve zero-defect product quality by eliminating the root causes of your equipment defects. An easy-to-read case study of TPM, TQC, and JIT at a world-class manufacturing plant." Without reading this book, we know that its advice is wrong. How do we know?

4-2 Shoe Company

A domestic shoe company distributes running shoes and tennis shoes for $95 per pair. The marginal cost of producing a pair of running shoes is $60, and the marginal cost of producing a pair of tennis shoes is $45. A Chinese retailer offers to purchase running shoes for $55 per pair and tennis shoes for $55 per pair for distribution in China. Should the shoe company sell any shoes to the Chinese retailer? (Ignore any potential issues of bundling the two types of shoes together as part of the sale and any competitive effects that international sales might have on current domestic sales.)

4-3 In-Sourcing Sales Force

Five years ago, to respond to cost-cutting pressure during a weak economy, your company decided to close five sales offices employing five people each. Currently your company employs independent sales agents who earn a 2.5% commission on all sales. The economy has recently turned around, and one of your colleagues suggests that you could hire 25 people for $50,000 per employee to do the sales job as independent agents at a cost of goods sold (COGS) of only 0.5%. What concerns might you have about such an approach?

4-4 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?

4-5 Incentive Pay

A company recently raised the pay of workers by 20%. Yet workers' productivity did not improve (i.e., they produced the same amount and quality as before). Why?

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.

CHAPTER 5

Investment Decisions: Look Ahead and Reason Back

In the summer of 2007, Bert Mathews was contemplating the purchase a 48-unit apartment building in downtown Nashville. The building was 95% occupied and generated $550,000 in annual profit. His investors were expecting a 15% return on their capital, 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 cost of capital as a weighted average of equity and debt as $0.2 \times (15\%) + 0.8 \times (5.5\%) = 7.4\%$. Based on his cost of capital, Mr. Mathews decided that he could pay no more than $550,000/7.4% = $7.4 million and still break even. Note that profit divided by the purchase price is the expected return, which has to cover his cost of capital.

Even though the owner was willing to sell, Mr. Mathews ultimately decided not to purchase because of the uncertain outlook. The business press was full of stories about the deteriorating housing market and the rising number of mortgage defaults, so Mr. Mathews decided to wait.

It turned out to be a good decision. A year later, the building's occupancy rate fell to 90%, which reduced the annual profit to only $500,000. And the bank was willing to loan him only 65% of the purchase price at a rate of 7.5%. His new weighted average cost of capital was $0.35 \times (15\%) + 0.65 \times (7.5\%) = 10.125\%$. This meant that he could offer only $5.4 million for the building. However, the owners rejected the offer as too low, hoping that the market would recover and allow them to sell at a higher price.

This story illustrates both the effect of the bursting credit bubble on real estate valuations, but more importantly from our point of view, the relevant costs and benefits of investment decisions, the topic of this chapter.

HOW TO DETERMINE WHETHER INVESTMENTS ARE PROFITABLE

All investment decisions involve a trade-off between current sacrifice and future gain. If you're willing to invest in projects with relatively low rates of return, say 5%, then you're willing to trade current dollars for future ones at a relatively even rate. Equivalently, we say that you have a low **discount rate** (r), or that the future is worth almost as much to you as the present. Formally, we can quantify the trade-off by compounding, (present value) $\times (1 + r) =$ (future value), or by

discounting, (present value) = (future value)/$(1 + r)$. For example, if you have a 5% discount rate, then $1.05 next year is worth $1.00 to you today. Discounting payoffs that occur k periods in the future can be computed by recursively discounting the payoffs, one period at a time, (present value) = (future value)/$(1 + r)^k$.

Individuals with low discount rates invest in more projects because more investments meet their return criteria. These individuals are more likely to go to college and graduate school, own stocks, and exercise. The common thread in these activities is that they have current costs and future payoffs, just like investments.

Individuals who require bigger returns, say 20%, place a lower value on future dollars. They invest only in projects with much higher rates of return, or, if none is available, they borrow money. These individuals are more likely to smoke, shun exercise, abuse drugs, and commit crime. The common thread in all of these activities is that they have current payoffs and future costs.

One reason for identifying individuals with different discount rates (other than to keep those with high discount rates out of your study group) is to recognize the possibility of trade between them. In the current example, there is an unconsummated wealth-creating transaction—at any interest rate above 5% and below 20%, the high-discount-rate individual would willingly borrow from the low-discount-rate individual.

Companies, like individuals, possess discount rates of their own, determined by their costs of capital. As we saw in the chapter opening, a company's cost of capital is a blend of debt and equity, its "weighted average cost of capital" or WACC.[1] Companies with a high cost of capital invest only in high-return projects, whereas companies with a lower cost of capital invest in a wider range of projects. Before the credit bubble burst, Mr. Mathews had a relatively low cost of capital, and so was willing to pay more for the apartment building. After the credit bubble burst, his cost of capital increased from 7% to 10% which reduced the amount he was willing to pay for the apartment building.

As you might imagine, time is a critical variable in investment decisions. Intuitively, this makes sense. Projects that return dollars sooner have higher rates of return, all else equal. For example, 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.

This intuition can be formalized into a general decision rule that allows a company to decide whether an investment is profitable. The use of net present value (NPV) leads to the rule's name—the **NPV rule**.

[1]Calculating a company's cost of capital is not a simple matter. Proper methods are the subject of much debate in the field of finance. Rough estimates suffice for many companies.

TABLE 5-1 NPV Example

	Outflow	Inflow 1	Inflow 2	Total
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

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

Consider the two projects shown in Table 5-1, both of which require an initial investment of $100. Project 1 pays off $115 at the end of the first year, whereas Project 2 pays off $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.

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 profit while Project 2 does not.

The NPV rule illustrates the link between economic profit in Chapter 3 and investment decisions. Projects with positive NPV create economic profit. Stated another way, only positive NPV projects 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. But real-world managers rely on a number of other techniques, as well. In a recent study, over one-half of chief financial officers (CFOs) used payback periods as their decision tool.[2] To evaluate the profitability of investments, CFOs calculate how many months it would take for an investment to break even. If it is longer than their break-even period, then they do not make the investment.

BREAK-EVEN ANALYSIS

In general, break-even analysis can be used in a variety of situations. Although these techniques may not be as "correct" as NPV analysis, break-even analysis is easier to do and it generates

[2]J. R. Graham and C. R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics* 61 (2001): 187–243.

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 break-even quantity, then entry is profitable; otherwise, entry is unprofitable.

To compute the break-even quantity, we have to distinguish between marginal costs (*MC*), which vary with quantity, and fixed costs (*F*), which don't. You'll be able to analyze the vast majority of your investment decisions with this very simple cost structure: You incur a fixed cost to enter an industry and a constant[3] per-unit marginal cost when you begin production.

The break-even quantity (Q) is

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

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

The break-even 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 contributes toward covering fixed costs, and you have to sell at least the break-even quantity to cover fixed costs. If you sell more than the break-even 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 break-even calculation to evaluate their investment alternatives. It would cost $400 million to design and build a new truck from the bottom up. At a 12% cost of capital, the investment would cost Nissan about $48 million per year. Since they earned only $1,500 per truck, they would have to sell at least 32,000 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.

[3] In later chapters we will analyze situations in which marginal costs are not constant.

[4] $0 = \text{Profit}$
$0 = \text{Revenue} - \text{Total Costs}$
$0 = \text{Revenue} - \text{Variable Costs} - \text{Fixed Costs}$
$0 = (P \times Q) - (MC \times Q) - F$
$0 = Q(P - MC) - F$
$F = Q(P - MC)$
$F/(P - MC) = Q$
$Q = F/(P - MC)$

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 $9.6 million, and reduce the break-even quantity to only 6,400 trucks. Even if Chrysler were to charge a Nissan a higher fee for building the Titan trucks so that the contribution margin fell to $1,000 per truck, the break-even 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." If the recession forces Chrysler into liquidation, look for Nissan to purchase Chrysler's truck plant in Mexico.

You can also think of stock market valuations in break-even terms. Price/Earnings or P/E ratios can be interpreted as a payback period for evaluating stock investments. The P/E ratio of the S&P 500 index in December 2008 was 15, which implies that it takes 15 years of earnings to break even on the purchase price. This P/E ratio is near its historical average of about 16, which is one way that analysts determine whether the stock market is under- or overvalued.

CHOOSING THE RIGHT MANUFACTURING TECHNOLOGY

We can use a variant of break-even 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 break-even quantity—solve for the quantity that equates the two costs. At a quantity of five

units, total costs are $150 for both technologies.[5] 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 aquiring Versatile because projected demand for tractors was low. However, the Antitrust Division of the U.S. Department of Justice challenged the acquisition as anticompetitive[6] 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 break-even 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 *break-even analysis*.

Remember, the relevant costs depend on which question you are asking. We've just seen that fixed costs are relevant before you incur them. In the next section, we will show that they can also be relevant when you decide to shut down or exit the industry.

SHUTDOWN DECISIONS AND BREAK-EVEN PRICES

To study shutdown decisions, we work with break-even 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,[7] then shut down.

The break-even price is the average avoidable cost per unit.

The only hard part in applying break-even analysis is deciding which costs are avoidable. For that, we use the Cost Taxonomy, shown in Figure 5-1.[8]

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[5]We can represent the different technologies by the following two cost functions:

$\text{Cost}_1 = 100 + 10Q$
$\text{Cost}_2 = 50 + 20Q$

And solve for the break-even point by equating costs:

$\text{Cost}_1 = \text{Cost}_2$
$100 + 10Q = 50 + 20Q$
$50 = 10Q$
$Q = 5$

[6]This was the first big case for one naive but enthusiastic young economist.

[7]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.

[8]Ivan Png, *Managerial Economics* (Malden, MA: Blackwell, 1998).

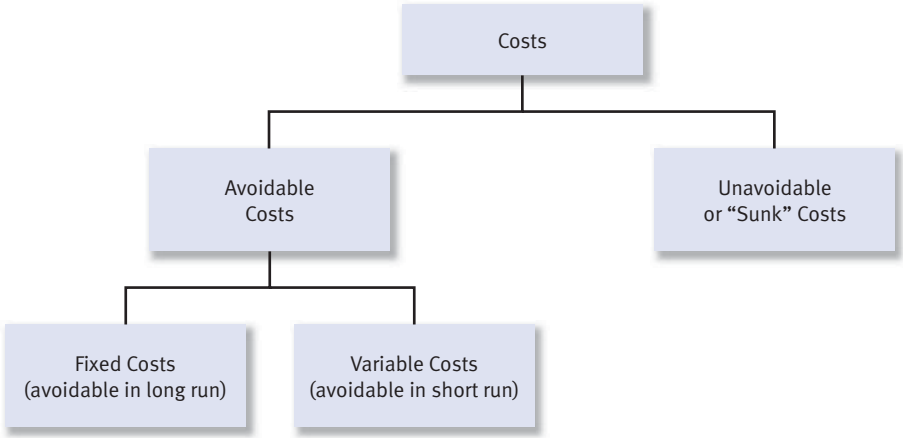

FIGURE 5-1 Cost Taxonomy

To understand how to use the taxonomy, consider the following problem. Fixed costs are $100, 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.[9]

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[10] 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

[9]Average Avoidable Cost = (Fixed Cost + Average Avoidable Cost × Q)/Q = ($100 + $5 × 100)/100 = $6.
[10]Industrial lubricants are very costly to produce. One 55-gallon barrel of oil yields just two quarts of lubricant.

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 break-even 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 ($1/copy).[11] This is the break-even 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 break-even 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.

[11] Average Cost = ($12,000,000 + $2,000,000)/(2,000,000) = $7.

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.[12]

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.

SOLUTIONS TO THE HOLD-UP PROBLEM

In general, there are many investments that are vulnerable to hold-up. Anytime that one person makes a **specific investment**—one that is sunk or lacks value outside a trading relationship—it 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 are 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[13] contracts 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.

[12]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.

[13]Requirements contracts "require" that one party purchase a certain percentage of its materials from the other party.

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.[14]

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

- Investments imply willingness to trade dollars in the present for dollars in the future. Wealth-creating transactions occur when individuals with low discount rates lend to those with high discount rates.
- 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 break-even analysis because it is easier and more intuitive.
- **Break-even quantity** is equal to fixed cost divided by the contribution margin. If you expect to sell more than the break-even quantity, then your investment will be profitable.

[14]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.

- **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 **break-even 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 minimize the costs of hold-up.
- Once **relationship-specific investments** are made, parties are locked into a trading relationship with each other, and can be held up by their trading partners. Anticipate hold-up and choose organizational or contractual forms to give each party both the incentive to make relationship-specific investments and to trade after these investments are made.

Multiple-Choice Questions

1. As manager of a company that is trying to maximize long-run profit, which of the following is a rational profit-maximizing business decision?
   a. In the long run, shut down the business if price falls below long-run average costs.
   b. In the long run, shut down the business if price falls below short-run average variable costs.
   c. In the short run, shut down the business if price falls below average costs.
   d. In the short run, shut down the business if price is not high enough to cover fixed costs.
2. You are considering opening a new business to sell golf clubs. 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 club. If you can sell clubs for $100 each, what is your break-even quantity?
   a. 1,000
   b. 3,500
   c. 4,375
   d. 17,500
3. You are the manager of a small production facility. Your annual fixed costs are $50,000, marginal costs are $10 per unit, and you are producing 50,000 units per year. In the short run, what is the minimum acceptable price level before it makes economic sense to shut down?
   a. $9.00
   b. $10.00
   c. $11.00
   d. $12.50

4. If production of a certain type of product requires a large specific investment, which of the following production setups would you *least* expect to see?
   a. Short-term outsourcing
   b. Vertical integration
   c. Long-term relationship with external supplier
   d. All production met through internal sources
5. Your new yo-yo has fixed costs of $2 per unit and marginal costs of $3 per unit, and you plan to sell the yo-yos for $9.50 each. What is the product's contribution margin?
   a. $3.00
   b. $4.50
   c. $6.50
   d. $9.50

Individual Problems

5-1 Printer Hold-Up

Suppose that in our *National Geographic* example, half of the original cost of the rotogravure printing press is fixed and half is sunk. How low can the offered price go before the printer will rationally refuse to print magazines?

5-2 OEM Hold-Up

Suppose you work for an original equipment manufacturer (OEM) who makes component pieces for a telecommunications company. The telecom company asks you for a price quote for 2,000,000 units that will require a $1,000,000 investment with marginal costs of $1. What is your bottom line in negotiations with the telecom? Suppose you agree on a price slightly above your bottom line. Immediately after quoting this price to the telecom company, you receive a faxed purchase order for one million units. What should you do?

5-3 Bagel Company Break-Even Analysis

You are considering opening a bagel restaurant aimed primarily at the breakfast trade. You'll sell bagels, coffee, and other items in relatively fixed proportions to one another. For each bagel sold, you expect the company to sell two cups of coffee and $2 of other items. You'll earn $0.50 on each bagel, $0.50 on each cup of coffee, and $1.00 on the other items. Salaries, equipment, and rent cost about $100,000 per year. What is the break-even quantity of bagels?

5-4 Pet Store—Part 1

A local pet store, Roscoe's Rascals, which has concentrated on selling puppies, is considering adding a line of pet food. A contractor estimates that it will cost $10,000 to convert some storage space into a retail area for the food. Roscoe's Rascals will purchase the specialty food for $15

and sell it for $30. Marketing research indicates that the store will sell 900 bags. Should Roscoe's Rascals add pet food to its products?

5-5 Pet Store—Part 2

Assume that Roscoe's Rascals decided to add the pet food line. Two months after it began selling the food, its pet food sales declined dramatically because a competitor across the street started selling the identical food for $22 per bag. Should Roscoe's Rascals match the price offered by the competitor?

Group Problems

G5-1 Shutdown Decision

Describe a shutdown decision your company has made. Compute the opportunity costs and benefits of the decision (using break-even 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.

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SECTION II

Pricing, Costs, and Profits

CHAPTER 6

Simple Pricing

From early 2007 to the middle of 2008, the average price of a gallon of gas in the United States rose from less than $2.00 to over $4.00. Although this was especially bad news for SUV drivers and airplane passengers, it was really good news for two McMinnville, Tennessee, workers named Dolly and Molly. Dolly and Molly had been unemployed, but the increase in gas prices put them back to work. What made these two workers unique? They're mules, and when the price of gas rose dramatically, the cost of running a tractor increased, leading to their re-employment.[1]

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

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

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

[1]For more on Dolly and Molly's story, see http://www.npr.org/templates/story/story.php?storyId=90840231

[2]Jo Johnson, "Camel Demand Soars in India," *Financial Times*, May 2, 2008.

[3]See "Pricing: the Neglected Orphan," available at http://www.parthenon.com/clients/media/Parthenon-Pricing%20The%20Neglected%20Orphan_09-2004.pdf

BACKGROUND: CONSUMER SURPLUS AND DEMAND CURVES

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

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

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

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

TABLE 6-1 Hot Dog Demand Schedule

Hot Dog Price	Hot Dogs Purchased
$5	1
$4	2
$3	3
$2	4
$1	5

TABLE 6-2 Hot Dog Value Table

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

consumer will purchase just three. If consumers behave optimally, they will try to maximize the surplus they get from consuming hot dogs, the difference between their value and the price they pay. Purchasing three hot dogs at $3 each leads to **consumer surplus** of $3 (total value of $12 less expenditure of $9). Purchasing five hot dogs at $5 each would lead to consumer surplus of zero.

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

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

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

To describe the buying behavior of a group of consumers, we add up all the individual demand curves to get an **aggregate demand curve.** The simplest way to show this is when each consumer wants only a single item (i.e., the marginal value of a second unit is zero). For example, to construct a demand curve that describes the behavior of seven buyers, simply arrange the buyers by what they are willing to pay (e.g., $7, $6, $5, $4, $3, $2, and $1). At a price of $7, one buyer will purchase[4]; 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 Hot Dog Consumer Surplus

Hot Dog Price	Hot Dogs 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

[4]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.

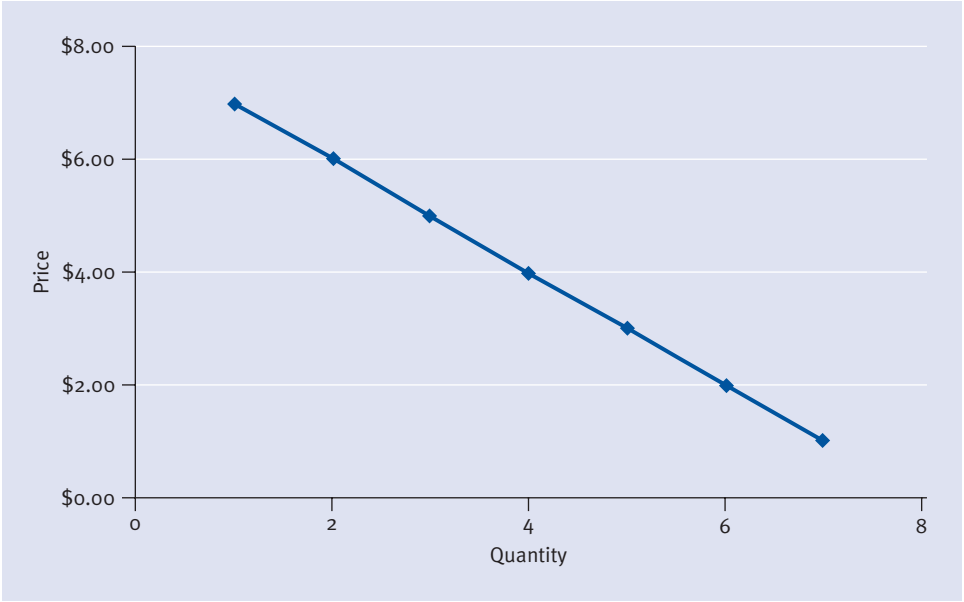


FIGURE 6-1 Demand Curve

Note that price—the independent variable—is on the wrong axis. There are good reasons for this that will become apparent, but for now, just accept that economists like to do things a little differently. Note also that economists have special jargon describing the response of demand to price. We say that as price decreases, "quantity demanded" increases. If something other than price changes stimulate demand, we instead say that the demand curve "shifts" to the right, or "increases," such that consumers purchase greater quantities at the same prices. We'll discuss factors that shift demand in a later chapter.

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

MARGINAL ANALYSIS OF PRICING

Demand curves present sellers with a dilemma. Sellers can raise price and sell fewer units, but earn more on each unit sold. Or they can reduce price and sell more, but earn less on each unit sold. This fundamental trade-off is at the heart of pricing decisions. We resolve it by using

marginal analysis. If marginal revenue (MR) is greater than marginal cost (MC),[5] you can increase profit by selling another unit.

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

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

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

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

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

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

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

TABLE 6-4 Optimal Price

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

[5]Marginal profit = $MR - MC$ and is the extra profit from selling one more unit.

Your boss has confused *average* revenue or price with *marginal* revenue. They're easy to confuse. Here's why. As long as price is greater than average cost, it appears that an increase in quantity would increase profit.[6] However, this reasoning is incorrect because it doesn't recognize the dependence of Q on P—you cannot sell more without decreasing price. Put another way, you can say that to sell more, you have to reduce price for *all* customers, not just the additional customers who would be attracted by the reduced price.

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

PRICE ELASTICITY AND MARGINAL REVENUE

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

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

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

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

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

[6]Profit = Revenue − Cost = $Q^*(P - AC)$, where AC is average cost.

If $|e| > 1$, *demand is elastic; if* $|e| < 1$, *demand is inelastic.*

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

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

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

$$\textit{Price Elasticity Estimator}^{7} = [(Q_1 - Q_2)/(Q_1 + Q_2)] \div [(P_1 - P_2)/(P_1 + P_2)]$$

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

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

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

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

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

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

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

[9]This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.

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*)

For example, if demand is elastic, then a price decrease will be smaller than the corresponding quantity increase, so revenue will rise following a price decrease. Likewise, a price increase will be smaller than the corresponding quantity decrease, so revenue will fall following a price increase. This relationship is illustrated in the bottom row of Table 6-5.

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

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

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

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

$$\%\Delta Revenue \approx \%\Delta Price + \%\Delta Quantity.$$

TABLE 6-6 Inelastic Demand ($|e| < 1$)

Price increase → Revenue increase (decrease in *Q* is smaller than increase in *P*)
Price decrease → Revenue decrease (increase in *Q* is smaller than decrease in *P*)

The exact numerical relationship between marginal revenue (change in revenue) and elasticity is $MR = P(1 - 1/|e|)$.[10] We can use this formula to express the marginal analysis rule—reduce price if MR > MC, and raise price otherwise—using price elasticity in place of marginal revenue:

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

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

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

WHAT MAKES DEMAND MORE ELASTIC?

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

Products with close substitutes have elastic demand.

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

[10] $MR = \Delta\text{Revenue}/\Delta Q = \Delta(PQ)/\Delta Q = (\Delta PQ + \Delta QP)/\Delta Q = P(1 - 1/|e|)$. The symbol Δ means "change in."

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

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

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

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

Products with many complements have less elastic demand.

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

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

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

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

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

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

As price increases, demand becomes more elastic: |el| *increases.*

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

FORECASTING DEMAND USING ELASTICITY

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

$$\%\Delta Quantity \approx e(\%\Delta Price)^{11}$$

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

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

$$\textit{Factor elasticity of demand} = \textit{(\% change in quantity)} \div \textit{(\% change in factor)}$$

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

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

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

[11]This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.

As the cost of operating a tractor increases with rising gas prices, demand for mules and camels increases. The home safe market saw a similar effect in 2008. As interest rates declined, the opportunity cost of keeping cash at home declined, leading to an increase in demand for home safes.

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

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

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

STAY-EVEN ANALYSIS, PRICING, AND ELASTICITY[12]

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.

[12]This section was inspired by material from Mike Shor's pricing class at Vanderbilt University.

The stay-even quantity is a simple function of the size of the price increase and the contribution margin, $\%\Delta Q = \%\Delta P/(\%\Delta P + \text{margin})$, where $\text{margin} = (P - MC)/P$. If you are considering a price increase, and the predicted quantity decrease is bigger than the stay-even quantity decrease, the price increase is unprofitable.

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

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

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

	Δ Revenue
Price ↑	−
Price ↓	+

[13] "Exhibit 1A—Part 1 of Plaintiff's Public Version of Its Corrected Brief on Its Motion for Preliminary Injunction," http://www.ftc.gov/os/caselist/0710114/080107corbrief.pdf

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

	△ Revenue
Price ↑	+
Price ↓	−

- MR > MC implies that $(P - MC)/P > 1/|e|$; that is, the more elastic demand is, the lower the price.
- Four factors make demand more elastic:
  - Products with close **substitutes** (or distant **complements**) have more elastic demand.
  - Demand for brands is more elastic than industry demand.
  - In the long run, demand becomes more elastic.
  - As price increases, demand becomes more elastic.
- **Income elasticity, cross-price elasticity,** and advertising elasticity are measures of how changes in these other factors affect demand.
- It is possible to use elasticity to forecast changes in demand:
- $\%\Delta\text{Quantity} \approx (\text{factor elasticity})(\%\Delta\text{Factor})$.
- **Stay-even analysis** can be used to determine the quantity change required to offset a price change. The stay-even quantity is $\%\Delta Q = \%\Delta P/(\%\Delta P + \text{margin})$.

Multiple-Choice Questions

1. A company currently sells 60,000 units a month at $10 per unit. The marginal cost per unit is $6. The company is considering raising the price by 10% to $11. If the price elasticity of demand is _____ in that price range, then profit would increase if the company decided to raise the price by 10%.
   a. equal to −3
   b. greater than +1
   c. less than −3.5
   d. greater than −2
2. The price elasticity of demand for bread is −0.5. If the price falls by 5%, the quantity demanded will change by:
   a. −2.5%
   b. +2.5%
   c. −1.0%
   d. +10%

3. Actions a firm can take to change a product's demand curve include:
   a. reducing the price of a substitute product the firm also produces.
   b. reducing the price of a complementary product the firm also produces.
   c. differentiating its product from competitors by offering an extended warrantee.
   d. All of the above will change a product's demand curve.
4. A product can be classified as a normal good if an increase in the income of buyers causes:
   a. a decrease in quantity demanded.
   b. a decrease in demand.
   c. an increase in demand.
   d. an increase in quantity demanded.
5. Assume that beer and pretzels are complements in consumption; if the price of beer increases, we would expect to see:
   a. an increase in the demand for pretzels.
   b. a decrease in the demand for pretzels.
   c. an increase in the quantity of pretzels demanded.
   d. a decrease in the quantity of potatoes demanded.

Individual Problems

6-1 Optimal Pricing for an Aggregate Demand Curve

Suppose you have 10 individuals with values {$1, $2, $3, $4, $5, $6, $7, $8, $9, $10}. Your marginal cost of production is $2.50. What is the profit-maximizing price?

6-2 But What About Fixed Cost?

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

6-3 Pricing ATM Machines

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

ATM Fee	Usage
$2.00	1,000
$1.75	1,500
$1.50	2,000
$1.25	2,500
$1.00	3,000

What ATM fee should the bank charge?

6-4 Kentucky Racetracks

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

6-5 Optimal Markup

If elasticity is −2, price is $10, and marginal cost is $8, should you raise or lower price?

Group Problem

G6-1 Pricing

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

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 company 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 go on a buying binge. 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.

However, the company also went on a buying binge 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. 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 than 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."

If you ever hear the words *synergy* or *efficiency* used to describe a business strategy, you are probably already on the wrong end of a bad investment. This newly renamed conglomerate was no exception, and by February 2009, Spectrum Brands was bankrupt.[1]

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

It is not that synergies don't exist; it is rather that they are difficult to realize[2] and too often used to justify acquisitions that enrich management at the expense of shareholders. In this chapter, we examine a potential source of synergies, economies of scope and scale, 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), and if MC goes down as well, you get an "extra" increase in profit from the increase in output; recall that if MC falls below MR, it becomes profitable to increase output.

Many business decisions, like break-even 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

As they try to increase output, most firms eventually face increasing average costs. The firm eventually finds that each extra unit of input 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.*

We can identify several causes for diminishing marginal returns, 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. And when productivity falls, 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.

[2]See, for example, Spencer E. Ante, "Sprint's Wake-Up Call," *Business Week*, February 21, 2008.

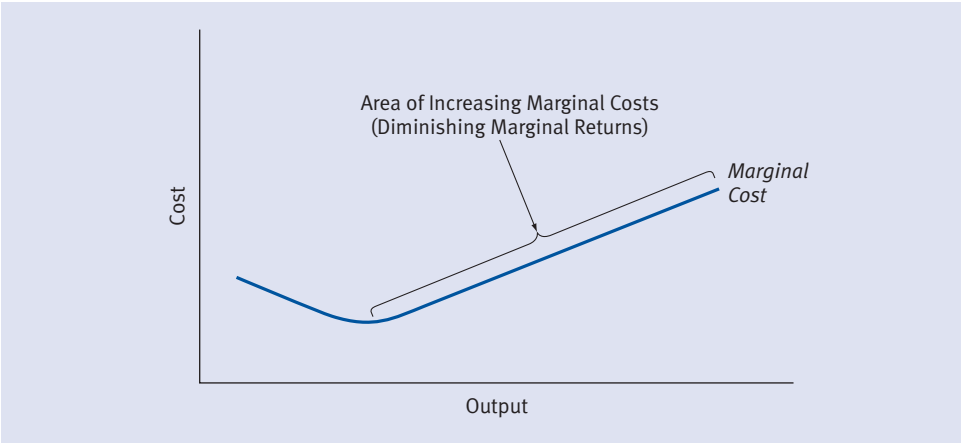


FIGURE 7-1 Diminishing Marginal Returns

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 rising 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

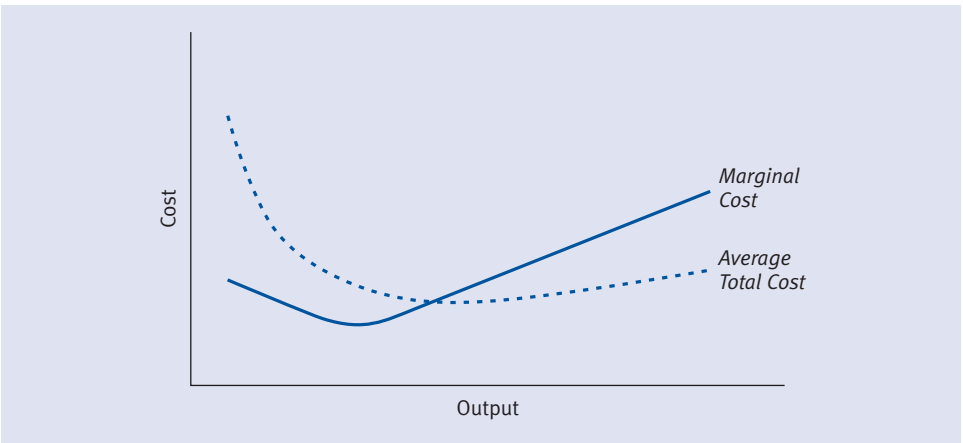


FIGURE 7-2 U-Shaped Average Cost Curve

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, ten times more than Mr. Morita's capacity. Mr. Morita turned the offer down because he knew that increasing output would require hiring and training more workers and an expansion of facilities, raising his average cost or break-even price.

The retailer decided to buy 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 the break-even price schedule, allowing him to bargain effectively with the retail chain.[3]

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.

However, 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 well. 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 price.

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 average costs fall with output, you have ***increasing returns to scale*** *or* ***economies of scale.***

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.

[3]Akio Morita with Edwin M. Reingold and Mitsuko Shimomura, *Made in Japan: Akio Morita and Sony* (New York: Penguin, 1988).

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.[4] 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.

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.[5]

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 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 the implied 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

[4]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.

[5]Marginal cost = 100*0.8^(Log(# planes)/Log(2)).

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

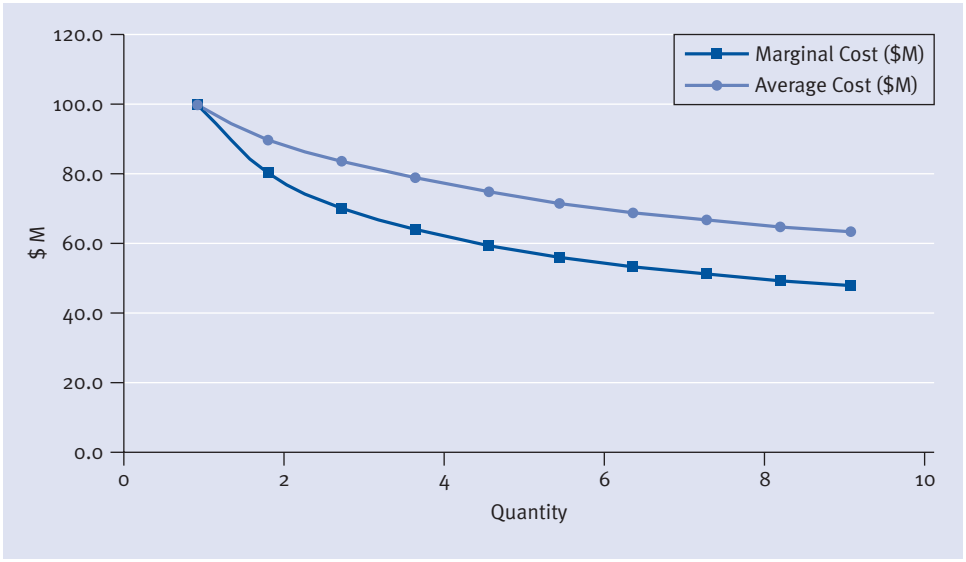


FIGURE 7-3 Airplane Manufacturing Learning Curve

must pursue other strategies. For example, American could ask for "kickbacks" on sales of future Boeing planes; however, this request may violate European 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

Traditionally, Gibson Guitar used rosewood to construct 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 two choices. 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 realize scope economies by distributing a full portfolio of meat products.

Our sausage maker eventually decided to outsource its distribution, but after it sold its trucking fleet, it was held up by the distributor. It 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 come 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.

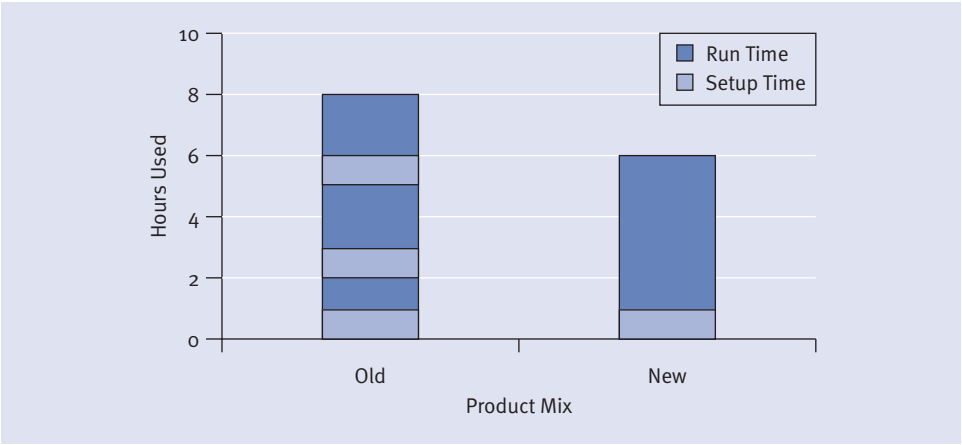


FIGURE 7-4 Pet Food Extruder Line Operation Times

Typical savings for one extruder line are illustrated in Figure 7-4. Under the new regime, 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.

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 break-even 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. 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.
2. 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
3. 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
4. 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.

5. A company faces the following costs at the respective production level 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 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?

7-3 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

7-4 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 break-even price? Suppose that if you get the contract, you estimate that you can win another project for two more units. Now what is your break-even price for those two units?

7-5 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.

CHAPTER 8

Understanding Markets and Industry Changes

In 1997, the portable electric generator industry was mildly profitable, if unexciting. For over a decade, consumption of portable electric generators had been very stable, exhibiting an average annual growth rate of 2%. But all this was about to change. Many consumers, including my 80-year-old dad, 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 Walters, Rosenberg, and Matthews (WRM) implemented a Y2K (year 2000) strategy designed to double their production capacity. They vertically integrated[1] into alternator head production which not only increased production capacity, but also reduced variable costs. Other firms in the industry made similar investments.

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

WRM's managers would have benefited from a better understanding of the changes affecting its industry. In particular, everything that happened to WRM was perfectly predictable, not just in hindsight, but at the time they made their investments. Being able to forecast and interpret industry-level changes requires an understanding of both aggregate consumer behavior (demand) and aggregate seller behavior (supply). Forecasting and interpreting these changes is the topic of this chapter.

WHICH INDUSTRY OR MARKET?

Each industry or market has a product, geographic, and time dimension. So 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

[1] *Vertical integration* refers to common ownership of adjacent stages in the vertical supply chain from raw materials down to finished product. In this case, alternators that had previously been purchased from outside suppliers were now being made by the generator company.

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 focus. 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), product (portable generators), and geographic (the United States) dimension. Different questions will suggest different markets to study.

Although this point may seem self-evident, people often overlook it. In many cases, you can sharpen your analysis and avoid confusion by first defining your market or industry. This is especially important if your firm's success or profitability is closely linked to profitability of the industry in which it competes. Demand and supply analysis will help you recognize business 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 and renovating existing apartments.

SHIFTS IN DEMAND

As we've seen, changes in price induce changes in consumer behavior that lead to quantity changes. For example, the demand curve that we saw in Chapter 6 shows 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—we can identify many others. In general it helps to catalog these factors 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—all of these are controllable factors.

It is easiest to illustrate this distinction with an example of demand for an individual firm's product, like Microsoft's operating system. In the late 1970s, 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.*

Uncontrollable factors include, among other things, 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 also affect current demand. The 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 variable, you need to understand how it affects the industry in which you compete because it can affect your own profitability. Understanding how both controllable and uncontrollable factors affect your own profit 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 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.

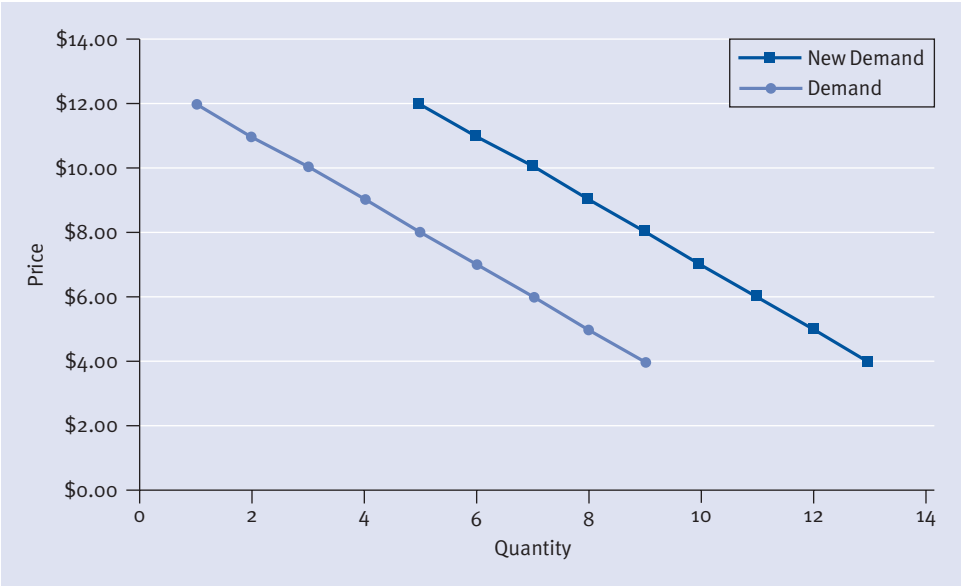


FIGURE 8-1 Demand Increase

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.

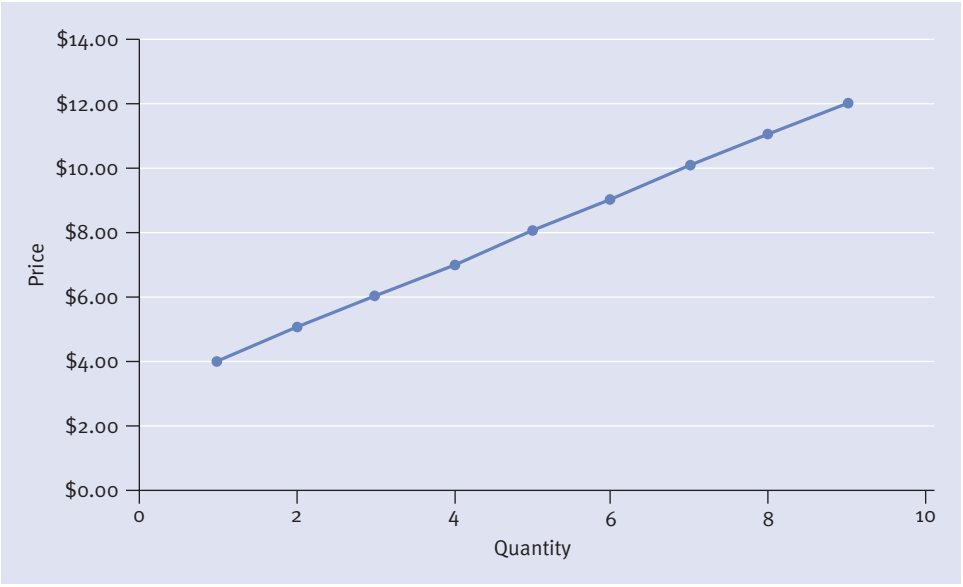


FIGURE 8-2 Supply Curve

As with demand curves, we plot supply curves with price on the vertical axis and quantity on the horizontal axis. In math, we are taught to plot the dependent variable (quantity) on the vertical axis, and the independent variable (price) on the horizontal axis. So the economics convention of plotting quantity on the horizontal axis may confuse those of you who are familiar with graphical analysis. Get used to it. There is a good reason for this, but it is also a long-established convention.

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 (to the left)—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, see 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 8 sellers are chasing only 2 buyers. Economists call this *excess supply*, and this type of imbalance exerts downward pressure on price.

At a price of $6, the quantity demanded (7) is greater than the quantity supplied (3)—7 buyers are chasing just 3 sellers. Economists call this *excess demand*. This type of imbalance leads to 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.

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

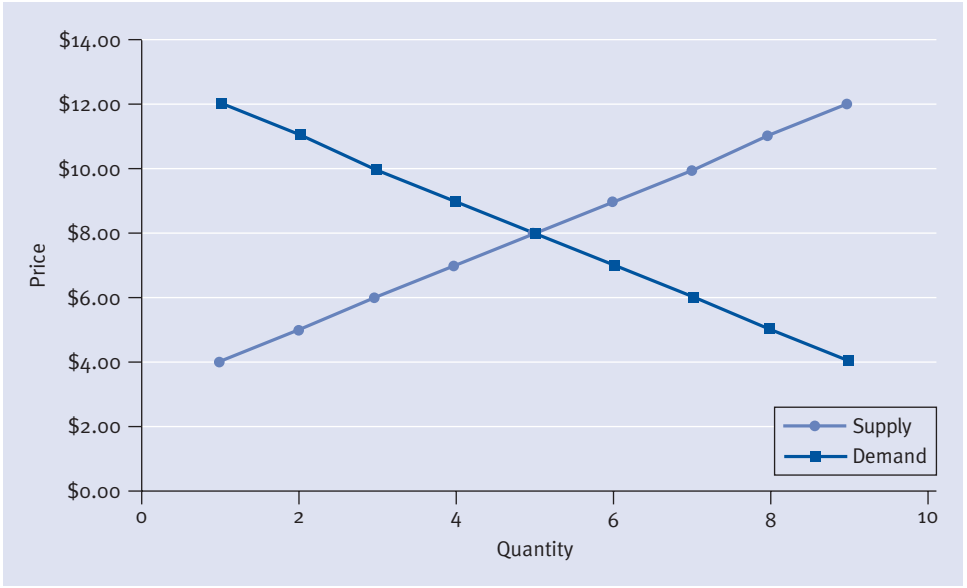


FIGURE 8-3 Market Equilibrium

wealth. Economists often personify market forces by saying that the market works with an "invisible hand."[2]

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 second equilibrium.

[2]Credit for the invisible hand metaphor goes to Adam Smith and his renowned *The Wealth of Nations*.

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

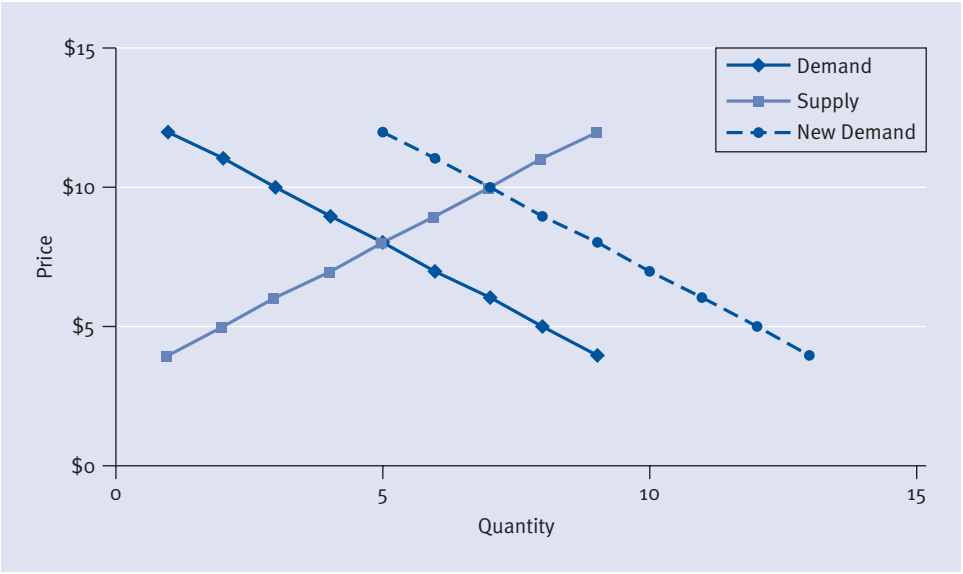


FIGURE 8-4 Market Equilibrium Following Demand Shift

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, as the price increased from $8 to $10, quantity also increased 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.

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 cost reductions and 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 exceeded 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 owing to the supply increase. Although it is relatively easy to predict these kinds of *qualitative* changes, predicting exact *quantitative* changes is a different matter altogether. 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 difficult to obtain. 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 much from simple qualitative analysis. WRM'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

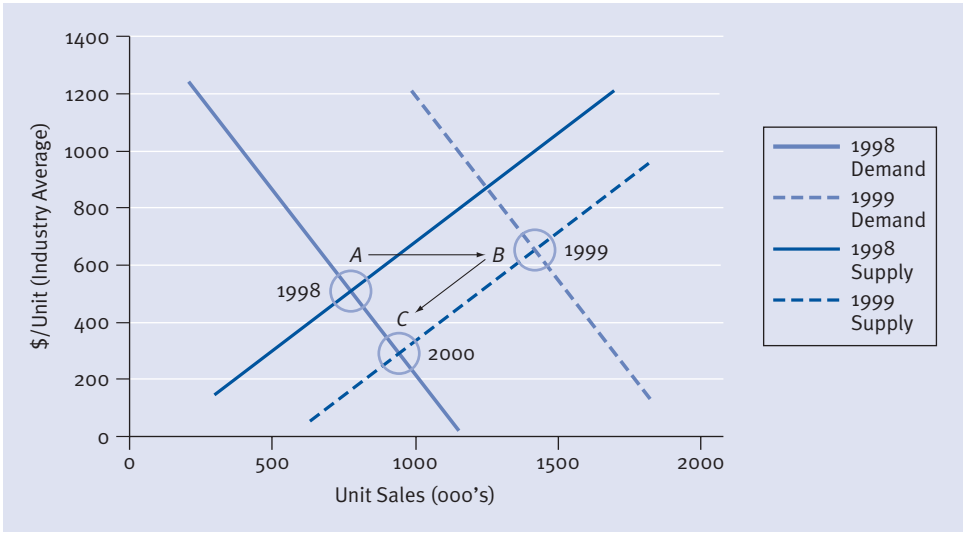


FIGURE 8-5 Demand-Supply in U.S. Generator Business

shift was temporary, they could 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 personal computers 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.[3]

We close 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, (e.g., 30-day loans supplied by companies with cash on hand to companies who have short-run borrowing demands). Think of them as IOUs. These loans are used by virtually every

[3]Note that an increase in demand could explain the increase in quantity but not the decrease in price.

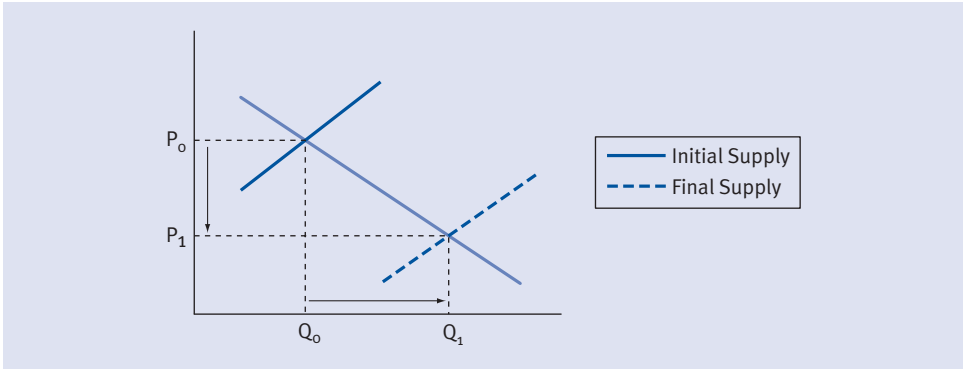


FIGURE 8-6 Demand–Supply Shifts in the Computer Industry

major business to balance the inflows of revenue with the outflows of costs, and are behind most major transactions. They have been called the lifeblood of the economy.

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. To explain the changes shown in Figures 8-7 and 8-8, we adopt the second convention, and define the "price" of a loan to be the interest rate that clears the market.

FIGURE 8-7 Shrinking Commercial Paper Market

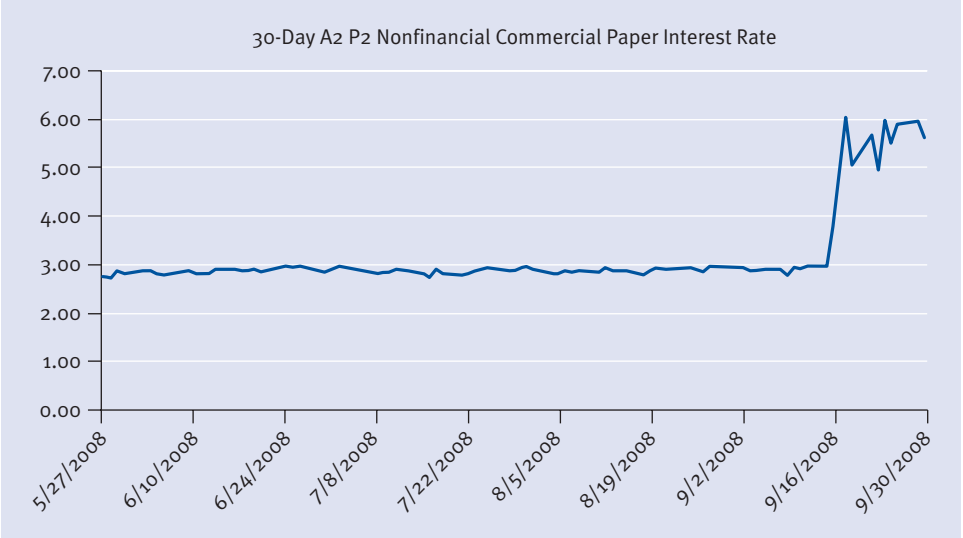


FIGURE 8-8 Prices in the Commercial Paper Market

In the second week of September 2008, the price (interest rate) on these loans shot up from 3% to 5% and the quantity of loans declined dramatically. 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, the essential "grease" that facilitates the movement of assets to higher-valued uses. 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, Fannie Mae and Freddie Mac, and the first bailout of AIG, commercial lenders became increasingly worried that borrowers would not be able to repay these loans. This 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 has since guaranteed these short-run financial transactions to remove the fear of default, and the interest rates have come back down as shown in Figure 8-9.

Many of my students tell me 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.

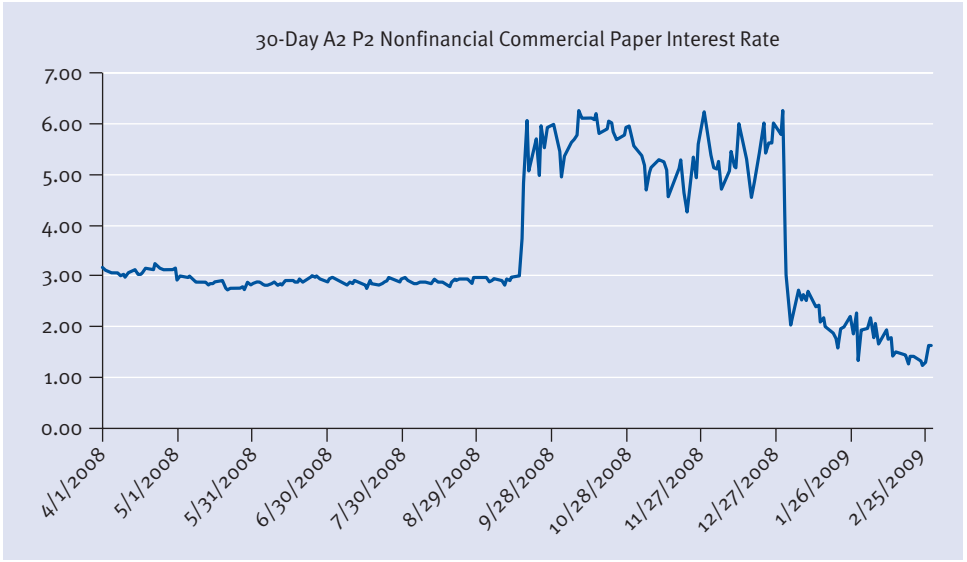


FIGURE 8-9 Price Recovery in the Commercial Paper Market

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.[4] The break could have been disastrous because Arizona has no refineries of its own; it obtains gasoline primarily through two pipelines, as shown in Figure 8-10. 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 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

[4]Federal Trade Commission, *Gasoline Price Changes: The Dynamics of Industry Supply and Demand* (Washington, D.C.: U.S. Government Printing Office, 2005).

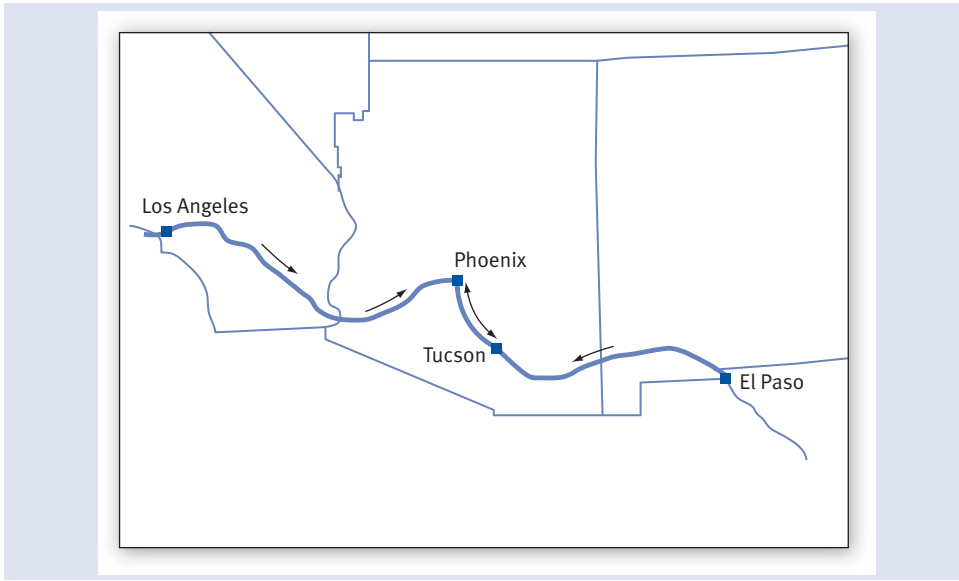


FIGURE 8-10 Phoenix Pipeline Map

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. 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 terminals in Tucson to Tucson gas stations discovered that delivering gas to Phoenix was more profitable than delivering it to Tucson. Tuscon 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—hence the price increase in that city. Similarly, supply decreased in Los Angeles as sellers found it more profitable to divert gasoline to Phoenix, leading to a price increase in that city as well. So 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.

Part of the blame for flight delays traveling across the United States can be traced to a failure to allow prices to help allocate resources.[5] The Federal Aviation Administration prices airport landing slots and access to the air traffic control system on a per-passenger basis, regardless of time of day, season, or overall stress on the system. These prices have no relation to the marginal cost of providing service. When you remove this communication mechanism from the market, you end up with problems like shortages, delays, congestion, and misallocation.[6]

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.[7] 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 relative to 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 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 cheap and selling dear. Consider a market maker facing the demand and supply curves shown

[5]Adapted from Peter Klein, Organizations and Markets.com blog, http://organizationsandmarkets.com/2007/10/25/why-the-resistance-to-prices/

[6] Tom Whalen, Dennis Carlton, Ken Heyer, and Oliver Richard, "A Solution to Airport Delays," *Regulation* 31, no. 1 (Spring 2008): 30–36.

[7]Barbara Kiviat, "The End of Management?" *Time,* July 12, 2004, "Inside Business" section.

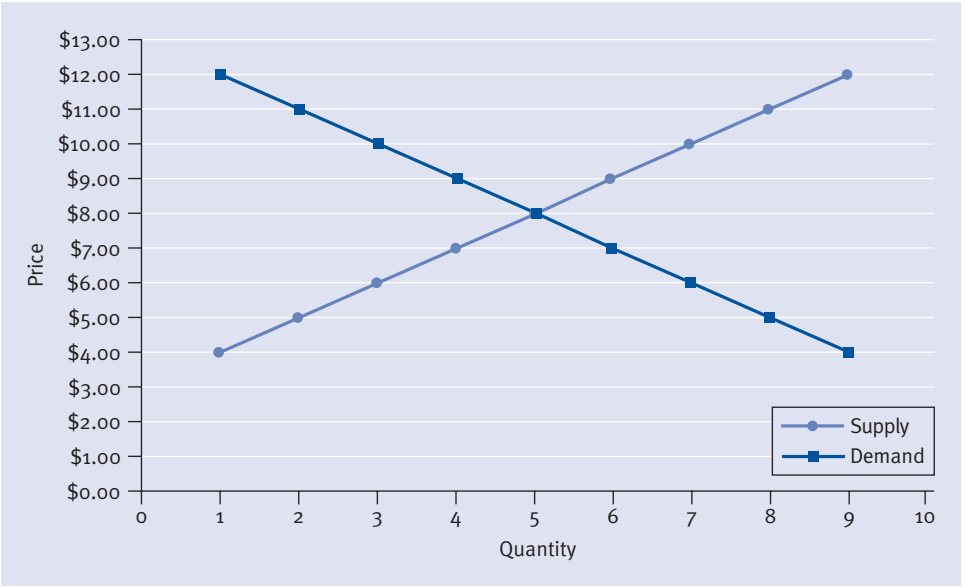


FIGURE 8-11 Market-Making Supply and Demand Curves

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:[8]

- Buy at $8 and sell at $8 (five transactions).
- Buy at $7 and sell at $9 (four transactions).

[8]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.

TABLE 8-2 Optimal Spread in Market Making

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

- 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.

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.

Normally, we expect that prices will be forced down to cost in highly competitive markets. But this is not always the case. On May 26, 1994, the *Wall Street Journal* and the *Los Angeles Times* reported on academic research by Professor Bill Christie showing that Amgen, Apple, Microsoft, Cisco, and Intel stocks rarely traded at odd-eighths (fractions ending in 1/8 or $0.125) and thus had bid–ask spreads of at least 1/4 ($0.25). Christie and coauthor Paul Schultz concluded that the behavior was the result of a price-fixing conspiracy by the market makers that kept bid–ask spreads abnormally high.

The following day, market makers in these stocks stopped avoiding odd-eighth bid and ask quotes. As a consequence, average spreads narrowed dramatically to just over $0.125. We can see this change illustrated in Figure 8-12—a graph showing the average bid–ask spread of Microsoft stock.

By ruling out cost-based explanations for the collapse, Christie[9] and his coauthors concluded that publicizing the conspiracy led to its collapse. We'll return to this theme later on when we examine the forces of competition and how firms attempt to control them.

[9]William G. Christie, Jeffrey H. Harris, and Paul H. Schultz, "Why Did NASDAQ Market Makers Stop Avoiding Odd-Eighth Quotes?," *Journal of Finance* 49, no. 5 (December 1994): 1841–1860.

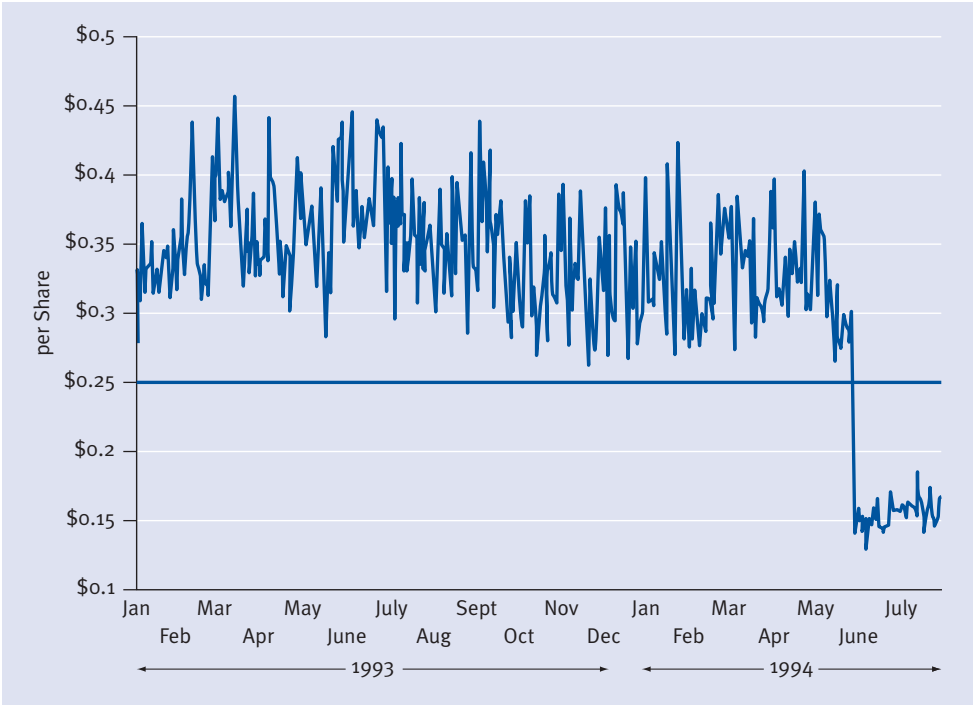


FIGURE 8-12 Microsoft Bid–Ask Spread

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. 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.
2. 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
3. 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
4. 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
5. 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

Individual Problems

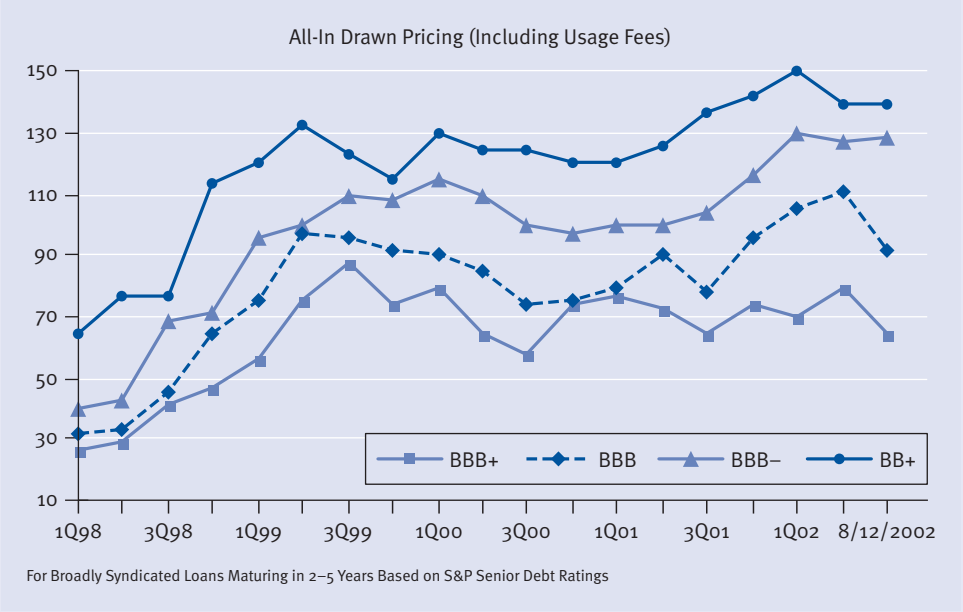
8-1 Widget Market

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.

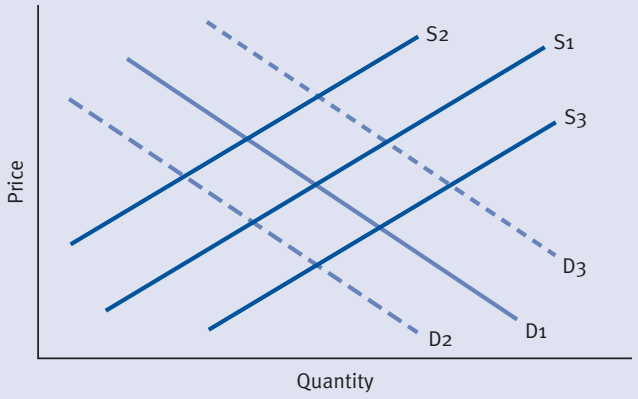


Over the same time period, in a related lending market, asset-backed commercial paper, we see a huge quantity increase as shown in the "Asset-Backed Commercial Paper" graph. Did prices for these loans increase or decrease? Justify your answer using shifts in supply and demand curves.

8-3 Candy Bars Market

a. In the accompanying diagram (which represents the market for chocolate candy bars), the initial equilibrium is at the intersection of S1 and D1. 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 S1 and D1. Circle the new equilibrium if there is rapid economic growth.



8-4 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

8-5 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.

CHAPTER 9

Relationships Between Industries: The Forces Moving Us Towards 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 above average market returns over a 15-year period. From the experiences of these 11 good-to-great companies, Collins distilled 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 companies, and its shares were trading below $1. Another one of the companies, Circuit City, declared bankruptcy in 2008, and was liquidated. Overall, the 11 companies failed to outperform the market over the years following the book's publication.

So where did Mr. Collins' analysis go wrong?

He 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."

Mr. Collins' second error was to ignore the long-run forces that tend to erode profit. High profit is like blood in the water to a shiver of sharks. Customers, suppliers, competitors, substitutes, and new entrants tend to behave in ways that erode above-average profit. 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 forces of competition, we first consider the extreme case of a **competitive industry** where:

- Firms produce a product or service with very close substitutes so they have very elastic demand.
- Firms have many rivals and no cost advantage over them.
- 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; and if price is below MC, 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.

For example, suppose industry demand suddenly increases for a product in a competitive industry. Following the increase in demand, price goes up and 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." But soon, the above-average profit attracts capital to the industry; existing firms expand capacity or new entrants come into the industry. New entry increases industry supply, which leads to a decrease in price. Entry continues 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 is in **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 greater time and effort to move assets.

In the long run, no competitive industry can earn 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 this cloud has a silver lining: 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 are condemned to 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.

In a competitive industry buffeted by demand and supply shocks, prices increase and decrease, but economic profit tends to revert to zero. We say that profit exhibits **mean reversion**. 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.

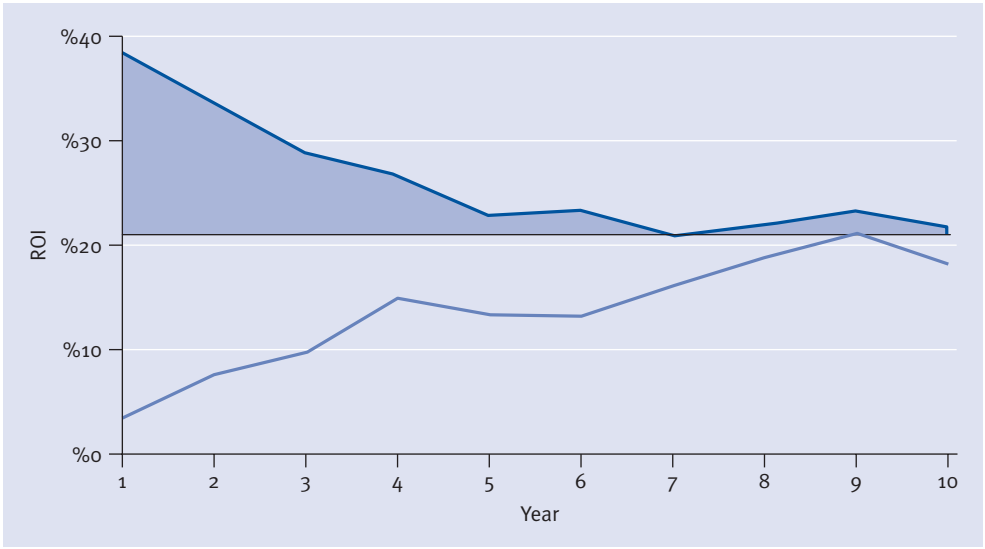


FIGURE 9-1 Mean Reversion of Profitability

[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 × Profitability at time t) 12.4% = 20% − 7.6%.

Students have a tendency to confuse short- and long-run analysis. If we are analyzing an increase in demand in an industry, in the short run, price and quantity will increase, and firms will earn above-average profit. In the long run, these above-average profits will attract new assets into the industry, which will shift supply out 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 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 being deployed in that industry relative to other industries.

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 enduring Nashville's hot and humid summers.

Similarly, wages 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 one profession is more attractive than another, labor will move to the more attractive profession, increasing supply and reducing the wage. Wages will keep falling until all professions are equally attractive. Now it may take a long time for entry to compete wages down to

[3]Steven Landsburg, *The Armchair Economist: Economics and Everyday Life* (New York: Free Press, 1993).

an equilibrium level, especially in professions that require a lot 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 26% 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. Just as lower-cost housing compensates Nashvillians for living in Nashville, so too do 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 handpicking 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 sporadic, Mr. Peralta went back to picking strawberries.[5]

One of the concerns following the housing meltdown is 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 is making 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 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 proposition 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.

[4]Median salary of embalmers equals $39,550, and median salary of rehabilitation counselors equals $31,350 according to May 2005 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.

We can illustrate this relationship with a very 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 increase in value to $120 with probability ½ and stay where it is with probability ½. The expected price is $110, so the expected return is 10%. The second stock will increase in value to $130 with probability ½ and decrease in value to $90 with probability ½. Although the second stock has the same expected return (10%), it is more risky because it has a higher variance. We can expect that 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 is analogous to a compensating wage differential. Just as higher wages compensate embalmers for preserving cadavers, so too do higher expected rates of return compensate investors in risky assets.

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 riskiness of the index, as computed from options prices. Since the fall of 2008, as the stock market has declined by about 50%, the volatility index has increased by about 100%. Whatever is making

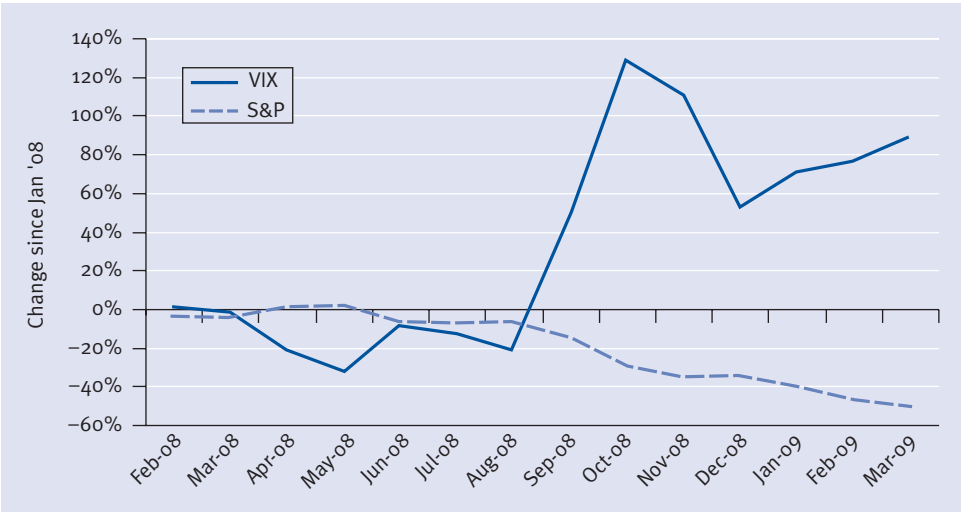


FIGURE 9-2 Stock Volatility and Returns

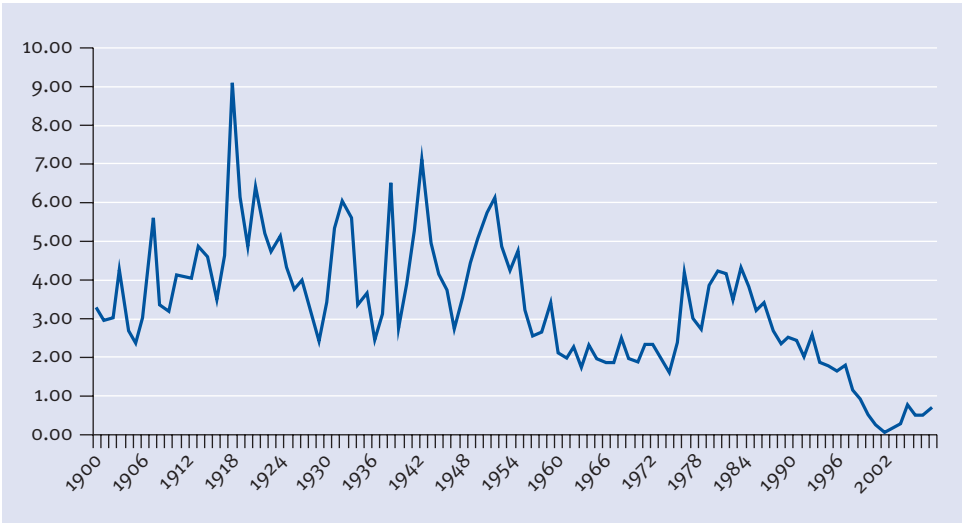


FIGURE 9-3 Historical Equity Risk Premium

stocks more volatile is 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 9% to 0%, as shown in Figure 9-3.[7]

In late 2006, most 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 saved yourself a lot of money.

[7]Adapted from information provided by William Spitz in October 18, 2006, presentation at Vanderbilt University.

MONOPOLY

If competitive firms live in the worst of all possible worlds, **monopoly** firms live in the best. Monopolies have some attribute(s) 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 might be a pharmaceutical company that develops and patents a new drug 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 long time. We can interpret this profit as a reward for doing something unique, innovative, or creative—something that gives the firm less elastic demand.

However, monopolies are not permanently insulated from the forces of entry and imitation. No barrier to entry lasts forever. Eventually other firms develop substitutes or invent new products that 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 profit to zero.

For example, in 1983, the Macintosh computer's innovative graphical user interface gave Apple Computer a unique, user-friendly product. The elasticity of demand for the Mac was very low and the markups for the product very high. Several years later, Microsoft came up with Windows 3.1, with its own graphical interface. The development of this substitute made demand for Macs more elastic. Later, Windows innovations (95, 98, 2000, and XP) became even better substitutes, making demand for Macs even more elastic. The higher elasticity reduced the Mac's markup over marginal cost, and Apple's profit eroded.

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

[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.

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 are condemned to 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. 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
2. 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
3. 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.
4. 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

5. 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

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 MBA Professors

Why do MBA economics professors earn more than regular economics professors? Why do MBA accounting professors earn more than MBA economics professors?

9-4 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?

9-5 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?

CHAPTER 10

Strategy—The Quest to Keep Profit from Eroding

In 1964, a professor of electrical engineering at the Massachusetts Institute of Technology founded a new technology company. It initially relied on research and development contracts from the government while it worked on commercial technologies. Its first product, the 2201 loudspeaker, launched a year later and was a total failure in the market. Although its technical performance was excellent, the design turned customers off. It took four more years until its first successful product, the 901 Direct/Reflecting speaker, hit the market. The company initially had to rely on door-to-door sales efforts to convince consumers of the quality of their product. Despite these early struggles, the company's ability to keep producing innovative products allowed it to slowly build and maintain a competitive advantage over its rivals. Annual revenues have since grown to $2 billion dollars, and the company now employs over 9,000 people.

What's the key to the company's success? According to the company's former president:[1] "Our challenge is to prod people into being innovative and using their creativity to do something that's better. In the long run, this is the source of sustainable advantage over our competition." The continuous stream of product innovations coupled with aggressive marketing and innovative control of its supply chain creates a competitive advantage that rivals find difficult to match. In a 2006 survey of over 4,000 U.S. households by a leading technology and market research company, the company was voted the most trusted technology brand, and it is the market share leader in its primary market.[2]

Succeeding in the face of competition requires that you first find a way to create an advantage and then devise a means to protect that advantage. How important is creating and sustaining advantage? Consider this story about the most storied investor 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."*

[1] S. Greenblatt, "Continuous Improvement in Supply Chain Management," *Chief Executive* 86 (1993): 40–43.
[2] The company is Bose Corporation.

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'll advise you to become a monopolist (assuming they're worth their hire). To keep one step ahead of competitors or imitators and keep profit from eroding, firms develop strategies to 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.

[3]Whitney Tilson, "Boring Portfolio" column on the Motley Fool site, February 28, 2000, http://www.fool.com/boringport/2000/boringport000228.htm

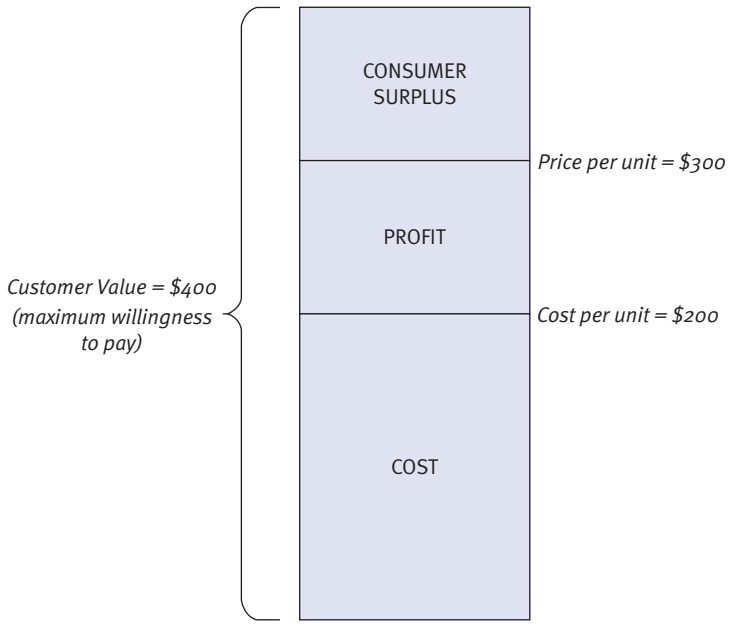


FIGURE 10-1 Allocation of Value

Teaching students to do this is probably the most difficult thing 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 Bose Corporation 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 fundamental unit of analysis is 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 inherently more attractive than other industries, and companies within those industries possess market power to generate economic profit. Industry structure determines firm conduct, and that conduct, in turn, determines the firms' performance. Industry structure is defined by the relatively stable dimensions of the industry that provide the context in which competition occurs. Typical structural characteristics of interest to IO researchers include barriers to entry, product differentiation among firms, and the number and size distribution of firms. As an example of the logic of this perspective, IO researchers believe that industries with higher entry barriers are more attractive because competitors find it more difficult to enter the industry and thus cannot drive profit down to competitive levels.

The IO perspective assumes that the industry structure is the most important determinant of long-run profitability. The key to generating economic profit for a business is its selection of 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 determining the industry. An industry is comprised of a group of firms producing products that are close substitutes to each other to serve a particular market. There's a bit of art in deciding just what your industry is, and for multi-product 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." Value created in each industry is distributed across suppliers, industry rivals, and buyers. Which of these players captures the lion's share of value differs across industries. 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. So, let's discuss the model in a bit more detail.

[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).

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 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.

In Figure 10-2, we see support for the IO view because it shows wide differences in profitability across a number of industries.[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? One example is companies who have developed auction systems to purchase raw materials and semi-finished inputs. Steps that you take to decrease rivalry, reduce buyer power, and build entry barriers will all help improve the attractiveness of your industry position.

[6]Profitability measured by operating income divided by assets over the period 1988–1995. Adapted from P. Ghemawat and J. Rivkin, "Creating Competitive Advantage."

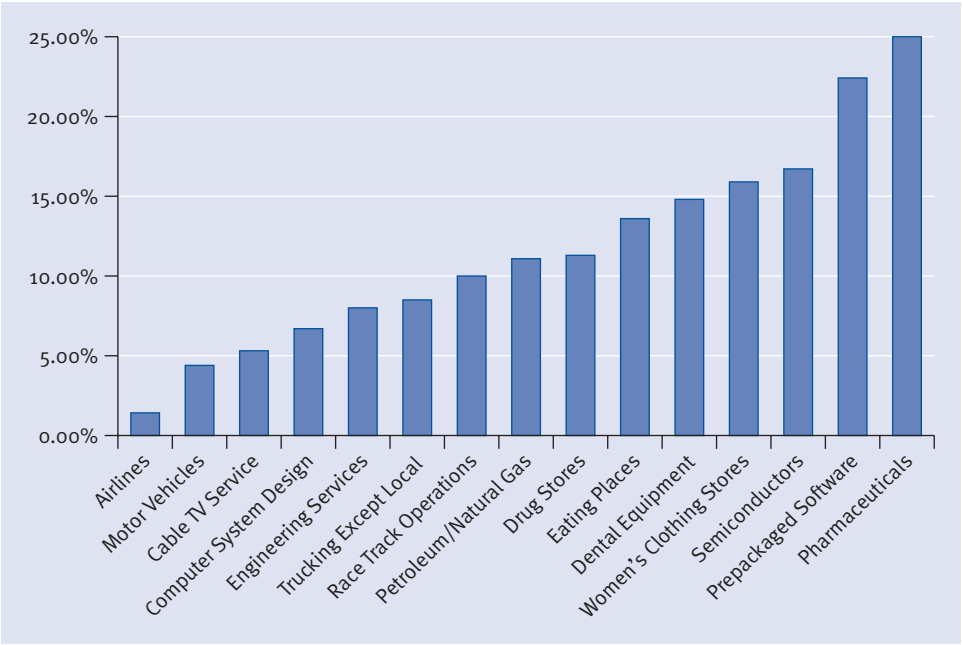


FIGURE 10-2 Profitability Differences Between Industries

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 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 recommend that as a complement to a Five Forces analysis, which focuses on *threats* in the industry, that firms also evaluate the *Value Net* of the industry for cooperative *opportunities*. 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

[7]A. Gawer and M. A. Cusumano, "How Companies Become Platform Leaders," *Sloan Management Review* 49 (2008): 28–35.

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 between firms within particular industries. These differences do exist, however, and the resource-based view (RBV) gained favor in the 1990s as an explanation for these inter-firm differences.

The RBV posits that individual firms may exhibit sustained performance advantages due to their superior resources, where resources are defined[8] as "the tangible and intangible assets firms use to conceive of and implement their strategies." Two primary assumptions underlie the RBV: The first is the assumption of resource heterogeneity (firms possess different bundles of resources); the second is the assumption of resource immobility (since resources can be immobile, these resource differences may persist).

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.

[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.

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.

So from the RBV perspective, resources and capabilities that are valuable, relatively rare, and difficult to imitate/substitute lie at the core of sustained, excellent firm performance. These resources and capabilities may include

- technology,
- physical capital,
- intellectual assets,
- human capital,
- financial resources, and
- organizational excellence.

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 I correctly discover that having a CMEO (Chief Managerial Economics Officer) in your company always leads to a competitive advantage in companies. So you, the astute reader, decide to hire a CMEO for your business and no competitive advantage follows. What happened? Well, your competitor probably heard 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. 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 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:

- cost reduction,
- product differentiation, or
- reduction in competitive intensity.

Most strategies fall into one of these three categories. The first strategy, cost reduction, is almost 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 markup 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 markup of price over marginal cost. Bose Corporation is an excellent example of a company that has successfully pursued a differentiation strategy for over 40 years.

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

[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://www.mercatus.org/Publication Details.aspx?id=23700

[11]Harvard Business School case number 9-373-052, "Prelude Corp."

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.

It's easy to identify successful strategies (and the reasons for their success) or failed strategies (and the reason for their failures) in retrospect. It's much more difficult to identify successful or failed strategies before they succeed or fail.

Before concluding this chapter, 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 sustainable competitive advantage. The stock price has to be low relative to future earnings.

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. 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).
3. 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
4. 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.
5. 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.

Individual Problems

10-1 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).

10-2 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

10-3 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?

10-4 Intangible Resources

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

10-5 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?

CHAPTER 11

Using Supply and Demand: Foreign Exchange, Trade, and Bubbles

In 2003, a small island nation known primarily for fishing, back-to-back Miss World winners, and geothermal heat suddenly became the fastest-growing economy on the planet. It began in the post-9/11 world of cheap money (low interest rates) 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, but also from the Netherlands and Germany. They offered the highest interest rates in the developed world, and depositors flocked in. In just two years, the number of depositors outnumbered the population of Iceland, and the amounts in just those accounts was much greater than Iceland's entire national income.

The rising incomes from the booming economy started a domestic consumption spree. Residents bought new houses, cars, and appliances. And what they couldn't pay for in cash, they borrowed. Icelandic residents borrowed from foreign banks because foreign interest rates (3%) were much lower than domestic rates (15.5%). The standard of living tripled and Iceland became the costliest place on earth to live.

Since every bank borrows short term and lends long term, they are vulnerable to bank runs. Banks make long-term loans or investments, but they borrow from depositors who can withdraw money at any time. Consequently, if depositors suspect that the banks cannot pay them back, they rush to withdraw their money. But since the deposits are lent out, or invested in non-liquid assets designed to earn money over the long run, they are not available for withdrawal. And if a bank cannot pay back its depositors, it goes out of business. This is why governments insure deposits. And, normally, insurance prevents bank runs because investors know that the government will guarantee their deposits. But in this case, Iceland's deposit guarantees were several times its entire national income. Consequently, the government insurance did little to reassure depositors.

When the bank run came, everything fell apart. The rating agencies downgraded the banks, and foreign depositors rushed to withdraw their money. Iceland's currency, the krona, dropped

in value, and prices soared. The British government went so far as to freeze the assets of one Icelandic bank in a vain attempt to protect British depositors. Although this was still under discussion while we were writing the book, it is likely that the UK government will eventually lend money to the Icelandic government so that the deposit insurance can be paid.

Today, Iceland is broke. In November 2008, the International Monetary Fund (IMF) agreed to a rescue package for Iceland and now it is essentially running the country. Consumer debt is over eight times national income. And due to the depreciation of the krona, Icelanders have little prospect of paying back their foreign loans. Coincidentally, late-model cars, purchased at the height of the bubble, have demonstrated a curious tendency to catch on fire. This allows the owners to collect insurance on the value of the car. It is next to impossible to sell expensive cars in Iceland now, so this may still offer some relief to debt-burdened car owners.[1]

To understand how this happened, we apply the tools developed in both Chapters 8 and 9 to foreign exchange, trade, and bubbles, the topics of this chapter. We first examine the market for foreign exchange, and then examine how changes in the exchange rate affect trade (i.e., imports, exports, and foreign investment). We end the chapter with a discussion of speculative "bubbles." We briefly review what little economists know about bubbles, and then show you how to use the long-run relationships of Chapter 9 to recognize markets whose prices are far away from long-run equilibrium.

THE MARKET FOR FOREIGN EXCHANGE

To analyze the market for foreign exchange, we begin by asking why 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 will change krona (ISK) into pounds (GBP) because Land Rover's workers, suppliers, and investors all 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. 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.

On the other side of the exchange 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

[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.

FIGURE 11-1 GBP/ISK Exchange Rate

rate, or the price of a pound measured in krona. We see from the graph in Figure 11-1 that the price of a pound moved between 110 and 140 krona from 2003–2007, and then began an increase to a peak in December 2008 at 220 krona. The price of a pound has come down since the IMF bailout.

To analyze these changes, we are going to 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 are going to ignore trade that runs through third-party countries.

Note that you can also analyze these movements by using the supply and demand for krona, instead of the supply and demand for pounds. 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 price of a pound. So when the price of a pound is at 200 krona, we could instead say that the price of a krona is half a penny. Likewise, the strengthening of the pound is equivalent to the weakening of the krona.

Now that you understand who is behind the demand and supply curves, try to analyze the effect of an increase in the so-called "carry" trade on the exchange rate, where Icelanders borrow in a foreign currency to invest domestically. Such a change could be caused by an increase in Icelandic interest rates relative to British interest rates.

Following an increase in the cost of borrowing domestically, Icelanders substitute towards a cheaper source of funds, and increase borrowing from foreigners (i.e., the British). After they

borrow in pounds, they sell pounds to buy krona (increasing the "supply" of pounds) and then spend the krona on projects in Iceland. The increase in the supply causes the price of a pound to fall. In the jargon of foreign exchange, the pound depreciates. However, Figure 11-1, which shows the price of a pound measured in krona, reflects no such fall. In other words, the data reject our theory.

The missing part of the explanation is to remember that the foreign borrowing was accompanied by increased import consumption. If Icelandic consumers borrow abroad to purchase imported goods, this generates two offsetting trades in the market for foreign exchange. British depositors sell pounds to buy krona to deposit in Icelandic banks. The banks then lend to Icelandic consumers who sell krona to buy pounds to purchase British goods. The first transaction increases the supply of pounds, whereas the second increases the demand for pounds. The quantity of foreign exchange transactions increases, but the price of a pound does not change. This probably explains the relatively flat exchange rates up until 2008.

In 2008, the rapid spike in the price of a pound was the result of the run on the Icelandic banks. Once foreign depositors became concerned that Icelandic banks would not be able to pay them back, they withdrew krona from banks, and then sold krona to buy pounds, essentially unwinding their earlier transactions. This increased the demand for pounds and drove up the price.[2] The price began to come down only after the IMF bailout and guarantees by the British government of the foreign deposits. Note that there are now capital controls in place that have restricted trade to such a degree that there is now an "official" exchange rate—the one we have plotted—and a black market rate that shows a much weaker 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, i.e., importers 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

[2]Note that if Icelandic consumers would have also sold back their imported goods, this would have generated an offsetting trade, and the exchange rate would not have moved very much.

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 means that it takes more dollars to buy a Chinese Big Mac. This is simply an increase in the dollar price of a Big Mac. Used in this way, the *Economist*'s "Big Mac Index"[3] 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, so one would not expect the prices of Big Macs to move together. Consequently, we would not expect changes in the Big Mac Index to be able to predict changes in exchange rates. But in this case it was remarkably prescient.

THE EFFECTS OF A CURRENCY DEVALUATION

Demand and supply analysis can also help us understand the effects of a currency devaluation on trade flows. For example, when the peso falls in value relative to the dollar (a 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?

Let's begin with the demand and supply of golf in Mexico. There are two sets of consumers who demand golf in Tijuana: Mexican and American golf players. For both groups, playing golf in the United States is a substitute for playing golf in Mexico. Following a peso devaluation, both groups' demand for golf in Mexico increases. Mexicans face an increase in the price of U.S. golf, a substitute product (their pesos buy fewer dollars); and U.S. citizens face a decrease in the price of Mexican golf (because their dollars buy more pesos). Both U.S. golfers and Mexican golfers substitute less expensive Mexican golf for more expensive U.S. golf. So a weaker peso increases demand for Mexican golf and simultaneously decreases demand for U.S. golf.

We represent these changes graphically in Figure 11-2. The key to understanding the changes is to look at the change in each area separately, using prices measured in the local currency. Since the short-run supply of golf is fixed, the supply curve is relatively inelastic, indicated by a nearly vertical line. Because quantity cannot adjust, we'd expect a relatively large adjustment in price. The price of golf in Tijuana, as measured in pesos, *increases*, and the price of golf in San Diego, as measured in dollars, *decreases*.

The devaluation was a benefit to Mexican golf-course owners who "export" a portion of their product to U.S. consumers. Simultaneously, the devaluation hurt U.S. golf-course owners

[3]See "Big Mac Index," *Economist.com*, http://www.economist.com/markets/bigmac/about.cfm

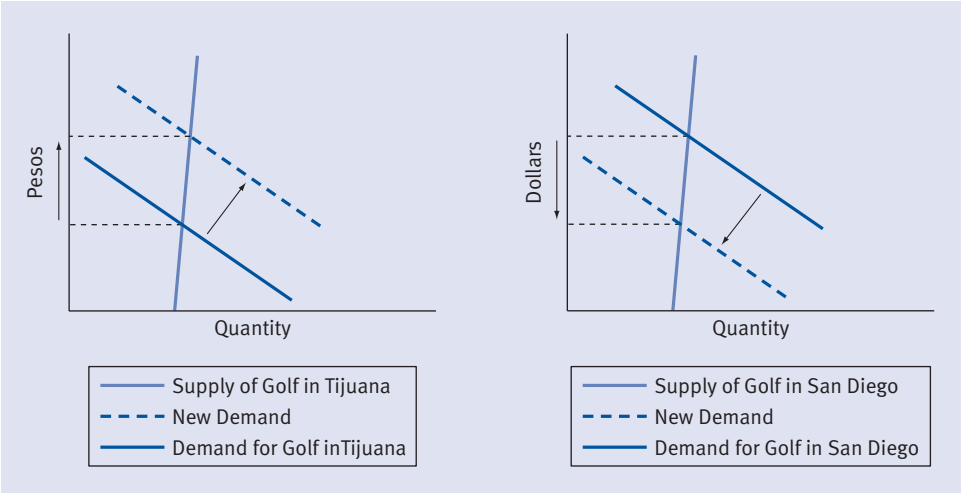


FIGURE 11-2 Demand-Supply Analysis of a Peso Devaluation

but helped U.S. golfers. In general, devaluations benefit suppliers but harm consumers and vice versa.

Currency devaluations help suppliers because they make exports less expensive in the foreign currency; but they hurt consumers because they make imports more expensive in the domestic currency.

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 can buy exported fish. An appreciation of the pound, like that which occurred in 2008, would increase demand from foreign consumers, who find that their pounds can purchase more krona. This would increase 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. 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.

Since Iceland imports so much of its consumption, the devaluation of its currency had a big effect on domestic prices. In Figure 11-3, we see that the increase in Iceland's inflation rate closely matches the depreciation of the krona relative to the pound. As the krona devalues relative to the pound, import prices increase.

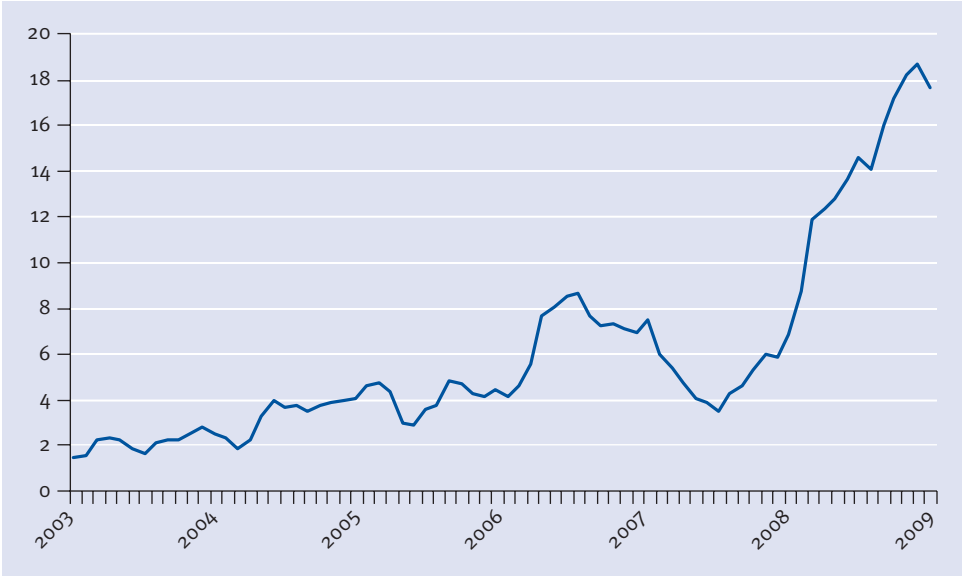


FIGURE 11-3 Iceland Inflation Rate

BUBBLES: PAST PERFORMANCE IS NO GUARANTEE OF FUTURE SUCCESS

We close this chapter with a relatively controversial topic. Bubbles are, by definition, prices that cannot be explained by normal economic forces; so it follows that there is no agreement among economists on how to explain them—in fact many economists don't think they exist. And even among those who believe in them, there is little agreement about how to model them. However, it is clear that once started, expectations about the future play a role in keeping bubbles going. To see how such expectations affect price, imagine that buyers and sellers see a big price increase in one year and expect a similar price increase in the following year. How will this affect the present?

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. 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. In this sense, the expectations are self-fulfilling.

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.

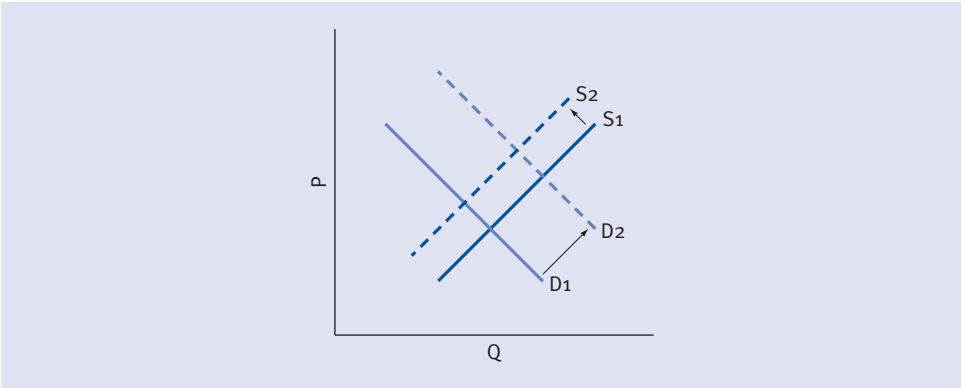


FIGURE 11-4 Effects of Expectations on Demand and Supply

There are certain features, or empirical regularities, of bubbles that economists have documented.[4]

1. Bubbles emerge at times when investors profoundly disagree about the significance of a big economic development, such as the birth of the Internet. Because it's more costly to bet on prices going down than up, the bullish investors dominate.
2. Once they get going, financial bubbles are marked by huge increases in trading, making them easier to identify.
3. Bubbles can persist even though many smart people suspect a bubble because no one has the firepower to successfully attack it. Only when skeptical investors act simultaneously—a moment impossible to predict—does the bubble pop.

To illustrate, let's look at the recent housing market in the United States. The increase in price began when government policies designed to encourage low-income homeowners to buy houses were enacted in 1993. They did this by reducing 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.[5] This is the "big economic development" that started the bubble.

Especially in areas where the supply was limited by strict zoning laws (e.g., Washington DC, California, or Florida), prices increased dramatically. The zoning laws made supply less

[4]Justin Lahart, "Bernanke's Bubble Laboratory," *Wall Street Journal*, May 16, 2008, http://online.wsj.com/public/article/SB121089412378097011-FFmV04y3UbiExIhWXW5XHa8Dplk_20080614.html

[5]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?_r=1

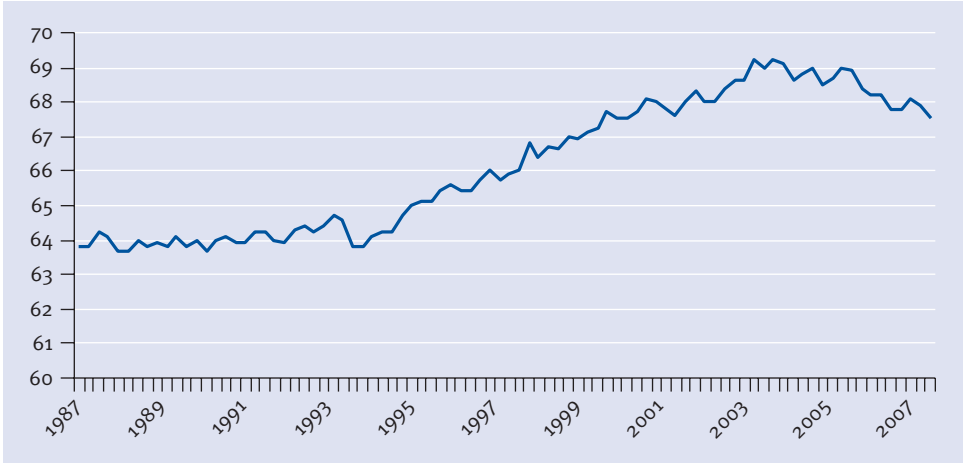


FIGURE 11-5 U.S. Home Ownership Rate

elastic (steeper) so the increase in demand led to a bigger increase in price. Because many market participants expected housing prices to continue to increase, they levered up and bought bigger and sometimes even second houses. Mortgage lending was thought to be safe because if the borrower defaulted, the house could be sold for more than the amount of the loan. So, banks were willing to lend on very favorable terms.[6]

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. Although his book is still selling for $12 on Amazon.com, Dr. Lereah is no longer employed by the National Association of Realtors.

In contrast to Lereah, Yale economist Robert Shiller warned of an irrational housing bubble in 2005.[7] 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

[6]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

[7]Jonathan R. Laing, "The Bubble's New Home," *Barron's*, June 20, 2005, http://online.barrons.com/article/SB111905372884363176.html

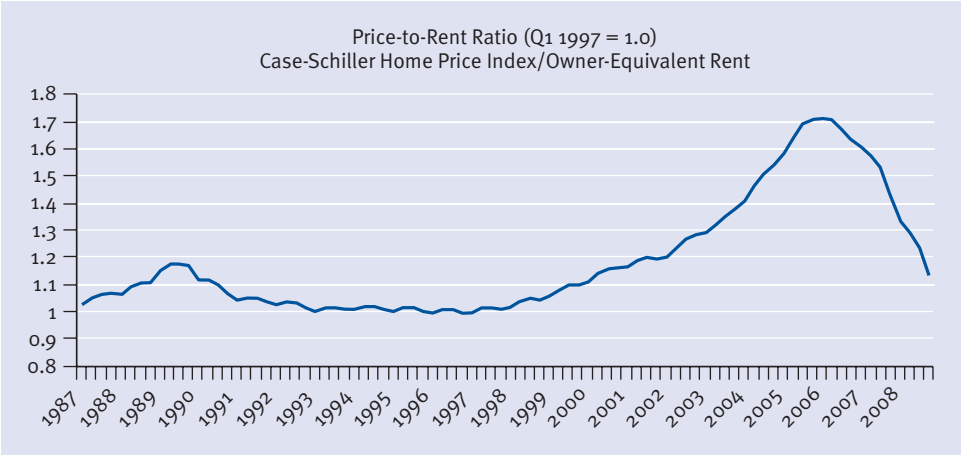


FIGURE 11-6 Renting vs. Owning

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.

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 I did, I probably wouldn't tell you; I would trade on the information instead.

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 so-called "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. We update his analysis using a 10-year trailing average of earnings.

In Figure 11-7, we 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.

So what do bubbles have to do with Iceland? Looking at Shiller's graph, we see that from 2003–2007, 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

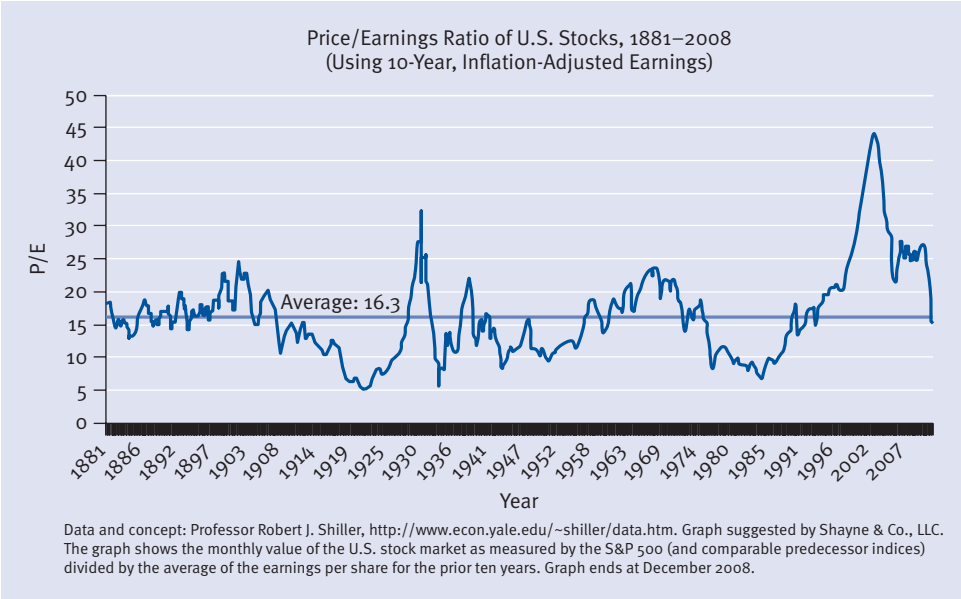


FIGURE 11-7 Stock Price/Earnings Ratio

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.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- In the market for foreign exchange, 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, 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.
- The so-called carry trade, borrowing in foreign currencies to spend or invest domestically, increases demand for the domestic currency, appreciating the domestic currency. However, borrowing in foreign currency to buy imports or invest in a foreign country does not affect the exchange rates.

- Currency devaluations help suppliers because they make exports less expensive in the foreign currency; but they hurt consumers because they make imports more expensive in the domestic currency.
- Once started, expectations about the future play a role in keeping bubbles going. 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. 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.
2. 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.
3. Following an increase in Mexican interest rates relative to U.S. interest rates, which caused 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.
4. Following an increase in Mexican interest rates relative to U.S. interest rates, which caused Mexican investors to borrow abroad to invest abroad, 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.

5. 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.

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.

11-2 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/U.S. dollar exchange rates.

11-3 The Carry Trade

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

11-4 Dollar Devaluation

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

11-5 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?

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SECTION III

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 Walmart offered the book for $18.18 and $17.87, respectively. Online retailer Amazon was even more aggressive. Those who pre-ordered 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 $(P - MC)/P = 1/|e|$ 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 3-liter Coke to generate additional foot traffic. Whatever the grocery store lost on 3-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 Hollows*. 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.

[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=1&fta=y

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. For firms that sell multiple products, or those who use low prices to win new customers, the rule does not hold.

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 consider how pricing changes after acquisition of a substitute product. Suppose, for example, you purchase a rival video rental store just across the street from your current video store. How does this change the price of video rentals at each store?

With just one store, 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 output at one store (through a price reduction) will "steal" some output from the other. Before you owned the rival store you didn't care where your additional sales came from, but now that you own both stores, you don't want to steal sales from a store 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 at each store.

Formally, common ownership of two substitute products reduces what we call the new, post-acquisition MR. Recall that MR is the benefit (additional revenue) of increasing output or reducing price. Acquisition causes the benefit of increasing output to fall, and MR falls below MC. As a consequence, the post-acquisition firm finds it optimal 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.

Another way to see this 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, which we can think of as a bundle. Acquiring a substitute makes aggregate demand for the bundle less elastic, and with a less elastic aggregate demand, you want to raise price. Remember from Chapter 6 that aggregate demand is less elastic than individual demands that comprise the aggregate.

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 where

the markup of price over cost is proportional to the inverse elasticity. Intuitively, the markup 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 high-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 your 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 inter-product cannibalization by *repositioning* the products so they don't directly compete with each other—provided that repositioning isn't too expensive. For example, using our video rental stores as an example, you might want to stock multiple copies of the most popular videos at one of the stores (add depth) but stock a wider range of titles (add breadth) at the other. Moving the products farther apart can further increase profit from acquiring a substitute product.[2]

Commonly Owned Complements

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

But after the acquisition, an increase in output at one (through a price reduction) will increase demand at the other. In other words, common ownership of parking lot and video store 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.

Again, we can understand this advice by examining how common ownership changes the aggregate elasticity of demand for the bundle of goods. Acquiring a complement makes aggregate demand more elastic than individual demand. And with a more elastic aggregate demand, you want to reduce price.

[2]Amit Gandhi, Luke Froeb, Steven Tschantz, and Gregory Werden, "Post-Merger Product Repositioning," *Journal of Industrial Economics* 56 (1): 49–67, March 2008.

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. Importantly, these costs are very large relative to marginal costs. In addition, firms in the industry 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 building 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 the hotel, cruise ship, parking lot, or stadium is built and the costs of building capacity have been sunk, the question of how to price arises. As we know from Chapter 3, we should ignore sunk or fixed costs when setting price to avoid committing the sunk-cost fallacy. In other words, 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.

Recall that MR and MC are the relevant short-run variables that vary with the decision of what price to charge. 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.

To understand this, it helps to use a numerical example. Suppose we are designing a new hotel. We keep adding rooms to the design plan, as long as LRMR > LRMC. Here LRMR and LRMC are the "long-run" marginal revenue and marginal cost of the building. Suppose that the optimal design size is of 300 rooms. At the optimal size, annualized LRMC of building, cleaning, and heating the room is about $400 per day.

But once the rooms are built—or, equivalently—once the costs have been sunk, the hotel's owners must decide how much to charge for the rooms. Suppose that 90% of the annualized long-run marginal costs are fixed or sunk (i.e., they do not vary with sales). This means that the relevant marginal cost is just $40 per day. Since the capacity decision is determined by *all* the costs, and the pricing decision *only* by short-run marginal costs, it's likely that

MR > MC at the capacity of the hotel. If so, then the hotel's owner should price to sell all available rooms.

To do this, simply choose a price that matches demand to capacity. If demand is known, this is relatively easy to do. For example, it's easy to set price for a parking lot in a downtown business district. Every day, you look to see what time the lot fills up. If the lot fills up before 9 A.M., then raise price; and 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. A higher price would leave unused parking spaces, whereas a lower price would allow you to raise price and still fill available capacity. The relatively constant demand and the daily observation of demand make this relatively easy to do.

In contrast, if demand is difficult 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 overpricing (lost profit on unfilled rooms) against the cost of underpricing (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. However, if the lost profit from overpricing is less than the lost profit from underpricing, then the firm should overprice, and vice versa. This will lead, on average, to more overpricing errors than underpricing errors, simply because the cost of these errors is lower.

> *If the lost profit from overpricing (unused capacity) is smaller than the lost profit from underpricing (lower margins), then price higher than would fill capacity, and vice versa.*

The precise degree of over- or underpricing depends not only on the costs of under- and overpricing, but also on the probability of under- and overpricing. In the chapter on uncertainty we will illustrate this difference more clearly.

Obviously, with better demand forecasts, the fewer errors of either type you'll make. Fewer errors mean more 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 is costly for two reasons. 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. In addition, there is another problem with adjusting price. 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 your marketing class, you'll learn that there are at least four dimensions to competition, the so-called Four Ps of marketing: Price, Product, Placement, and Promotion. *Product* refers to product design, like the decision of the video store owner to add "depth" or "breadth" to the titles it carries; *Placement* refers to the distribution channel (retail stores, catalog sales, discount stores, Internet sales, or distributors); and *Promotion* refers to advertising, discount coupons, end-of-aisle displays, and any other expenditures that increase demand for your product. 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.[3]

> *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. Typically, this kind of advertising informs some consumers 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 informing consumers about relative prices, you also make them more sensitive to price differences. Put another way, consumers are more sensitive to price differences when they know about those differences. When you see this kind of promotion, you also typically see a reduction in the price of the promoted good. And this makes sense. If you make demand more elastic, you want to reduce price to attract more customers.

On the other hand, advertising designed to increase the inherent attractiveness of the product makes demand less elastic. Advertising that influences consumer perceptions about the inherent product quality or associates the product with a celebrity or desirable activity falls into this category. When you run this kind of promotional campaign, the seller is trying to reduce the customer's sensitivity to price. In this case, it makes sense to *increase* price.

[3]Luke M. Froeb, Steven Tenn, and Steven T. Tschantz, "Mergers when Firms Compete by Choosing both Price and Promotion," April 11, 2007. Vanderbilt Public Law Research Paper No. 07-09; Vanderbilt Law and Economics Research Paper No. 07-11. Available at SSRN: http://ssrn.com/abstract=980941

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 price, you may infer that it is of high quality. In other words, a high price may signal high quality. In this case, you'd want to price high to signal quality. Many wines are priced high for this reason.

But low prices can also signal quality. For example, restaurant owners sometimes keep prices too low, thus generating long queues of customers willingly waiting to get in. The long lines signal that the price is low relative to the quality of the meal. Long lines tell customers who don't know anything about the restaurant that quality is high relative to price. We'll discuss signaling further in Chapter 19.

PSYCHOLOGICAL PRICING

All of the above pricing strategies are built on the assumption that consumers behave rationally, optimally, and self-interestedly. But, as we mentioned in Chapter 3, sometimes they don't. In fact, there are a number of well-known biases that can influence optimal pricing.

As just one example, consider the pricing decision that some airlines made 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. By charging for snacks, airlines led passengers to focus on the loss of their free snacks. They viewed the change negatively, and some switched airlines in response.

Research from the relatively new field of behavioral economics tells us that this reaction was entirely predictable. Much of this work draws insight from prospect theory, which says that the way a decision is framed matters a great deal to the decisions that consumers make. In particular, consumers tend to "feel" losses more than gains, so that it makes sense to frame decisions or changes as gains whenever possible. In particular, the airline would have been better off providing everyone who skipped the snacks a $5 discount or rebate. The revenue consequences are the exact same, but "framing" the change as a gain (the $5 you save) would have been perceived as a gain by consumers. Similarly, retailers who offer a discount for cash rather than a surcharge for using a credit card understand this framing effect. Prospect theory provides an explanation for many of the decision-making biases discussed in Chapter 3 and an explanation for the strategies companies use to take advantage of these biases.

Also beware of consumer concerns with fairness. One of the reasons that Home Depot did not charge more for building supplies in the wake of Hurricane Katrina was that they didn't want to be perceived as "unfair." This is the same reason that vending machines don't charge more as temperatures increase; or that hardware stores don't raise prices for snow shovels when

it snows. 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 2008 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 unknown, and the costs of underpricing are smaller than the costs of overpricing, then underprice, 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.

[4]Mark Hefflinger, "Top Artists 'Scalping' Own Tickets on Resale Sites," *Wall Street Journal*, March 12, 2009.

Multiple-Choice Questions

1. You own two products, each of which is a substitute for the other. You raise price on the first product. What happens to marginal revenue?
   a. MR for the first product falls but increases for the second.
   b. MR rises for both products.
   c. MR falls for both products.
   d. MR for the second product falls but increases for the first.
2. Your company produces and sells Product A, which has an associated elasticity of demand of −1.8. You acquire as a substitute product B, which has an associated elasticity of demand of −2.0. How should you handle pricing?
   a. Raise price on both products with a larger increase on Product A.
   b. Raise price on both products with a larger increase on Product B.
   c. Reduce price on both products with a larger decrease on Product A.
   d. Reduce price on both products with a larger decrease on Product B.
3. Your company is in the same position as that in the previous question, but Products A and B are now complements. How should you handle pricing?
   a. Raise price on both products with a larger increase on Product A.
   b. Raise price on both products with a larger increase on Product B.
   c. Reduce price on both products.
   d. Reduce price on one product and raise price on the other.
4. A real estate development company is considering building a new office building in downtown. Above 20,000 square feet, the company's managers believe they can generate approximately $600,000 in additional lease payments for every additional 1,000 square feet built. This $600,000 represents
   a. Long-run economic profit
   b. Long-run marginal revenue
   c. Long-run marginal cost
   d. Long-run average additional revenue
5. Local retailers and producers often use weekly mailed circulars to promote their products to local consumers. The circulars feature a variety of products and make consumers aware of pricing advantages of the products available at local establishments. How would you expect one of the retailers to handle pricing for a product that appears in the circular?
   a. Maintain price and allow the promotion to drive sales.
   b. Raise price to capitalize on the additional potential traffic.
   c. Reduce price to take advantage of the benefits of the promotion.
   d. The advertising and pricing decisions should be unrelated.

Individual Problems

12-1 Pricing Commonly Owned Substitute Products

Branded drugs face generic entry by rival drugs that typically take 80% of sales away from the branded drug within three years. This loss occurs because generic drugs are much cheaper than branded drugs, and most insurance companies won't pay for a branded drug if a generic is available. But in one instance, the branded-drug maker sued the generic entrant for violating its patent. In the settlement negotiations that ensued, the branded-drug maker offered to pay the generic entrant $10 million to settle the patent dispute by staying out of the industry. Why would the branded drug offer to pay the generic drug to stay out of the industry?

12-2 Pricing Commonly Owned Complementary Products

You are a hospital administrator trying to raise capital to refurbish the hospital. Your local bank is reluctant to lend to you because you already have a large mortgage on the property on which the hospital complex lies. But your bankers tell you that they can lend you more if you reduce your debt by selling your parking lot to some private investors who'll lease it back to you for the next 50 years. And you'll have to renegotiate the price of the lease every 5 years. What concerns might you have about this sale-and-lease-back contract?

12-3 Yield or Revenue Management 1

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?

12-4 Yield or Revenue Management 2

Suppose your elasticity of demand for your parking lot spaces is −0.5, and price is $20 per day. If your MC is zero, and your capacity at 9 A.M. is 96% full over the last month, are you optimizing?

12-5 Yield or Revenue Management 3

Suppose your parking lot has two different consumers who use it at two different times. Daily commuters use it during the daytime, and sports fans use it at different times to park at sporting events. Daily commuter demand is variable, yet stable and known. Demand for sporting events is uncertain, and depends on the quality of the match, as well as on unpredictable events, like the weather. How would you price these two events differently?

Group Problems

G12-1 Pricing Commonly Owned Products

Describe 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

Describe 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

Describe 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.

CHAPTER 13

Direct Price Discrimination

INTRODUCTION

Pricing Laptops

Dell, Inc., sells about 140,000 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 Cell Phones

In 1997, a global cell phone manufacturer—let's call it Ideal Roaming Kinetics (IRK)—was losing market share in the Philippines because its competitors were selling mobile phones at significantly lower prices. Since IRK charged a uniform worldwide price of $120 and sold primarily in Western Europe, competitors could undercut it in important, but less lucrative, markets like the Philippines.

The Philippine market was growing fast, and IRK wanted to position itself for future growth. Experience had shown that the 10% penetration point was critical in terms of future sales. According to this rule of thumb, the manufacturer with the largest market share at 10% market penetration would see its share grow by 40% when market penetration reaches 30%. Why? Due to "word-of-mouth" marketing. When consumers choose a particular brand, they're largely copying the choices that their friends and neighbors have already made. So an early sale to one consumer leads to later sales to his friends and neighbors.

In 1997, Philippine market penetration was just 5%, and IRK's market share was below 10% (see Figure 13-1). To raise market share before market penetration reached the critical 10% threshold, IRK's Philippine division wanted to price IRK's cell phones below its worldwide price. However, IRK was worried about the fallout from such discriminatory pricing.

Potentially, both Dell and IRK could benefit by charging different prices to different consumer groups. In the first case, Dell could increase profit by offering lower prices to more price-sensitive home users; in the second, IRK could increase profit by selling cell phones for less in the Philippines.

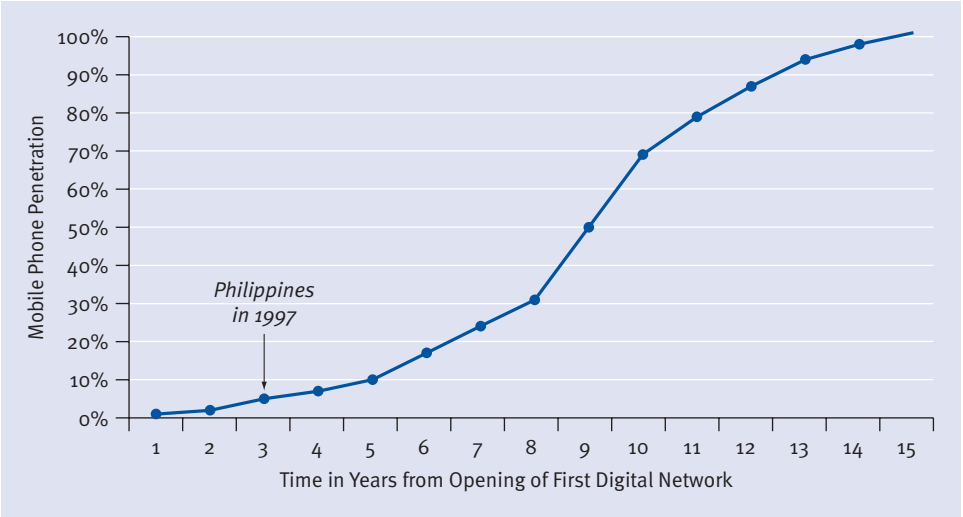

FIGURE 13-1 Forecast Adoption Rates of Cell Phones

However, discriminatory pricing carries with it attendant risks. 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.

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 the customers who would buy the product at lower prices: 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, by offering discounts to senior citizens, or by offering discounts for families with children.

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 can charge a separate price to the low-value consumers—those willing to pay $4, $3, $2, and $1—we face a second demand curve, illustrated in Figure 13-2. 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 low marginal costs and/or less elastic demand, 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. Software, music, drugs, and books fall into this category.

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

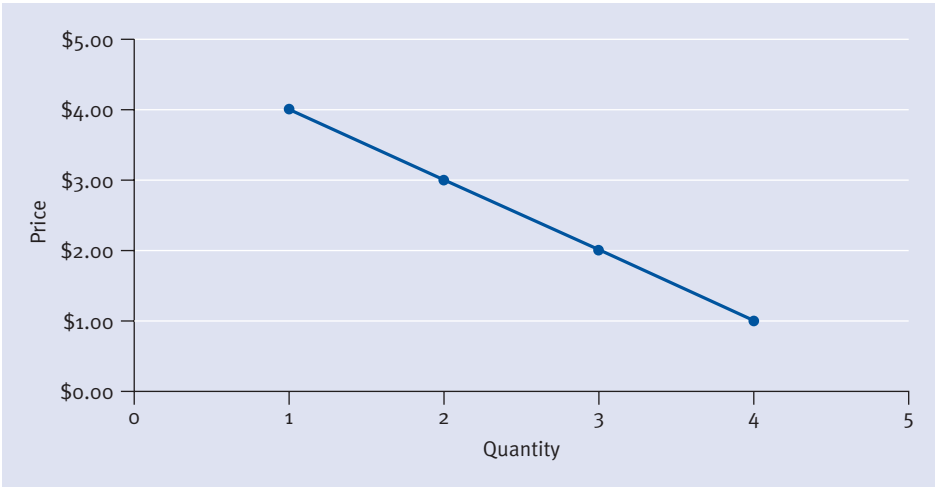

FIGURE 13-2 Demand Curve for Low-Value Consumers

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 re-importation" emerged as an issue in the 2008 U.S. presidential campaign. If we allow re-importation, what do you think will happen?

Drug re-importation means that low-value consumers (e.g., those in Table 13-2), will buy drugs at $3 and re-sell them to the high-value group for $5 (e.g., those in Table 13-2). In other words, they will arbitrage the price difference away. Once drug manufacturers realize that they cannot price discriminate, they will abandon the price discrimination scheme and set a single price for the drug (i.e., they will go back to behaving as if they face only a single demand curve). Price will increase to $5, so no one in the low-value group will purchase the drug. The policy implication is that if we allow drug re-importation, we will see consumers in Mexico and Canada pay higher prices, while consumers in the United States pay lower prices. Because the United States consumes so many more drugs than Mexico or Canada, we would expect the price to end up much closer to the U.S. price than to the prices in Mexico or Canada.

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 Walmart 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 can neither perfectly identify the two groups nor 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. 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.

$$(P_1 - MC_1)/P_1 = 1/|elasticity_1| \quad \text{and}$$
$$(P_2 - MC_2)/P_2 = 1|elasticity_2|$$

But this creates an incentive for the high-priced group to try to purchase at the lower prices offered to the group with more elastic demand. If too many high-value 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, we can't explain the price difference by costs alone. In other words, the markup of price over marginal cost is higher to the low-elasticity group.

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 re-sell their tickets to younger customers.

Likewise, airlines discriminate between business and leisure travelers. Business travelers have less elastic demands than do leisure travelers for several reasons. Business travelers don't pay for their own tickets; they have very specific time and geographic demands for a flight ("I have to be in Dallas, Texas, at 8:00 A.M. on Tuesday"); and they have schedules that can change at the last minute, so they need the flexibility of changing their tickets up until flight time. Airlines exploit the differences between the two consumer groups to design price discrimination schemes. The airline is able to identify the leisure travelers because they're willing to buy tickets in advance, and they're willing to stay over a Saturday night.

Although the airline can't prevent some business customers from buying tickets with these characteristics (which makes this more like an indirect discrimination scheme), most want the

flexibility of a fully refundable ticket without restrictions. But if enough business travelers take advantage of discounts for an advance purchase and a Saturday night stay, they can render the price discrimination scheme unprofitable, analogous to arbitrage between the two groups. In this case, the inability to identify the two groups can make the discrimination unprofitable.

It's also possible that the opportunity cost of holding a seat open for a business traveler with an uncertain demand (the probability that the seat will go unused is higher) can justify the higher price paid for a refundable, or business class, ticket. If so, the price difference arises from differences in *expected* costs and therefore is not discrimination.

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, if you charge prices closer to what consumers are willing to pay for a good, you also reduce consumer surplus.

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, Walmart, and other large retailers (together with their suppliers) for giving and receiving price discounts.[1] Economists have criticized the Act throughout its history because it protects *competitors* rather than the process of *competition*. By penalizing those who give or receive price discounts, the Act often has the perverse effect of reducing price competition and raising prices, thus hurting consumers.

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 advice, taken from the *The Antitrust Laws: A Primer*, a book advising businesses 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]

[1]European 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.

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 valuable 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, under the "Shop" link are options for Home & Home Office, Small & Medium Businesses, Large Businesses, etc. Prices will vary depend on which category you click. In March of 2009, you could purchase a 2.2-GHz Dell Latitude E6400 running Windows Vista Business SP1 with 2 GB of RAM (and other standard options) for $1,197 in the Small & Medium Business store. If you used the Large Business store, you would pay $1,339 for the exact same laptop with an identical configuration, a price increase of just under 12%. 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 Small & Medium Business link.

Pricing for Cell Phones

In early 1998, IRK, our cell phone manufacturer, abandoned its global uniform pricing and reduced the price of low-end models sold in the Philippines from $120 to $90. Since the Philippines used the same communication standard as most of the world (GSM), the lower prices created an arbitrage opportunity that threatened sales in higher-priced countries (15 million units annually). To prevent arbitrage, the firm sold the $90 phones with built-in SIM-locks—encrypted mathematical algorithms that allow the phones to operate only in local networks—which made those cell phones useless outside the Philippines.

In the past, Turkish hackers had managed to break the SIM-lock algorithms and reprogram phones to work in other networks. To defeat the hackers, the firm developed new, more complex algorithms for the SIM locks. The hackers managed to break the algorithm codes twice during 1998, but they were able to buy and ship just 15,000 phones to Western European markets before IRK changed the algorithms.

During 1998, IRK sold 200,000 phones to the Philippines. Without the price discrimination scheme, sales would have been only 50,000 units. Its market share went from below 10% to over

25% in one year. The competitors didn't respond because they were already selling their phones at a significant loss. Then, in early 1999, IRK returned to the global uniform pricing policy, raising the cell phone prices in the Philippines back to $120. Competitors followed and raised their prices to the same level. In 2000, cell phone penetration in the Philippines surpassed 12%, and IRK's market share rose to 34%.

ONLY SCHMUCKS PAY RETAIL

Research[3] has shown that 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[4] pay retail [prices]." If low-elasticity consumers know they're being discriminated against, they may even refuse to purchase. A study of online pricing showed that when shoppers are asked whether they have any discount coupons (thus revealing the existence of a price discrimination scheme), the click-through rate to completion[5] of the sale drops by enough to 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.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- If a seller can identify two groups of consumers with different demand elasticities, and it can prevent arbitrage between two 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 that are not cost-justified. 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 re-sell to high-value consumers. This can force a seller to go back to a uniform price.
- A **direct price discrimination scheme** is one in which we can identify members of the low-value group, charge them a lower price, and prevent them from re-selling their lower-priced goods to the higher-value group.

[3]Richard L. Oliver and Mikhael Shor, "Digital Redemption of Coupons: Satisfying and Dissatisfying Effects of Promotion Codes," *Journal of Product and Brand Management* 12, no. 2 (2003): 121–134.

[4]Schmuck also shmuck: n. Slang; a clumsy or stupid person; an oaf.

[5]*Click-through rate to completion* refers to "clicking through" all of the checkout screens to complete an order.

- 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 them 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.

CHAPTER 14

Indirect Price Discrimination

Apple iPhones

On June 29, 2007, Apple released the iPhone in the United States at a price of $599 for the 8-GB version and $499 for the 4-GB model. Customers lined up days in advance at Apple stores across the country to have a chance to be one of the first purchasers, and the company sold around half a million iPhones in the first weekend of its release.

Fast forward two months to September 5, 2007. Apple announced that it was discontinuing the 4-GB model and cutting the price of the 8-GB model by a third, from $599 to $399. What might account for this strange behavior? If you didn't know it was the iPhone, you might guess that the product was so unpopular that the price had to be cut to stimulate sales. But, given the appeal of the iPhone, this seems a pretty unlikely explanation. A more plausible explanation is that Apple was using the lower price to sell to additional customers. Firms often do this by designing different versions of a product, like home and business versions of the same software. In this case, the "versions" of the product differ in the time dimension. The premium version comes with the "feature" of being available now. The lower-valued version is the same except it's not available until sometime in the future. High-value customers identify themselves by purchasing early, and low-value customers wait to buy. Economists call this "inter-temporal price discrimination."

The strategy would have made Apple a lot of extra money except that the price cut irritated a lot of loyal customers. Remember, no one wants to be the schmuck who paid $200 "too much" for the phone. Negative publicity eventually caused Apply to offer $100 rebates (in the form of store credits) to assuage the early adopters.

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 cartridges at a 50% markup over marginal cost while it charges only a 15% markup on its printers. In 2003, HP sold about $10 billion worth of printers; it also sold $12 billion worth of ink and supplies. Despite the revenue similarities, HP earned about three times as much profit from ink cartridge sales as it did from printer sales.

TABLE 14-1 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

The relatively low margin on printers and the high margin on cartridges are similar to the margins on razor blades and razors, on movies and popcorn, and other complementary item pairs. Perhaps the most famous example of this kind of pricing involves Barbie dolls and dresses, inspiring a nickname for the practice: *Barbie Doll marketing*—you give away the dolls and sell the dresses at very high markups.

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 14-1. 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.

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 identify high-value shavers, who use more razor blades (replacing them more frequently as they become dull); high-value moviegoers, who buy popcorn at the movies, and high-value doll users, who purchase more Barbie outfits. Lower-value consumers buy fewer razors, forgo popcorn, and buy fewer doll accessories.

This kind of indirect price discrimination is more difficult to design and implement than the direct price discrimination schemes we discussed in Chapter 13 because it's more difficult to sort consumers into high- and low-elasticity groups, and to figure out what to charge them. You might end up charging a high-value customer too low a price, or a low-value customer too high a price. In the former case, you're leaving money on the table; in the latter, the consumer may decide not to purchase.

INDIRECT PRICE DISCRIMINATION

When a seller cannot directly identify who has a low or high value or cannot prevent arbitrage (buying at the low price and re-selling the item at a price just below the high price), the seller can still discriminate by designing products or services that appeal to different consumer groups. To see how this works, let's look at a series of examples.

Grocery stores use discount 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. The grocery store essentially reduces prices to low-value consumers who identify themselves as low value 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 to. If too many high-value customers (those with a low elasticity of demand) clip coupons, then the scheme becomes unprofitable. Fear of cannibalizing high-priced sales by offering low-priced items is characteristic of most indirect price discrimination schemes.

Another problem that plagues both direct and indirect discrimination schemes is the risk of creating profitable entry opportunities for rivals. Take printer manufacturers, for example. Rivals may try to enter the toner cartridge business or provide toner refill kits because it is so profitable. Unless the firm can find a way to prevent rivals from selling lower-priced cartridges, say, by "tying" the sales of new cartridges to sales of printers, this kind of competition can render the firm's price discrimination scheme unprofitable. But such ties can run afoul of the antitrust laws. Here is some advice from a former antitrust prosecutor:[1]

> *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.*

Software manufacturers discriminate between high-value and low-value consumers by designing different versions of software to appeal to each group. For example, in March 2009, the price of the "academic"—and disabled—version of the statistical software MINITAB was $50 but the full-featured version sells for $1,195. The academic version is designed to appeal to students while the full-featured version is aimed at businesses users. Here, the cannibalization threat is obvious—the manufacturer must price and/or design the two versions so that high-value business consumers prefer the full-featured version to the much cheaper academic version. MINITAB does this by putting limits on the number of observations and by omitting some of the statistical tests in the academic version.

[1]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.

TABLE 14-2 Demand for Software

Software Version	Home Users	Commercial Users
Full-featured version	$175	$500
Disabled version	$150	$200

TABLE 14-3 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

To make this concrete, let's go through a numerical example. Suppose your marketing department does a survey (see Table 14-2) 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. The profitability of these two strategies is reported in the first two rows of Table 14-3.

By now, you should expect what the indirect price discrimination scheme (strategy 3 in Table 14-3) looks like: sell the full-featured version to high-value consumers, and sell a disabled version to the low-value consumers. The difficult part of implementing this scheme is pricing the full-featured version to make sure that the high-value customers do not purchase the disabled, and cheaper, software.

It turns out that 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 ($50 = $200[value] – $150[price]). 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.

This example illustrates the potential for what marketers call *cannibalization*. When you offer a low-priced version of a good, you have to be careful that you do not cannibalize sales

of the high-priced version. In other words, we cannot charge $500 for the full-featured software because it leaves the high-value consumers with zero surplus. If we did charge $500, high-value consumers would purchase the disabled version. We avoid cannibalization only by charging $449 for the full-featured version and by making the home version unattractive by disabling the features most important to business users. In one of the more infamous examples of this, 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]

This simple numerical example is a little misleading because there is no cannibalization if we price the full-featured version at $449. But with more types of customers, as we would expect in a real application, some cannibalization is inevitable. If too much cannibalization occurs, setting a single price may become more profitable than price discrimination.

It is also difficult to sustain a profitable price discrimination scheme in the face of competition. And, as we described in Chapter 9, profits like those that flow from successful price discrimination are likely to attract competition. To see the effects of competition on price discrimination, look at what happened to United Airlines' pricing on its Philadelphia to Chicago route over the period 1997–2005.[3] In 1997, United didn't face much competition on this route and its highest priced fare (90th percentile) was three times higher than its lowest-priced fare (10th percentile). Entry by low-cost carriers like Midway and Southwest reduced the top fares, leading to less dispersion. By 2005, United's highest-priced fare was less than twice the lowest fare.

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

[2]Raymond J. Deneckere and R. Preston McAfee, "Damaged Goods," *Journal of Economics and Management Strategy* 5 (2): 149–174 (June, 1996).

[3]Kristopher Gerardi and Adam Hale Shapiro, "Does Competition Reduce Price Discrimination? New Evidence from the Airline Industry," Federal Reserve Bank of Boston, Working Paper #07-7, available at http://www.bos.frb.org/economic/wp/wp2007/wp0707.pdf

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—in this case, 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 but, if not, then bargain over how to split it.

Notice that this bundled pricing resembles the timber tract pricing discussed in Chapter 4. If you set a bundled price of $27, the consumer purchases the entire bundle. This is analogous to the logger who harvests all the trees under a fixed payment of $15,000. Instead of charging by the tree—and letting the logger choose how many trees to consume—the tract owner makes more money by bundling all the trees together and selling them for a lump sum.

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 owner 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 $3 to see the horror film and $2 to see the adventure film; the other half would pay $2 to see the horror film and $3 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 $2 (revenue = $200 per film), or it can sell to half of the moviegoers at a price of $3 (revenue = $150 per film). In this case, pricing low is more profitable, so each film would be sold at a price of $2 and the theater owner would earn $400 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 $5, so the theater can sell to all customers at the bundled price of $5 (revenue = $500).

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]

[4]Adapted from http://www.nytimes.com/2001/07/26/business/26SCEN.html?pagewanted=print

[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 à la Carte?" *Information Economics and Policy* 19 (2007): 379–404.

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, but only indirectly, by designing products or services that appeal to groups with different price elasticities of demand, who identify themselves based on their purchasing behavior.
- 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. The individual demand curve slopes downward because
   a. the value an individual places on an extra unit of the good decreases.
   b. the amount an individual is willing to pay for the additional unit increases.
   c. the total value consumers derive from consuming a product increases when they consume more units.
   d. All of the above.
2. The strategy underlying price discrimination is
   a. to charge higher prices to customers who have good substitutes available to them.
   b. to charge everyone the same price, but limit the quantity they are allowed to buy.
   c. to increase total revenue by charging higher prices to those with the most inelastic demand for the product and lower prices to those with the most elastic demand.
   d. to reduce per-unit cost by charging higher prices to those with the most inelastic demand and lower prices to those with the most elastic demand.

3. Direct price discrimination may be based on
   a. the age groups of buyers.
   b. the location of buyers.
   c. a buyer's membership in certain clubs or associations.
   d. All of the above.
4. Which of the following statements is consistent with an *indirect* price discrimination scheme?
   a. The seller doesn't have market power.
   b. The seller has no means to identify different customer groups with different demand elasticities.
   c. The seller cannot prevent arbitrage between the two groups.
   d. None of the above.
5. Bundling different items together helps sellers extract more consumer surplus by
   a. smoothing out different preferences in different buyer groups.
   b. grouping buyers into more heterogeneous segments.
   c. implementing a direct price discrimination scheme.
   d. None of the above.

Individual Problems

14-1 Newspaper versus Soft Drink Vending Machines

Why do newspaper vending machines allow buyers to take more than one paper while soft drink vending machines dispense just one can of soda at a time?

14-2 Movie Theater Price Discrimination

You run a chain of movie theaters, so you commission a marketing study that categorizes your potential customers into 10 equal-sized groups according to what they're willing to pay for a movie ($10, $9, $8, $7, $6, $5, $4, $3, $2, $1). It turns out that the low-value customer groups, those with values ($5, $4, $3, $2, $1), are all over 65 years old. All the costs of exhibiting movies are fixed except for the $3.50 royalty payment you must make to the film distributor for each ticket sold. What price should you charge for movie tickets? Should you offer senior citizen discounts? If so, how much?

14-3 Browsing Behavior and Price Discrimination

Some Internet retailers track whether its customers have recently visited popular price-comparison sites. Why might these retailers offer different prices to those who have and have not recently visited price-comparison sites? If different prices are offered, which group will be offered the lower price?

14-4 Inter-temporal Price Discrimination

Suppose that technophiles are willing to pay $400 now for the latest iPhone, but only $300 if they have to wait a year. Normal people are willing to pay $250, and their desire to purchase does not vary with time. Ignore the time value of money and compute the optimal pricing scheme of the iPhone. Assume that there are equal numbers of each customer type, and that the MC of the iPhone is $100.

14-5 Software Discrimination

Suppose your marketing department does a survey of potential users and finds that these users place the following values on the two versions of your software:

Software Version	Home Users	Commercial Users
Full-featured version	$175	$225
Disabled version	$150	$200

If the numbers of home and commercial users are equal, and you cannot distinguish between commercial and home users, what is the most profitable pricing strategy? Assume the MC of production is zero. Explain your answer.

a. Sell to only commercial users.
b. Sell to only home users.
c. Sell to both groups using a single price.
d. Sell to both groups at two different prices.

Group Problems

G14-1 "Barbie Doll Marketing" as a Way to Price Discriminate

Does your company use "Barbie doll marketing" as a way to price discriminate between high- and low-value consumers? Explain how the practice works and estimate the profit consequences. If your company doesn't currently engage in this practice, 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.

[7]Taken from Pat Bajari's economics class.

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.

In your paper, 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.

SECTION IV

Strategic Decision Making

CHAPTER 15

Strategic Games

In February of 2002, nine of the world's largest electronics companies, led by Sony, announced plans for a next-generation large-capacity optical disc video recording format called *Blu-ray*. Shortly thereafter, in August of 2002, Toshiba and NEC announced plans for a rival technology, which would become known as HD-DVD. A common standard would have allowed consumers to play a variety of movies on video players produced by a variety of manufacturers. Studios, electronics manufacturers, and consumers would have all benefitted from a common standard, as the market would have grown rapidly. Unfortunately, they could not agree on one. The Sony group preferred Blu-ray, and Toshiba preferred HD-DVD. They spent the next few years fighting what is known as a "standards war" while consumers waited on the sidelines to see who would win the war.

In 2004, Sony recruited HP, Dell, and Disney into the Blu-ray camp whereas Toshiba convinced Paramount Pictures, Universal Pictures, Warner Brothers, HBO, and New Line Cinema to support HD-DVD. In 2005, Microsoft and Intel also joined HD-DVD; Lions Gate Home Entertainment and Universal Music Group went with Blu-ray, and Paramount and HP backed off their previous commitments in order to back both standards. In 2007, both camps resorted to big price cuts to try to attract consumers—Blu-ray players formerly priced at $499 could be had for a price of $399, along with a $100 gift certificate and five free movies. In 2008, Blu-ray convinced Warner Brothers Entertainment, owner of the hugely popular *Lord of the Rings* and *Harry Potter* movies, to release movies exclusively in Blu-ray. The final victory for Blu-ray came in February of 2008 when Walmart announced it would drop HD-DVD players in favor of Blu-ray.

In situations like this, the profit of one firm depends critically on the actions of others. To analyze this interdependence, we use what is known as *game theory*. In a game, we identify the players, the options or moves available to them, and the payoffs associated with combinations of moves. If each player acts optimally, rationally, and selfishly, we can calculate the likely outcome—or equilibrium—of the game.

Studying game theory doesn't just help you figure out what's likely to happen; it also gives you insight on how you might be able to change the game to your advantage. For example, in fighting the standards war, Sony (Blu-ray) and Toshiba (HD-DVD) realized that

there were two potential equilibria to the "game" they were playing: for consumers, retailers, manufacturers, and content providers to coordinate on either one or the other of the two standards. The standards war was the result of their efforts to convince other market participants that their standard would emerge victorious.

This chapter can also be thought of as a complement to Chapter 11, where we introduced the basic three strategies for slowing profit erosion: reducing costs, differentiating your product, and reducing competitive intensity. Game theory will help you understand the third strategy. In what follows, we distinguish between two different types of games: sequential-move games and simultaneous-move games.

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 equilibrium of a sequential game, it's important to *look ahead and reason back*. 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. Each player chooses her best move, knowing how the other will react.

The likely outcome of the game is called a **Nash equilibrium**, named for John Nash, the mathematician (and Nobel laureate in economics) who is the subject of 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 against the other.*

In equilibrium, neither player wants to change his or her strategy because each player is doing the best that he or she can given what the other player is doing.

In the games that follow, we represent sequential games using the *extensive* or *tree form* of a game, familiar to anyone who's ever used a decision tree.

Entry Deterrence

In the game illustrated in Figure 15-1, an entrant is trying to decide 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 pricing 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 the incumbent does better by accommodating if the entrant decides to enter. In Figure 15-2, we denote the best strategy of the monopolist by putting two lines through the suboptimal strategy.

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.

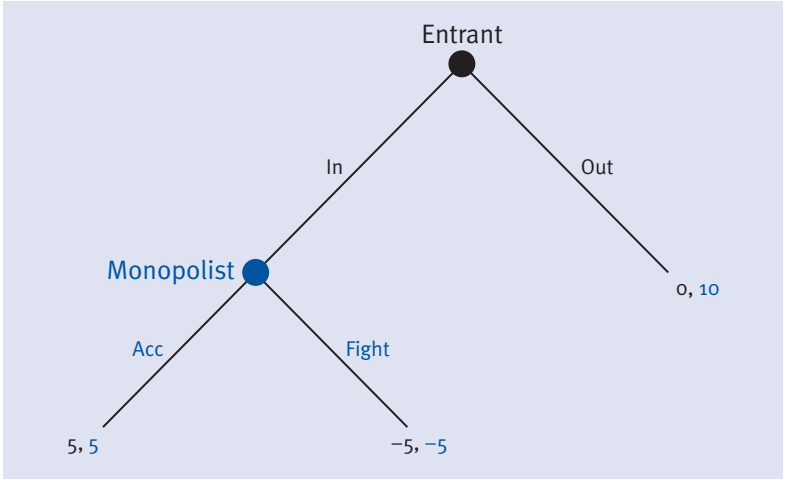

FIGURE 15-1 Entry Game

If the entrant stays out, it doesn't matter what the incumbent does—the entrant earns nothing. Comparing $5 to $0, the entrant will enter; and the incumbent will accommodate entry. We denote the best strategy of the entrant in Figure 15-2 by putting two lines through the suboptimal strategy. What remains is the *equilibrium* of the game {In, Accommodate}, where each player is playing the best it can given what the other player is doing.

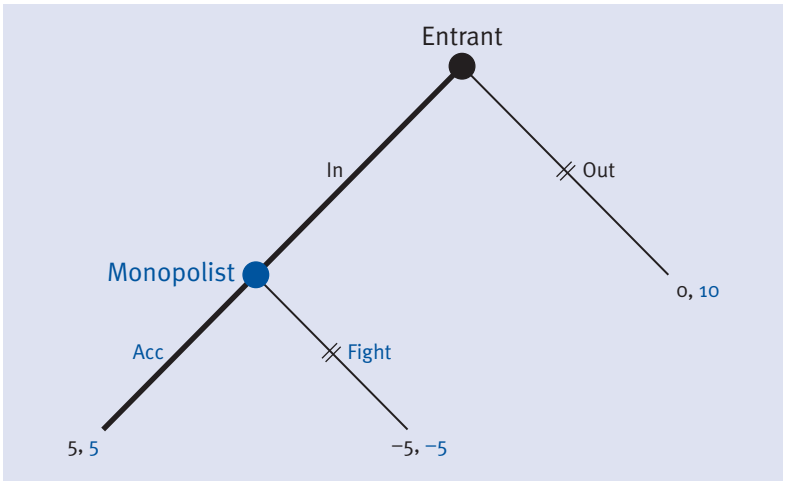

FIGURE 15-2 Entry Accommodation

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 of deterring entry is to threaten to fight if the entrant should enter. 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. We diagram the threat by eliminating one of the branches of tree. Suppose the entrant believes the option of the incumbent pricing high has been eliminated; then, if the entrant enters, she'll end up on the branch where the incumbent prices low. On the other hand, if she stays out, she'll earn nothing. 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 actually be better off by having fewer options. The new equilibrium {Out, Fight} is highlighted in Figure 15-3.

The difficult part if you are the incumbent is figuring out how to convince the entrant you'll price low following entry because pricing low is less profitable than pricing high if entry does occur. To make this threat credible, you have to act against your own self-interest.

This is very difficult to do. If, for example, the incumbent is able to choose between two technologies—one with a high fixed cost but a low marginal cost, the other with a high marginal cost but a low fixed cost—the incumbent could commit to pricing low by choosing the technology with the low marginal cost. (Recall that in the short run, fixed costs are irrelevant to the pricing decision.) With the low-marginal-cost technology, the incumbent may find it profitable

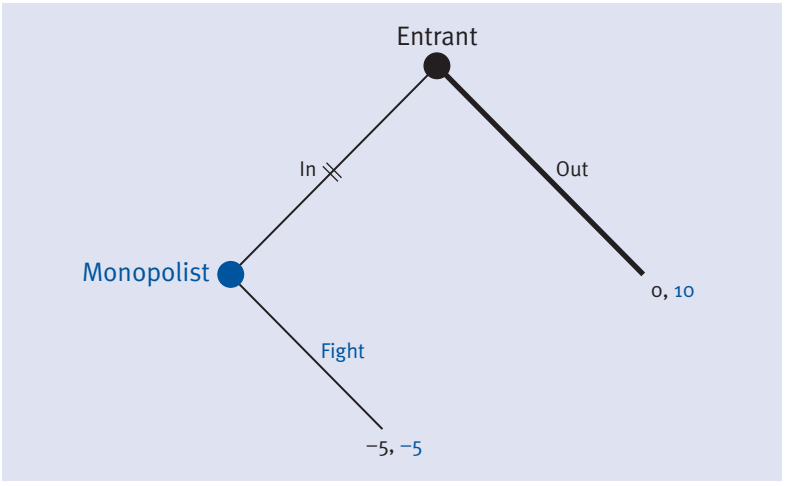

FIGURE 15-3 Entry Deterrence with Commitment

to price low in the event of entry. This choice would change the payoffs, permitting the incumbent to rationally price low in the event of entry.

Remember that this is the whole point of studying game theory. Being able to compute the Nash equilibrium tells you where you are likely to end up, but this depends on the payoffs and rules of the game, neither of which is fixed. Analyzing the game helps you figure out how you can restructure the game to your advantage.

SIMULTANEOUS-MOVE GAMES

In **simultaneous-move games**, players move at the same time.[1] To analyze these games, we use the *matrix* or reduced form of a game. As in sequential-strategy games, likely outcomes are Nash equilibria, a set of strategies such that no player has an incentive to change because all players are doing the best that they can.

How to Compute Nash Equilibria[2]

In a two-player game, we can represent the payoff as a matrix in which one player (Row) chooses among the row strategies, and the other (Column) chooses among the column strategies, as in Table 15-1. Player Column chooses among the five strategies represented by columns labeled V, W, X, Y, and Z; Player Row chooses among the five strategies represented by rows labeled A, B, C, D, and E. The payoff to each is the two-element entry (row, column) in the corresponding cell. For example, if Player Column chooses V and Player Row chooses B, then Column's payoff is 8 and Row's payoff is 7.

TABLE 15-1 Sample Payoff Matrix

		PLAYER COLUMN				
		V	W	X	Y	Z
Player Row	A	9, 9	7, 1	5, 6	3, 4	1, 1
	B	7, 8	5, 2	3, 6	1, 4	3, 3
	C	5, 6	3, 3	1, 8	9, 7	1, 5
	D	3, 9	1, 9	9, 4	7, 9	5, 9
	E	1, 2	9, 8	7, 7	5, 6	3, 7

[1]For a simultaneous- move game, it is not strictly necessary for the players to move at the same time. It is only necessary that each player not know the other's action before moving.

[2]Adapted from notes by Mikhael Shor, http://www2.owen.vanderbilt.edu/mike.shor/courses/game-theory/docs/lecture03/Equilibria.html

To compute equilibrium, 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 comprises a Nash equilibrium.

Let's start from the perspective of Player Row. For each of Player Column's strategies, select the Row strategy that maximizes Player Row's payoff. For example, if Player Column plays V, Player Row's best response is to play A, earning a payoff of 9. Underline this payoff in the game box. Then proceed with Player Column's other strategies. In each column, underline Player Row's best response to each of Player Column's strategies, as shown in Table 15-2.

Now, we can do the same thing for Player Column's best response to Player Row. If Player Row plays D, Player Column is indifferent among V, W, Y, and Z. Note that a best response is not necessarily unique. A player can have a number of strategies, all of which are best responses if each earns the same payoff and earns a bigger payoff than other strategies. In cases such as these, underline all of the best responses. Continue for the rest of Player Row's strategies, as in Table 15-3.

Recall that equilibrium means both players are simultaneously playing their best responses so that neither player has any incentive to change. This is equivalent to saying that a pair of strategies is in equilibrium if both payoffs are underlined.

TABLE 15-2 Identifying Player Row's Best Strategies

		PLAYER COLUMN				
		V	W	X	Y	Z
Player Row	A	9, 9	7, 1	5, 6	3, 4	1, 1
	B	7, 8	5, 2	3, 6	1, 4	3, 3
	C	5, 6	3, 3	1, 8	9, 7	1, 5
	D	3, 9	1, 9	9, 4	7, 9	5, 9
	E	1, 2	9, 8	7, 7	5, 6	3, 7

TABLE 15-3 Adding Player Column's Best Strategies

		PLAYER COLUMN				
		V	W	X	Y	Z
Player Row	A	9, 9	7, 1	5, 6	3, 4	1, 1
	B	7, 8	5, 2	3, 6	1, 4	3, 3
	C	5, 6	3, 3	1, 8	9, 7	1, 5
	D	3, 9	1, 9	9, 4	7, 9	5, 9
	E	1, 2	9, 8	7, 7	5, 6	3, 7

In the preceding example, we find three equilibria: {A, V}, {E, W}, and {D, Z}. You should convince yourself that, in all three cases, neither player has an incentive to change strategy unilaterally.

Now that you know how to find equilibria, let's consider several different games and their application to common business problems.

Prisoners' Dilemma

The **prisoners' dilemma** is perhaps the oldest and most studied game in the history of game theory. It is the story of two parolees, Frank and Jesse, who are caught riding in a car together shortly after someone robbed a nearby bank. The police suspect that Frank and Jesse—known felons—robbed the bank, but they have no direct evidence tying them to the crime. However, association with other felons is a violation of parole, so the district attorney (DA) can send them both back to jail to serve out their remaining sentences on their previous crimes. The DA puts Frank and Jesse in separate cells—and creates a nasty dilemma. He offers each prisoner immunity from prosecution in exchange for testimony or evidence to convict the other.

If only one confesses, that confessor goes free, whereas the other gets 10 years in jail. If both confess, each receives 5 years. If neither confesses, each serves 2 years. We present these payoffs in the matrix shown in Table 15-4.

The only Nash equilibrium is in the upper-left corner {Confess, Confess}. We can verify that this is an equilibrium by making sure that each player's strategy is a best reply to what the other is doing. If Jesse changes his strategy from "confess" to "say nothing," his payoff goes down, from −5 to −10. And because the game is symmetric, the same thing happens to Frank. So this is an equilibrium.

Note the tension between conflict (self-interest) and cooperation (group interest) inherent in the game. If Frank and Jesse could cooperate (both "say nothing"), they could make the group better off by moving to the bottom right corner. However, if your rival is saying nothing, you can do better by confessing. In other words, cooperation {Say Nothing, Say Nothing} is not an equilibrium. By following their self-interest (by trying to make themselves better off), the players make the group worse off.

TABLE 15-4 Prisoners' Dilemma

		FRANK	
		Confess	**Say Nothing**
Jesse	**Confess**	−**5**, −**5**	**0**, −10
	Say Nothing	−10, **0**	−2, −2

Now we can see an opportunity for the group to improve its position. Our subsequent study of the prisoners' dilemma will focus on how to move Frank and Jesse out of the low-payoff equilibrium (upper left) to the high-payoff cooperative square (lower right).

Horizontal Pricing Dilemma

The pricing dilemma illustrated in Table 15-5 has the same logical structure as the prisoners' dilemma. Both Coke and Pepsi could make more money by pricing high, but {Price High, Price High} is not a Nash equilibrium. Pepsi does better by pricing low, regardless of what Coke does; and Coke does better by pricing low, regardless of what Pepsi does. The only Nash equilibrium is for both to price low, in the upper-left corner.

If Coke and Pepsi 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.*

TABLE 15-5 Horizontal Pricing Dilemma

		COKE	
		Price Low	**Price High**
Pepsi	**Price Low**	**0**, **0**	**4**, −2
	Price High	−2, **4**	2, −2

[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.

Another way out of this dilemma is to buy or merge with your competitor. Again, if the only reason for doing so is to eliminate competition, by moving out of the {Price Low, Price Low} equilibrium, the merger may violate the antitrust laws. The Clayton Act outlaws mergers that substantially lessen competition.

Note the similarity of this advice to that given in Chapter 12 on pricing commonly owned substitute products. If you own both substitutes (Coke and Pepsi), your aggregate demand becomes less elastic, so you want to raise price. Game theory offers us another way of analyzing the same problem.

Price Discrimination Dilemma

As you learned in Chapters 13 and 14 on price discrimination, you can always raise profit by charging different prices to different consumers, provided they have different demand elasticities and you can prevent arbitrage. But when you're competing against other firms, you 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 they would've 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] Similarly, long-distance phone service providers offer lower prices to their competitors' customers.[8] In each of these cases, we would expect rivals to react by offering lower prices to these targeted customers as well, with the result that equilibrium prices creep closer to costs than they would be without targeted price reductions.

In Table 15-6, we see an illustrative game involving two grocery stores. These stores (Kroger and Safeway) are considering whether to offer targeted discount coupons providing a

[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.

[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.

[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]See ibid. at 399 (noting how AT&T and MCI will offer cash payments to induce customers to switch services). See also Yongmin Chen, "Paying Customers to Switch," *Journal of Economics and Management Strategy* 6 (1997): 877; and Drew Fudenberg and Jean Tirole, "Customer Poaching and Brand Switching," *Rand Journal of Economics* 31 (2000): 634. Discrimination based on consumers' spatial positioning also may take place in vertically differentiated settings. For example, private-label or generic firms may offer "choosy" customers a discount on their product, and at the same time branded firms may offer discounts on their products to consumers with lower valuations of quality. See Kenneth S. Corts, "Third-Degree Price Discrimination in Oligopoly: All-Out Competition and Strategic Commitment," *Rand Journal of Economics* 29 (1998): 306.

TABLE 15-6 Oligopoly Price Discrimination Dilemma

		KROGER	
		Price Discriminate	**Set Uniform Price**
Safeway	**Price Discriminate**	**0**, **0**	**4**, −2
	Set Uniform Price	−2, **4**	2, 2

percentage reduction on their customers' next grocery bills. Customers living close to the store have less price-elastic demand than do customers located farther away. Thus, either grocery store can raise profit by offering bigger discounts to customers who live farther away—and nearer to a competitor's store.

If just one grocery store offers such coupons, then its profit increases. However, if its competitor retaliates and does the same thing, then all the stores wind up with about the same overall sale volume, but at lower prices. In the equilibrium (upper left in Table 15-6), all players 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 each customer, 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.

Both RJR and Phillip Morris could make more money by not advertising. Cigarette advertising is predatory; that is, it serves mainly to steal market share from rivals without increasing market size. But the lower-right corner in Table 15-7 is not an equilibrium. Each firm could do better by advertising to steal the other'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 because the ban moved the industry from the

TABLE 15-7 Advertising Dilemma

		RJR	
		Advertise	**Don't Advertise**
Phillip Morris	**Advertise**	**0**, **0**	**4**, −2
	Don't Advertise	−2, **4**	2, 2

TABLE 15-8 Free-Riding Dilemma

		JOE	
		Shirk	**Work**
Sally	**Shirk**	**C+Leisure**, **C+Leisure**	**B+Leisure**, B
	Work	B, **B+Leisure**	A, A

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.

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.

To determine the Nash equilibrium of the game, you need to know how study group members rank various outcomes. Assume that both students rank the outcomes as follows:

- A grade of B, with leisure time is better than
- a grade of A and no leisure time, which is better than
- a grade of C plus leisure, which is better than
- a grade of B and no leisure.

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 conflict between competition and cooperation. Successful study groups figure out how to manage this conflict, 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 between or among the 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. Try one of the strategies mentioned in the text: Differentiate your product by providing something novel that your competitors can't easily imitate, 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. If a prisoners' dilemma is played only once, it is difficult to do this. But if the game is repeated, only a fool (or someone who hasn't read this book) would stay stuck in a bad equilibrium.

How Best to Get out of a Repeated Prisoners' Dilemma

To determine the best way to play a repeated prisoners' dilemma, economist Robert Axelrod[9] 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 ran simulated tournaments among the programs. Axelrod was able to characterize the features of the strategies that earned the highest profit:

- *Be nice*: No first strikes.
- *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 it responds immediately to defection, but punishment is limited to only one period. It is focused on maximizing your own profit, and not on limiting competitor's profits. And finally, it is easily understood by rivals.

Consider another similar situation. Companies B and C produce automobile carburetors. The demand for carburetors is declining because fuel injection technology has superseded

[9]Robert Axelrod, *The Complexity of Cooperation: Agent-Based Models of Collaboration and Competition* (Princeton, N.J.: Princeton University Press, 1997), http://pup.princeton.edu/titles/6144.html

TABLE 15-9 Carburetor Producer Dilemma

		COMPANY B	
		Offer Both Types	Offer Only Bronze
Company C	Offer both types	**0**, **0**	**4**, −2
	Offer only chrome	−2, **4**	2, 2

carburetor technology. However, people with older automobiles still demand carburetors. Direct competition between the two companies is small because Company B produces a bronze-finish carburetor, whereas Company C specializes in a chrome finish. Muscle car owners, whose engines are often on display, prefer the more expensive chrome carburetors because chrome enhances the appearance of the engine. Other owners prefer the less expensive bronze carburetors, which are functional but have no cosmetic appeal.

Company B hired a recent MBA who decided to go after C's customers by producing a new chrome-finish carburetor. Company C then retaliated by offering a bronze-finish carburetor. Both companies' profits suffered. What should the companies do?

When you analyze this game in Table 15-9, you can easily see what happened. The parties started off in the lower-right corner, the cooperative outcome, each earning high profit. Then, Company B became envious, coveting the high profit it could earn from entering the chrome-finish carburetor market. Company B's entry into C's business essentially moved the game from the lower right to the lower left. Company C, thus provoked, immediately retaliated by entering B's core business. They ended up in the Nash equilibrium outcome, upper left, each competing in the other's market and earning low profit. Both companies' managers could have foreseen the consequences of their behavior—which is about as self-destructive as starting a price war. In general, it's a bad idea to compete using easily copied strategies like lowering price.

To get out of this dilemma, Company B should announce its withdrawal from the chrome market and hope that C follows suit. If C doesn't follow suit, B should consider further actions against C—actions that would allow C's managers to see clearly that they must leave the bronze-finish market to make high profit. Whatever B does should comply with the antitrust laws. As we noted earlier in this chapter, explicit agreements to allocate customers, divide up territories, and agree not to compete in each other's areas are illegal.

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

TABLE 15-10 Game of Chicken

		JAMES	
		Go Straight	**Swerve**
Dean	**Go Straight**	−10, −10	**3**, **0**
	Swerve	**0**, **3**	0, 0

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.

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 they can given what the other is doing. James cannot improve his payoff by swerving and Dean cannot improve his by going straight. In Table 15-10, 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.

Now that we have analyzed the game and the likely outcomes, it is time to go to the next step and try to figure out how to change the game to make yourself better off. 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

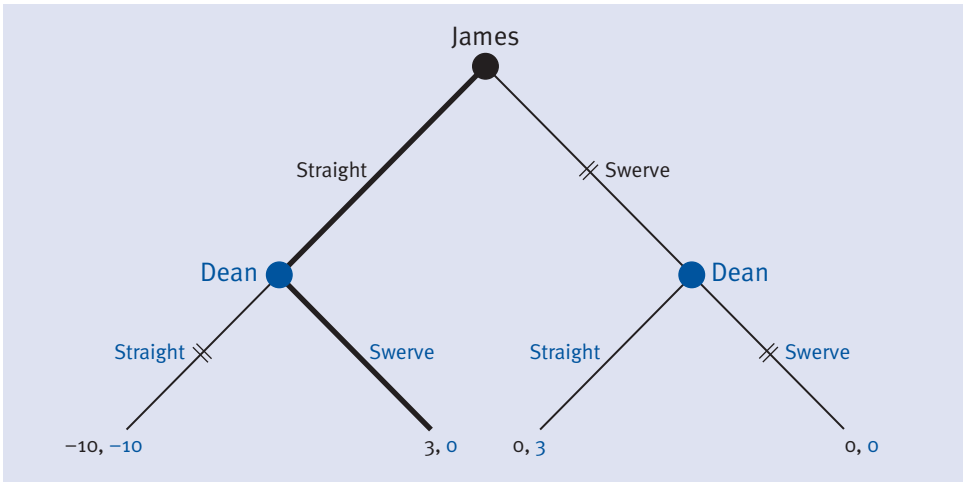

FIGURE 15-4 First-Mover Advantage in a Game of Chicken

TABLE 15-11 Market Entry Game of Chicken

		A	
		Italy	**South Africa**
B	**Italy**	0, 0	**100**, **50**
	South Africa	**50**, **100**	−50, −50

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}. This first move advantage is illustrated in Figure 15-4. The difficult part is convincing the other player that you have committed to a position (i.e., moved first). 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 try to commit to going straight, and you could both end up dead.

The game of chicken has business applications as well (see Table 15-11). In 2000, a biotechnology company (A) had a choice of developing hybrid (disease-resistant) grapes to grow in either South Africa or Italy. The company could afford to develop only one grape variety. The Italian market is much bigger than the South African market, so A's managers would prefer to serve the Italian market. However, A's only rival (B) is also developing hybrid grapes and faces the same choices. Both would prefer to be the sole entrant in a market, and both prefer Italy 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 with a "first-mover advantage" in which it gets to "choose" the favorable equilibrium. We graph this outcome in Figure 15-5.

The standards war between Blu-ray and HD-DVD can be thought of as a "coordination" game that has the same logical structure as a game of chicken. Consumers, manufacturers, and movie studios all have a choice to purchase, build, or produce movies for one of the two formats. Unless they all decide on the same format, the payoffs are all zero. The game has two equilibria: everyone could coordinate on Blu-ray or everyone could coordinate on HD-DVD. The resulting standards war was a struggle between Sony and Toshiba to convince the market participants that their preferred format would eventually win out. Until it became clear that Blu-ray had won, consumers sat on the sidelines and refused to purchase. As one reader commented on the Nashville newspaper's website, "Anyone remember the Betamax? I do . . . never again! I'm going to wait and see who wins this battle."

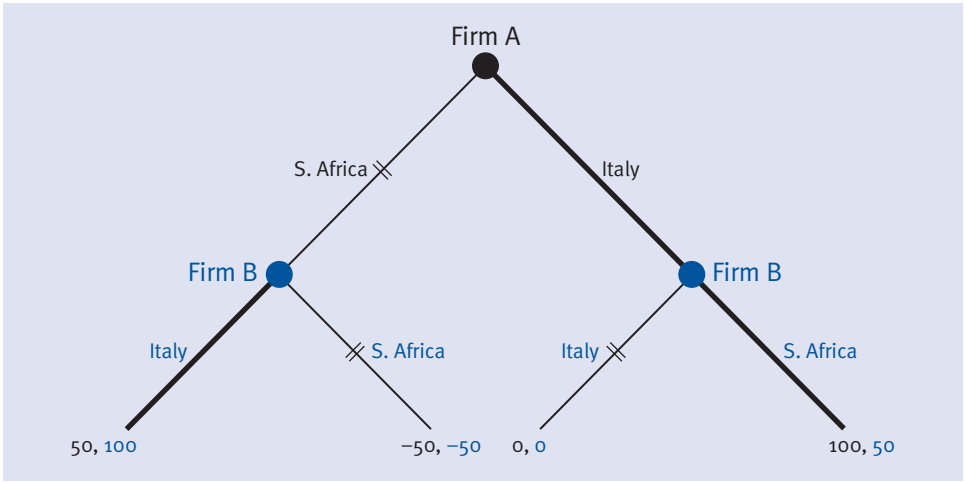

FIGURE 15-5 Sequential Market Entry

The end of the war occurred on February 19, 2008. On that date, Toshiba conceded, shortly after Walmart went exclusive with Blu-ray. Predictably, the price of Blu-ray players increased by about 50% relative to both HD-DVD and to dual players (both formats).

Dating Game

The dating game shares the tension between group interest (cooperation) and self-interest (conflict) inherent in a prisoners' dilemma. The game 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, regardless of the event. The group (Sally and Joe) would be best served if Sally and Joe could agree to attend an event together (group 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 in Table 15-12, where Joe goes to the wrestling match and Sally goes to the ballet. As in the prisoners'

TABLE 15-12 Dating Game

		JOE	
		Wrestling Match	**Ballet**
Sally	**Wrestling Match**	1, **4**	0, 0
	Ballet	**2**, **2**	**4**, 1

TABLE 15-13 Corporate Division Dating Game (Externality)

		SATURN	
		Goodyear Tires	**Michelin Tires**
Cadillac	**Goodyear Tires**	1, **4**	0, 0
	Michelin Tires	**2**, **2**	**4**, 1

dilemma, the idea is to find a way to change the rules of the game so both players can earn higher payoffs.

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 Saturn and Cadillac—two separate divisions under the same parent company, General Motors (GM)—receive a volume discount if they purchase common tires from a single supplier. However, Saturn and Cadillac cannot agree on a common supplier because each has its own preference: Saturn wants Goodyear Tires, but Cadillac wants Michelin. This interdivision conflict negatively affects company-wide profit (see Table 15-13). We will return to this topic in Chapter 22, "How to Get Divisions to Work in the Firm's Best Interests."

Interdivision conflict is more likely to arise when the parent company runs each division as a separate profit center. Finding a way to cooperate, for the good of the parent company, is management's problem. In this case, GM might offer some kind of profit sharing or payoff from one division to another (e.g., Cadillac could pay Saturn to use Michelin tires).

Shirking/Monitoring Game

We can consider the problem of how to efficiently manage workers as a game between an employer and an employee. Using game theory helps us understand how to manage self-interested employees.

Consider the most basic situation: A self-interested employee would prefer to work less (shirk), but he can only shirk if his manager is not monitoring what he does. His employer wants him to work hard, but she must incur costs to monitor the employee's behavior. Table 15-14 is a diagram of the shirking/monitoring game. Try to find an equilibrium. If the manager monitors, then the employee does better by working hard. If the employee works, the manager does better by not spending resources to monitor employee behavior. But if the manager doesn't monitor, then the employee does better by shirking. And so on. This game has no "pure strategy" equilibrium.

TABLE 15-14 Shirking/Monitoring Game

		EMPLOYEE	
		Shirk	**Work Hard**
Manager	**Monitors**	−**1**, 0	5, **5**
	No Monitoring	−10, **10**	**10**, 5

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 a 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 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. Employers 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 employee's shirking gains are large, or 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.

- A **Nash equilibrium** is a pair of strategies, one for each player, in which each strategy is a best response against the other.
- When players act rationally, optimally, and in their own self-interest, it's possible to compute the likely outcomes of games. By studying games, we learn where the pitfalls are and how to avoid them.
- Sequential games include a potential first-mover advantage, or disadvantage, and 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 in an unprofitable way—against their self-interest.
- In **simultaneous-move games**, players move at the same time.
- 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. What is the equilibrium of the following game?

		MARY	
		Left	**Right**
Gary	**Up**	10, 10	15, 5
	Down	5, 15	12, 12

a. Up, Left
b. Down, Left
c. Up, Right
d. Down, Right

2. In a strategic game, if the other player has adopted a Nash equilibrium strategy, you should
   a. also adopt a Nash equilibrium strategy.
   b. use a strategy that delivers you a higher payoff than the Nash equilibrium strategy.
   c. use either A or B, depending on the specifics of the game.
   d. None of the above.
3. If you find yourself in a repeated prisoner's dilemma, which of the following would be appropriate actions?
   a. Launch a first strike.
   b. Punish your competitor severely.
   c. Respond immediately to your competitor's actions.
   d. Make sure your actions confuse your competitor.
4. The following matrix representation identifies a Nash equilibrium (Black, Even) for a simultaneous-move game between Joe and Sally. If this were a sequential-move game, and Joe had the opportunity to move first, what would be the outcome?

		JOE	
		Odd	**Even**
Sally	**Black**	Joe makes $40 Sally makes $20	Joe makes $80 Sally makes $60
	White	Joe makes $90 Sally makes $30	Joe makes $100 Sally makes $40

   a. Black, Odd
   b. Black, Even
   c. White, Odd
   d. White, Even
5. In the previous game, up to how much, if anything, would Joe be willing to pay to move first?
   a. $0
   b. $10
   c. $80
   d. $90

Individual Problems

15-1 Study Group Free Riding

1. In the game shown below, change the ranking of values that Sally and Joe place on leisure and grades to change the game from a prisoners' dilemma into a game of chicken with two equilibria.

2. Give advice to Joe about how to change the game to his advantage.

		JOE	
		Shirk	**Work**
Sally	**shirk**	C+Leisure, C+Leisure	B+Leisure, B
	work	B, B+Leisure	A, A

Upper left is an equilibrium if both students rank the outcomes as follows:

a. A grade of B and leisure is better than
b. a grade of A and no leisure, which is better than
c. a grade of C and leisure, which is better than
d. a grade of B and hard work.

15-2 Coke versus Pepsi

In 1931, Pepsi was almost broke. The Great Depression hit it hard, and Coke had most of the duopoly market for soft drinks in the United States. Pepsi tried many things: marketing campaigns, label changes, and more. Then it came up with the idea of selling 12-ounce bottles for 5¢, which had been the 6-ounce price. Coke could have followed the price per unit down, but it didn't. Total soft drink demand increased, and Pepsi took a larger share of the demand. Why is the equilibrium of this game different from that of a prisoners' dilemma? (*Hint*: Change the payoffs of the prisoners' dilemma to reflect the implied equilibrium.)

15-3 Cell Phone Standards Game

Nokia and Ericsson plan to introduce new handheld communications devices. However, they must decide whether to use their own software standard or a common third-party-developed standard. The respective payoffs are diagrammed here. What is the likely outcome?

		NOKIA	
		Own Standard	**Common Standard**
Ericsson	Own Standard	$15M, $18M	$25M, $10M
	Common Standard	$8M, $29M	$20M, $23M

15-4 Airline Hub Game

Two airlines, A and B, are deciding to choose whether Atlanta or Chicago should be their major hub. Given the diagram here, find all equilibria of this game.

		AIRLINE A	
		Atlanta	**Chicago**
Airline B	Atlanta	$40M, $40M	$85M, $60M
	Chicago	$60M, $85M	$35M, $35M

15-5 Auditing Game

The manager of a corporate division faces the possibility of an audit every year. She prefers to spend time preparing if she will be audited; otherwise, she would prefer to invest her time elsewhere. The auditor, who gets recognized for uncovering problems, prefers to audit unprepared clients. If the players match their actions (i.e., the manager prepares and the auditor audits, or the manager doesn't prepare and the auditor doesn't audit), the manager wins with a payoff of 20, and the auditor loses with a payoff of −20. If the actions don't match, the auditor wins with a payoff of 20, and the manager loses with a payoff of −20. Diagram this game, and comment on the equilibrium.

Group Problems

G15-1 Simultaneous Game

Describe a simultaneous game within your firm, or between your firm and a competitor, or between your firm and a customer or supplier. Draw a formal 2×2 payoff matrix with the strategy choices clearly labeled, and the payoffs to each of the parties. (Use numbers if you can

estimate them; otherwise, describe qualitative rankings among outcomes.) Clearly identify the equilibrium by shading the cell of the table. What advice can you derive from your analysis? Compute the profit consequences of the advice.

G15-2 Sequential Game

Describe a sequential game facing your firm, and represent it in extensive or tree form. Compute and analyze the equilibrium of the game. What advice can you derive from your analysis? Compute the profit consequences of the advice.

G15-3 Repeated Game

Describe a repeated game facing your firm. Compute and analyze the equilibrium of the game, and explicitly show how it differs from the one-shot (non-repeated) equilibrium. What advice can you derive from your analysis? Compute the profit consequences of the advice.

CHAPTER 16

Bargaining

On March 17, 2008, to prevent Bear Stearns from going out of business, the Treasury Department pressured Bear Stearns management to accept an acquisition offer by rival JP Morgan for just $2 per share. It was a mighty fall for the legendary investment bank, whose stock had been trading at $170 only a year earlier. But after big losses from investments in mortgages, the bank was insolvent.

Bear shareholders weren't happy with the low offer. They threatened to reject the deal, and put the company into bankruptcy instead. Initial reactions from the stock market—Bear stock rose to almost $6 in just two days—demonstrated the effectiveness of this negotiating ploy. One week later, JP Morgan upped its offer to $10 a share, and Bear Stearns shareholders accepted.

The oil industry gives us another example of how firms can use bankruptcy to influence negotiations. In November 1985, a Texas jury delivered a $10.5-billion judgment against Texaco for interfering with Pennzoil's attempt to buy Getty Oil. Texaco appealed the verdict and continued to bargain with Pennzoil for a lower settlement. In early 1987, Pennzoil's demand had come down to $5 billion, but Texaco was offering only $2 billion. In April 1987, Texaco filed for bankruptcy, which prevented Pennzoil from seizing control of Texaco's assets. Bankruptcy also freed Texaco from its obligations to pay interest and dividends. The negotiating tactic was successful—a year later, the two companies settled the case for $3 billion. By using bankruptcy to prevent Pennzoil from collecting on its judgment, Texaco was able to reduce its liability by over 70%.

How Texaco was able to do this is the topic of this chapter. We use two complementary ways of thinking about bargaining. We begin with the strategic view by analyzing bargaining using the tools of game theory from Chapter 15. We can characterize bargaining as either a simultaneous-move game with two equilibria, or as a sequential-move game, where the ability to commit to a position gives one player bargaining power over his rivals.

The non-strategic view of bargaining begins with the observation that real negotiations rarely have fixed 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 agreement—or

decrease your own—you are likely to gain a bigger share of the proverbial pie. For example, by threatening or putting themselves into bankruptcy, both Bear Stearns and Texaco gave themselves a better alternative to the offers from JP Morgan and Pennzoil. These improved alternatives led to better settlements.

BARGAINING AS A GAME OF CHICKEN

In this section, we model bargaining as a *simultaneous-move game* and as a *sequential-move game*, where the ability to commit to a position gives one player bargaining power over his rivals.

Bargaining as a Simultaneous-Move Game

Suppose that a company's managers are bargaining with a labor union over the wages the firm will pay its workers. To simplify matters, assume that management and labor are bargaining over a fixed sum of $200 million 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 proverbial pie (i.e., the gains from trade).

We see in Table 16-1 that this game has the same logical structure as a game of chicken. There are two equilibria: {Bargain Hard, Accommodate} in the upper-right quadrant and {Accommodate, Bargain Hard} in the lower-left quadrant. Management prefers the lower-left equilibrium, whereas labor prefers the upper right. If both bargain hard, then each earns nothing (upper left), but upper left is not an equilibrium—either party could do better by changing its strategy unilaterally.

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 the lion's share of the gains from trade.

TABLE 16-1 Labor Negotiation Game

		MANAGEMENT	
		Bargain Hard	**Accommodate**
Labor	**Bargain Hard**	0, 0	**150**, **50**
	Accommodate	**50**, **150**	100, 100

Bargaining as a Sequential-Move Game

But committing to a position isn't as easy as it sounds, as it requires you to act against your own self interest. If you rival doesn't believe your commitment, she will test you by bargaining hard as well. To make your commitment credible, you will have to convince her that you are willing to deliberately lose money.

To see the value of commitment, we re-characterize the game as a sequential-move game where management makes either a generous offer or a low offer; and then the union can either accept or reject the offer. If the union accepts the offer, the game ends; but if not, the union goes on strike, and each party earns nothing.

We diagram the offers and payoffs in Figure 16-1. To analyze the game, begin at the second stage, and notice that the union does better by accepting whatever is offered in the first stage. Whether management makes a generous offer or a low offer, accepting the offer gives the union a higher payout than rejecting it. Management, looking ahead and reasoning back, realizes that making a low offer is better. We identify the equilibrium by putting two lines through all the sub-optimal options in Figure 16-1.

This game illustrates a classic *first-mover advantage*—by moving first, management has an advantage because it can decide which branch of the tree to go down. The union has the power only to accept or reject management's offer.

Now that the union knows what's likely to happen, can it figure out how to change the game to its advantage? Only if it can find a way to credibly threaten a strike if it receives a low offer from management. And if management believes the union's threat, it will make a generous offer.

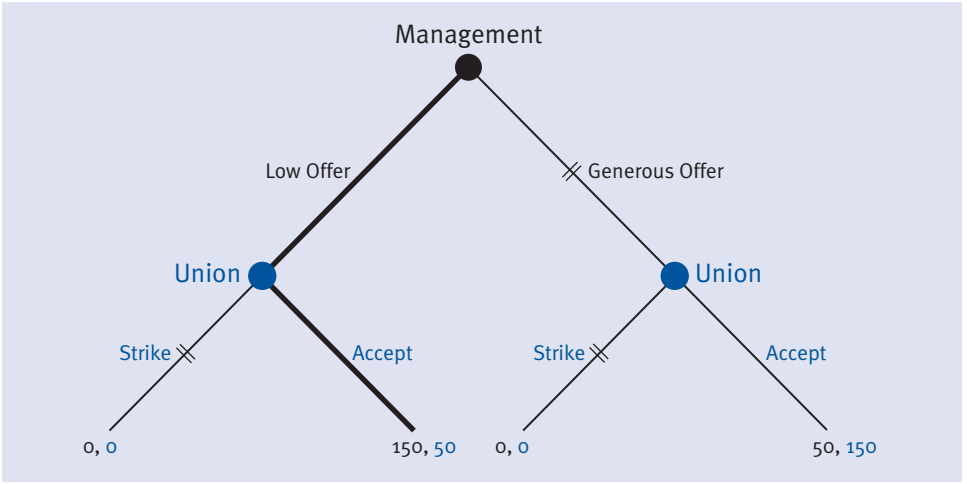

FIGURE 16-1 Management versus Labor Union Game

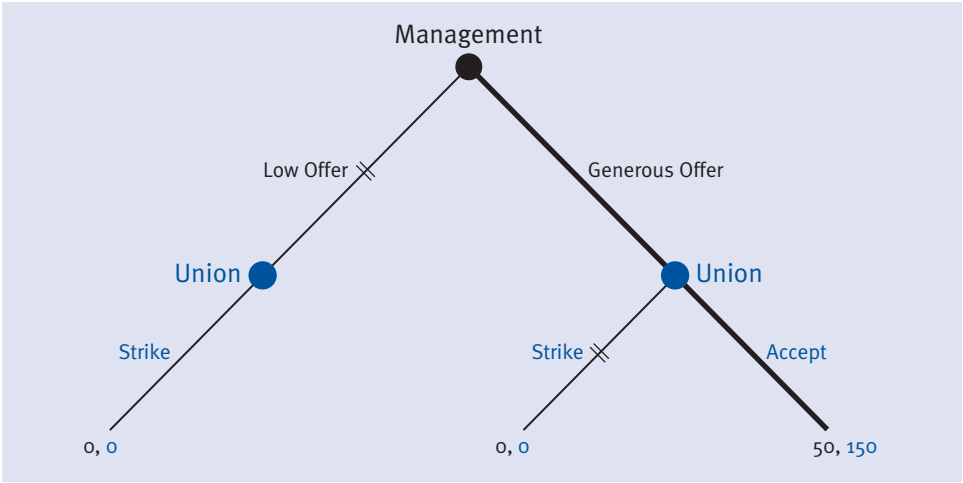

FIGURE 16-2 Negotiation With Labor Commitment to Strike

As in the entry deterrence game in Chapter 15, by committing to a position, the union eliminates an option, thereby changing the equilibrium of the game. We illustrate the new equilibrium in Figure 16-2.

Although committing to a strike sounds simple, it's difficult for the union to persuade management that it will pursue an otherwise unprofitable strategy, like striking. If the threat is not credible, the union might actually have to strike, leading to the following maxim:

The best threat is one you never have to use.

Strikes often occur because management doesn't believe the union's threat. In these cases, the only way for the union to convince management that it's committed to striking is to actually go on strike.

HOW TO IMPROVE YOUR BARGAINING POSITION

The games just described take a **strategic view of bargaining,** in which the outcome of bargaining games depends on who moves first and who can commit to a bargaining 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 uncertainty, John Nash, the same mathematician responsible for the Nash equilibrium concept, proved that any reasonable bargaining outcome would split the gains from trade.[1] We call this an "axiomatic" or "non-strategic" view of

[1]Formally, Nash proved that the bargaining outcome would maximize the product of the bargaining surpluses of the two players, $(S_1(z) - D_1)^*(S_2(z) - D_2)$. See John Nash, "The Bargaining Problem," *Econometrica* 18 (2): 155–162, (1950).

bargaining because it does not depend on the rules of the bargaining game or whether players can commit to an otherwise unreasonable position.

Formally, if $S_i(z)$ is the value to player i of reaching agreement z, and D_i is the "disagreement value," or payoff if no agreement is reached, then player i's gain from agreement, z, is $S_i(z) - D_i$. The total gains from trade are then split between the two, i.e., each receives $(S_1(z) - D_1 + S_2(z) - D_2)/2$.

To make this concrete, imagine two players bargaining over how to split a dollar, each receiving nothing if they don't reach agreement. If they reach an agreement, which we denote by the variable z, then Player 1's surplus is z, and Player 2's surplus is $1 - z$. The total gains from trade are $z + (1 - z) = 1$. The Nash outcome is to split the gains from trade (i.e., each earns \$0.50).[2]

The Nash outcome is useful because it tells us how bargaining is likely to change as circumstances change. Suppose, for example, that Player 1 receives a \$0.50 bonus for reaching agreement. As before, Player 1 is bargaining against Player 2 over how to split a dollar. The total gain to reaching agreement has now risen from \$1 to \$1.50. The Nash bargaining outcome is for the two players to split the total gains from agreement. In this case, Nash's outcome predicts that each player receives \$0.75. In essence, Player 1 "gives" away half of his \$0.50 bonus to Player 2. When 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 20 when we talk about the incentive conflict between salespeople, who typically prefer lower prices so they can make more sales, and the companies that employ them.

The other interesting feature of the Nash bargaining solution is that it highlights the role that outside alternatives to agreement (D_1 and D_2) play in determining the terms of agreement. This leads immediately to the following advice:

> *To improve your own bargaining position, increase your opponent's gain from reaching agreement,* $S_2(z) - D_2$*, or reduce your own gain from reaching agreement,* $S_1(z) - D_1$.

By increasing your opponent's gain from reaching agreement, you make him more willing to compromise to reach an agreement, weakening his bargaining position. Likewise, reducing your own gain from reaching agreement makes you less willing to compromise, improving your bargaining position.

[2]In this case, the disagreement values are 0, and the problem is to maximize $z(1 - z)$, where z is the amount that Player 1 receives, and $(1 - z)$ is the amount that Player 2 receives.

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 we just considered. The strategic view of bargaining emphasized the role of commitment and timing in affecting the outcome of a game. For example, a union's commitment to strike in the event of a low offer, or the ability to move first, changes the equilibrium of the game. But these two strategies don't affect the gains from reaching agreement, so neither would affect the Nash bargaining outcome. 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 Nash bargaining outcome also tells you that if you can *decrease* your own gain to reaching agreement, you become a tougher bargainer—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. Because you have a good alternative [D_1 is big which makes $S_1(z) - D_1$ small], your gain to reaching agreement is relatively small, thus improving your bargaining position. Note the similarity of this idea to *opportunity cost*. The opportunity cost of staying in your current job is the offer you give up if you stay. If you have a good alternative offer, your opportunity cost of staying in your job is high, putting you in a stronger bargaining position.

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 Christmas Eve, when few other customers are around. 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 are much worse. If the MCO fails to reach agreement with the merged hospital, then its managers must go to the next best alternative, which might create a big hole in its network. Such a hole could reduce the attractiveness—and profitability—of the network, and make the MCO more eager to reach agreement.

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 gain to the MCO from adding either of the hospitals to its network when it already has the other is $20. In other words, the gain from agreement with any one hospital, given that you have already reached agreement with the other, is only $20, which under the Nash bargaining solution is evenly split. Thus, before a merger, each hospital gets $10 for joining the MCO network. 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.

Similarly, mergers can increase the bargaining power of pharmaceutical manufacturers petitioning to get on a list of approved drugs (formularies) for use by an MCO or hospital. Just as a merger can improve the bargaining position of the merged hospitals, so too can a merger improve the bargaining position of two substitute drugs. If failure to reach agreement with the merged drugs generates a product gap in the drug formulary (because the next best alternative medication is significantly less effective), then the merged company can improve its bargaining position. Note, however, that both the Department of Justice (DOJ) and Federal Trade Commission (FTC) have challenged mergers as anticompetitive if the mergers are predicted to raise prices significantly.

Let's close this chapter by analyzing an actual negotiation between the state of Rhode Island and a group of pharmacies. In 2003, Blue Cross Blue Shield (a health insurance company covering Rhode Island's state employees) hired PharmaCare to provide pharmaceutical services to 20,000 state employees. PharmaCare assembled a limited network of retail pharmacies willing to sell drugs to state employees at a significant discount. The old (expiring) contract had been more liberal, allowing employees to go to any pharmacy in the state, but it cost the state $820,000 more.

After Blue Cross signed the new contract, four pharmacies that were not part of the new network lobbied Rhode Island legislators to allow them to join. Stop & Shop, Target, Walgreen's, and Shaw's Supermarkets said they'd be willing to sell drugs to state employees at the same prices specified in the new contract. These four pharmacies argued that opening the network would benefit state employees, as they would have a wider array of stores from which to purchase their medications.

Blue Cross declined the offer to open the network. Scott Frasier, spokesman for Blue Cross, said, "Adding all the other stores eliminates the savings you can generate from having a [restricted] network."

The ensuing controversy reignited debate in the state's legislature over the merit of "freedom-of-choice" bills. Such bills would open networks to any pharmacy willing to meet the prices and terms of the negotiated contracts. The governor supported this legislation. He favored

expanding the network to include more pharmacies[3] to increase convenience for state workers, who could then go to any pharmacy they wanted.

But the governor did not understand that Blue Cross was able to improve its bargaining position (and negotiate a reduced price) only by threatening to exclude some pharmacies from the network. If you take that capability away—which the freedom-of-choice laws do—then Blue Cross loses its ability to negotiate lower prices. Why would a pharmacy offer lower prices if it knows it is going to be included in the network, no matter what price it offers?

If the governor had read this chapter, perhaps he would have recognized that the freedom-of-choice laws he supported would lead to higher prices in future negotiations. The FTC has found that states which restrict the ability of firms to form limited networks have higher medical expenditures,[4] and it has warned the Rhode Island legislature against passing the law.[5] Apparently, they listened.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Bargaining can be modeled as either a simultaneous-move or sequential-move game.
- A player can gain an advantage by 1) turning a simultaneous-move game into a sequential-move game with a first-mover advantage; or by 2) committing to a position.
- Credible commitments are difficult to make because they require players to commit to a course of action against their self-interest. Thus, the best threat is one you never have to use.
- The **strategic view of bargaining** focuses on how the outcome of bargaining games depends on who moves first and who can commit to a bargaining position, as well as whether the other player can make a counteroffer.
- The **non-strategic view of bargaining** does not focus on the explicit rules of the game to understand the likely outcome of the bargaining. This view focuses on the gains from bargaining relative to alternatives.
- The gains from agreement relative to the alternatives to agreement 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.

[3]Liz Anderson, "Blue Cross Rejects a Carcieri Administration Request to Add Pharmacies to the Recently Limited Options for State Workers," *Journal State House Bureau*, January 13, 2004.

[4]Michael Vita, "Regulatory Restrictions on Selective Contracting: An Empirical Analysis of 'Any Willing Provider' Regulations," *Journal of Health Economics* 20 (2001): 955–966.

[5]The FTC's comments on the competitive effects of the Rhode Island "freedom-of-choice" bills are outlined in a letter to the Rhode Island attorney general and deputy senate majority leader dated April 8, 2004; available at http://www.ftc.gov/os/2004/04/ribills.pdf

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. How many pure strategy equilibria does the following game have?
   a. 0
   b. 1
   c. 2
   d. 3

		LABOR	
		Bargain Hard	**Be Nice**
Mgmt.	**Bargain Hard**	0, 0	20, 10
	Be Nice	10, 20	15, 15

3. 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.

4. 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. Who is likely to be the better bargainer?
   a. Pete
   b. Lisa
   c. They will be equally effective.
   d. The potential gains will have no impact on bargaining.

5. 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.

Individual Problems

16-1 Ultimatum Game

You are given an offer to split a $20 bill. The other player offers you $1. If you accept the offer, you keep the $1, and the other player keeps $19. If you reject the offer, neither of you will get anything. Do you take the offer?

16-2 Ultimatum Game Continued

How could you take the advantage away from the other player in the ultimatum game?

16-3 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?

16-4 Price Matching

ElectroWorld and Galaxy Appliance are competing retail stores that tacitly bargain with each other in deciding pricing policies. Each can either price high or price low. If both price high, payoffs to each are $50 million; if one prices high and the other low, the low-pricer gains $70 million and the high-pricer gains $30 million. If both price low, each gains $40 million. Model this situation as a 2×2 game, and identify the equilibrium. How would this change if each of the retailers, as part of the bargaining, committed to a price-matching guarantee, where one would match any low price from the other?

16-5 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?

Group Problems

G16-1 Sequential Bargaining

Describe a bargaining game within your firm, or between your firm and a competitor, or between your firm and a customer or supplier. Draw a formal game tree with the choices and payoffs to each of the parties. (Use numbers if you can estimate them; otherwise, describe qualitative

rankings among outcomes.) Clearly identify the equilibrium path of the game. What advice can you derive from your analysis? Compute the profit consequences of the advice.

G16-2 Repeated Bargaining

Describe a repeated bargaining game your firm faces. Compute and analyze the equilibrium of the game, and explicitly show how it differs from the one-shot (non-repeated) equilibrium. What advice can you derive from your analysis? Compute the profit consequences of the advice.

G16-3 Test Your Bargaining Skill[6]

How do different bargaining strategies influence the final purchase price of a new car? In particular, determine whether having better information, being willing to walk away from a deal, or being male affects the price that you receive.

Each group will be assigned one make of car (e.g., Toyota); then the group should pick a particular model (e.g., a Toyota Corolla), with a fixed set of options that is identical for each member of the group. Each person should go into a dealership alone and bargain over the price of the car. Assign the following four types of bargainers:

1. Someone who's researched the dealer cost on the Internet
2. A patient bargainer who tells the salesperson he "needs time to think about it" and returns to negotiate at a later date
3. A man who doesn't follow strategies 1 or 2
4. A woman who doesn't follow strategies 1 or 2
5. Another strategy?

When bargaining, please make sure to follow these rules:

1. The group should send no more than two people to a single dealership.
2. Do not disclose that you're doing this for a homework assignment.
3. Make sure to bargain for an identical car within the group, but each group should choose a different manufacturer (e.g., one group will buy a Toyota, one a Ford, one a Chevrolet, etc.).

After you're finished, the group should write an assignment together. Compare and contrast the prices you were able to get. What were the differences in the final prices you paid versus the predictions of bargaining theory? How did your experience of bargaining differ across group members?

[6]From Pat Bajari's economics class.

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SECTION V

Uncertainty

CHAPTER 17

Making Decisions with Uncertainty

Historically, TeleSwitch, a large telecommunications manufacturer, sold switching equipment to its customers (phone companies) only through distributors. But in 2000, the distributors' largest customers began pressuring TeleSwitch to deal directly with them. Dissatisfied with the level of distributor support, the large customers thought they'd get quicker access to the latest technology if they dealt directly with the manufacturer. The large customers threatened to switch to a competing supplier unless the manufacturer would sell directly to them.

Meanwhile, the distributors, alarmed by the potential loss of their most lucrative clients to direct sales, threatened to change to a competing supplier as well. But this was less of a threat because distributors would find such a switch costly because they'd have to invest significantly in additional technical training to gain expertise with the new supplier's equipment.

The large customers' request put the telecommunications manufacturer in a dilemma: If TeleSwitch dealt directly with its large customers, it might lose its distributors (together with many small customers). If it didn't sell direct, it might lose its large customers. Although the probability of losing distributors was lower (because they would have to incur costs to change suppliers), losing them would be catastrophic because the distributors represented a large share of TeleSwitch's profit.

This quandary illustrates the uncertainty inherent in most business decisions. In this section, we look at how to quantify uncertainty, thereby helping you better weigh the benefits of a decision against its costs. In particular, we model missing pieces of information as *random variables*; that way, we can compute the *expected costs* and *expected benefits* of various decisions.

In addition to leading to better decisions, this kind of analysis identifies the sources of risk, and it may even suggest ways to mitigate those risks. The analysis also tells us what kind of information we most need to gather to make better decisions.

RANDOM VARIABLES

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 both costs *and* benefits will be uncertain. Instead, we use

random variables to explicitly take account of the uncertainty. A **random variable** is simply a way of taking account of what we don't know. In this chapter, we will work with discrete random variables, which can assume only a limited number of values.[1] When we're uncertain about what value a variable will take, we list possible values it could take, assign a probability to each value, and compute expected values, or *average outcomes,* using a weighted average, where the weights are the probabilities. Random variables that can take only two or three values are special cases that we will use in this chapter.

A binomial random variable, X, *is one that can take two values,* $\{x_1, x_2\}$ *with probabilities* $\{p, 1 - p\}$. *The mean or expected value of a binomial random variable is* $E[X] = p \times x_1 + (1 - p)x_2$.

A trinomial random variable, X, *is one that can take three values,* $\{x_1, x_2, x_3\}$ *with probabilities* $\{p_1, p_2, 1 - p_1 - p_2\}$; *the mean is* $E[X] = p_1 \times x_1 + p_2 \times x_2 + (1 - p_1 - p_2)x_3$.

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, or \$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) + (1/3)(\$75) + (1/3)(\$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, then the expected value of playing is only (1/6)(\$100) + (1/6)(\$75) + (2/3)(\$5) = \$32.50.

Now, let's return to the dilemma facing our telecommunications manufacturer, TeleSwitch. Total company profit is currently \$130 million, split between large customers (\$30 million) and small customers (\$100 million). If the firm sells directly to large customers, TeleSwitch managers estimate that they have a 20% probability of losing distributors (as well as their capacity to serve small customers), but they keep their large customers. If they don't sell directly, they estimate a

[1] A continuous random variable assumes an infinite number of values corresponding to the points on an interval (or more than one interval).

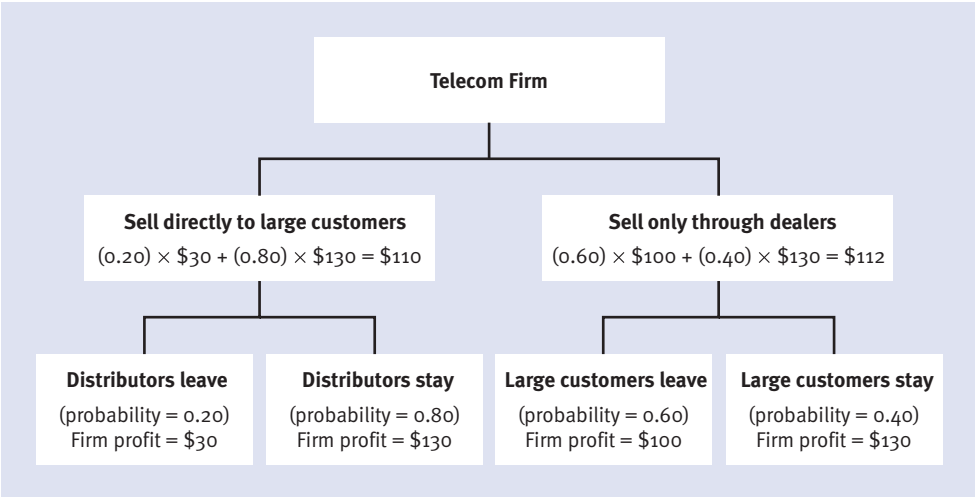

FIGURE 17-1 Modeling an Uncertain Decision

60% probability of losing large customers, but they keep their distributors. What should the TeleSwitch do? We diagram the consequences of the decision in Figure 17-1.

Look first at the left branch of the decision tree in Figure 17-1. If TeleSwitch decides to sell directly to large customers, it doesn't know whether its distributors will leave. The firm quantifies its uncertainty by estimating a 20% probability that its distributors will leave if it does sell direct, in which case firm profit drops to $30 million. If distributors stay, profit remains the same at $130 million. Thus, the sell-direct option has an expected value of $110 million in profit.

Now check out the right branch of the tree. If TeleSwitch sells only through dealers, its managers estimate a 60% probability that its large customers will leave, in which case firm profit drops to $100 million. If the large customers stay (40% probability), profit remains unchanged at $130 million. The option of selling only through dealers has an expected value of $112 million in profit.

This is a close call. Just $2 million in expected profit separates the alternatives—less than 2% of total expected profit. It's unlikely that the firm has estimated probabilities precisely enough to distinguish between the two alternatives. Thus, TeleSwitch may want to gather better information—perhaps by surveying large end users and distributors in hopes of estimating outcome probabilities more precisely.

This kind of analysis clearly identifies two separate risks that TeleSwitch faces. The next obvious step is to find a way to avoid them. For example, perhaps the firm could find a way to retain its dealers, even if it does deal directly with large customers—perhaps by giving them a cut of the profit from large customer accounts. Or TeleSwitch may be able to prevent large customers from leaving if it sells only through dealers—perhaps by providing large customers with in-house, company-trained technicians.

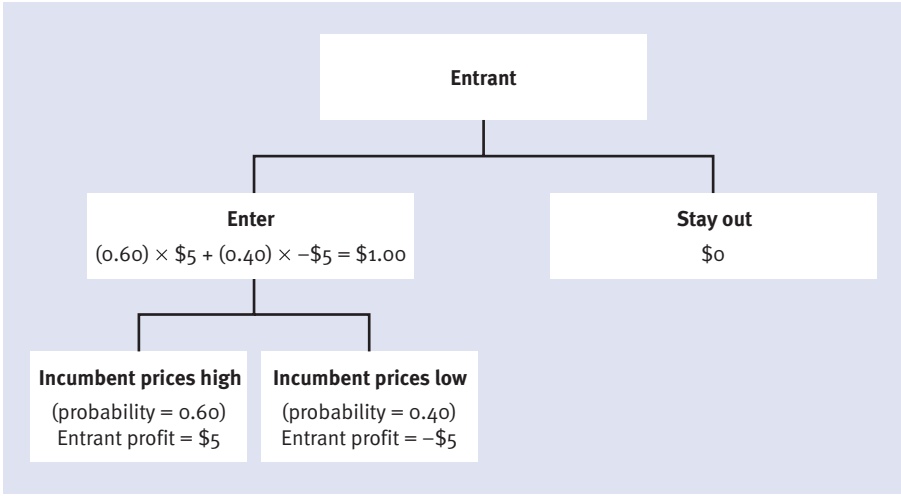

FIGURE 17-2 Entry Decision with Uncertainty

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 17-2.

We've seen that using random variables—and their associated probability distributions—rather than exact numbers to do benefit–cost analysis identifies sources of risk as well as pointing out ways to mitigate them. But we have another very good reason for doing this kind of analysis: If things don't turn out well, we have a good excuse for making the wrong decision. When you use a distribution that includes a worst-case scenario, you can always say that you correctly foresaw the possibility and that things went wrong because the firm was unlucky. Also, by presenting decision makers with analyses that account for uncertainty, you alert them to the riskiness of the decisions they face.

To illustrate the final benefit of replacing exact numbers with random variables, let me use a hypothetical example. If the characters in this example bear any resemblance to any real character, it is pure coincidence. 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). Don't invest. Or, alternatively, 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.

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 17-3. If you price high, you earn \$8 − \$3 = \$5, provided you get a high-value customer. And such sales happen only 50% of the time, so 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, but earn an *expected* \$0.50 more on each unit you sell.

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 defeat your price discrimination scheme

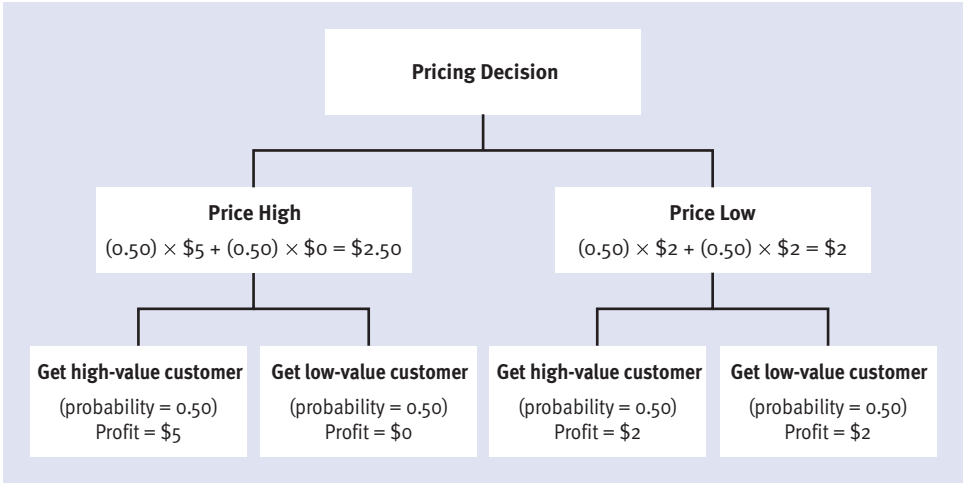

FIGURE 17-3 Pricing Decision with Uncertainty

by mimicking the behavior or appearance of low-value customers. 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 you're willing to wait, the bigger your price discount. 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[2] 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.

[2]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

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,[3] Professor Mark Cohen found that minority consumers—African Americans and Hispanics in particular—paid about $400 more for car loans than White borrowers paid. But the differences 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 NATURAL EXPERIMENTS TO REDUCE UNCERTAINTY

One way to gather information about the benefits and costs of a decision is to run what economists call *natural experiments*. The easiest way to explain this is with an example. A regional manager of a national restaurant chain decided to test the profitability of a new holiday menu by introducing it in only half the restaurants in her territory. By comparing sales changes at these restaurants (the experimental 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. The first difference is before versus after introduction of the menu; the second difference is between the experimental and control groups. The difference-in-difference approach controls for other unobserved factors that might have accounted for the change.

She found that although sales jumped during the holidays, the increase was similar in both the control and experimental 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.

When the Congressional Budget Office criticized the FTC for not challenging more gasoline mergers during the Clinton era, the FTC used its own difference-in-difference estimator to try to isolate the effects of a 1998 gasoline merger in Louisville.[4] We reproduce their analysis in Figure 17-4. The three lines are the price of gasoline in Louisville minus the price at three control cities, Chicago, Houston, and Arlington, Virginia. The control cities allow us to control for demand and supply shocks that might have caused price to rise, but which have nothing to do with the merger. In other words, by comparing prices in Louisville to the control cities (the first difference), before and after the merger (the second difference), we can isolate the effect of the merger on prices. In Figure 17-4, we see that the pre-merger prices (to the left of the vertical line)

[3]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

[4]Christopher T. Taylor, and Daniel S. S. Hosken, "The Economic Effects of the Marathon- Ashland Joint Venture: The Importance of Industry Supply Shocks and Vertical Market Structure," March 17, 2004. FTC Bureau of Economics Working Paper No. 270. Available at SSRN: http://ssrn.com/abstract=532427 or DOI: 10.2139/ssrn.532427

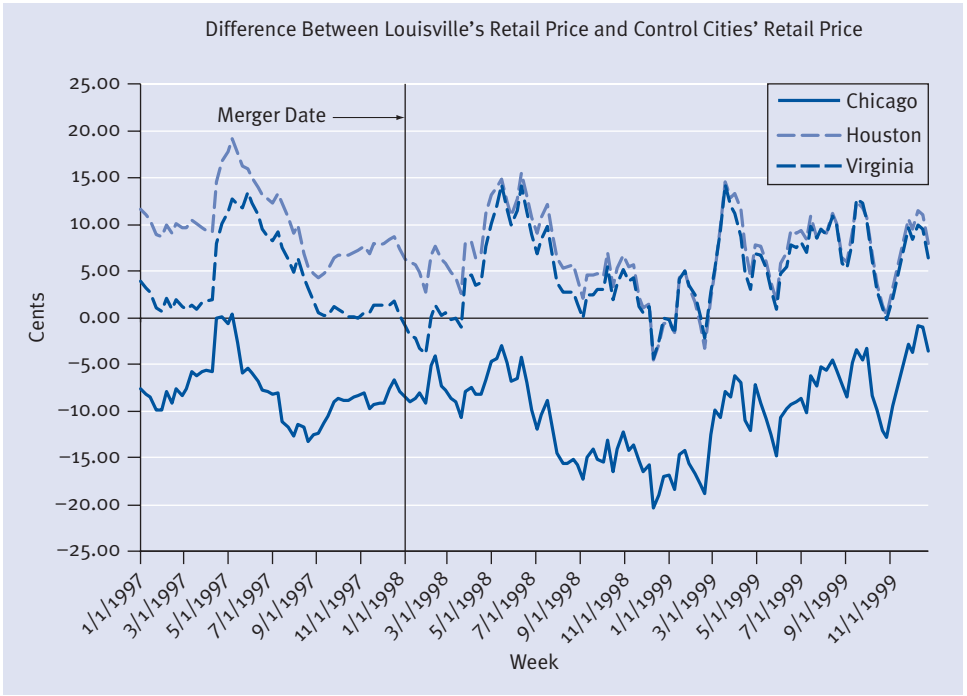

FIGURE 17-4 Pre- and Post-Merger Gas Prices

do not appear to increase after the merger (to the right of the line). So it appears that the FTC was correct to let the merger through without a challenge.

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, and you are uncertain about which state of the world you are in. For example, there is considerable debate about whether global warming is caused by human activity. If it is, then we can stop it with, for example, a big carbon tax. But if it's not, then the carbon tax will reduce economic activity but not do anything for global warming.

We illustrate this decision in Table 17-1. The two alternatives are represented by the two columns, and our uncertainty is represented by the rows. In other words, we can choose a column, but we don't know which row we are in. If we choose to implement a carbon tax, and global warming is caused by human activity, then our column matches the row, and our error cost is zero. Similarly, if we choose not to implement a tax, and global warming is not caused by human activity, the column again matches the row. The two errors are represented by the off-diagonal

TABLE 17-1 Error Costs of a Carbon Tax

	Carbon Tax	No Tax
Global warming is caused by human activity (p)	0	*p**(Error Cost II)
Global warming is not caused by human activity (1 − p)	(1 − *p*)*(Error Cost I)	0

elements in the table: we can implement a tax when global warming is not caused by human activity (Type I error); or we can fail to implement a tax when it is (Type II error). The labels, Type I and Type II, are chosen to match the two columns.

The optimal decision is to choose the column with the smaller *expected* error costs. So, if $(1 - p)$*(Error Cost I) $<$ p*(Error Cost II), then choose column I, and vice versa. This framework allows us to say several things about the global warming debate.

First, most of the debate about global warming has been focused on the scientific uncertainty (what is the probability, p, that global warming is caused by human activity?), and on the size of the Type II error costs (what changes will occur if the planet heats up?). But what has been mostly missing from the policy debate so far is any information on Type I error costs (what do we lose if we impose a carbon tax?).

Second, an increase in p increases the likelihood that a carbon tax is optimal. And third, since the costs of a carbon tax are incurred in the present, whereas the costs of inaction are incurred only in the future, benefit–cost analysis requires a discount rate. A small discount rate favors a tax. A big discount rate favors inaction.

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; that is, you can list the possible outcomes and assign probabilities to each of those outcomes. Technically, we should describe this as "risk" not "uncertainty." *Risk* is how we have been characterizing our uncertainty about information that affects our decisions. We model risk using random variables. *Uncertainty* is a way of characterizing uncertainty about the distribution of the random variables themselves. In particular, which probabilities should we assign to the various values that the random variables can take?[5]

[5]The distinction between risk and uncertainty traces back to the work of economist Frank Knight. See F. H. *Risk, Uncertainty and Profit* (New York: Augustus Kelley, 1921).

The difference between risk and uncertainty is critical in the financial markets. Participants are very comfortable with risk because risk can be predicted, 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. At least part of the housing meltdown can be traced to an error in translating uncertainty to risk through a mathematical formula created by David Li.[6] The formula (a Gaussian copula function) was designed to measure the correlation among returns of all of the various assets that made up collateralized debt obligations. There was uncertainty about how the failure of one asset might be related to the failure of another asset, and the big problem with coming up with a formula to quantify the risk (turn uncertainty into risk) was the lack of detailed historical information regarding the relationships among the underlying assets. Li's solution was to use past credit default swap (CDS) prices as an indicator of correlation returns.

His was a really clever solution, but the problem was that the only CDS pricing information came from a time when home values were on a continuing upward trend. The inputs into the model (and therefore the output) weren't valid during a time of decreasing home values. And, apparently, just about everybody was using his formula to quantify risk and price collateralized debt obligations.

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 quantify uncertain situations.[7] For example, retailer Best Buy used 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 translate uncertainty into risk. We also think the U.S. Marines provide some good advice:

> *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.

[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.

- 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 approaches 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.
- If you are facing a decision in which one of your alternatives would work well in one state of the world, and you are uncertain about which state of the world you are in, think about how to minimize expected error costs.

Multiple-Choice Questions

1. If you roll a pair of standard dice, what's the probability that the total will be an odd number less than six?
   a. 0.083
   b. 0.167
   c. 0.25
   d. 0.5

2. You are taking a multiple-choice test that awards you one point for a correct answer and penalizes you ¼ point for an incorrect answer. If you have to make a random guess and there are four possible answers, what is the expected value of guessing?
   a. 1 point
   b. 0.25 points
   c. −0.25 points
   d. −1 point

3. 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

4. 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

5. 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 contribution?
   a. $10
   b. $6
   c. $7.60
   d. $8

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 Boat Insurance

Maritime Insurance Company offers insurance policies for recreational boats. A typical policy will pay the replacement cost of $25,000 if the boat is a total loss. If the boat is not a total loss but the damage is more than $10,000, the policy pays $5,000. For damage under $10,000, no coverage is offered. The company estimates the probability of no damage to be 0.60, the probability of damage between $0 and $10,000 to be 0.25, and the probability of damage between $10,000 and $25,000 to be 0.12. If the company wants to make a profit of $200 above the expected cost, what should be the price of the policy?

17-4 Hot Dog Uncertainty

You want to invest in a hot dog stand near the ballpark. You have a 0.35 probability that you can turn your current $15,000 into $50,000 and a 0.65 probability that fierce competition will drive you to ruin, losing all your money. If you decide not to enter, you keep your $15,000. Would you enter the market?

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 ($1 - 10^{-6}$). 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).

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.

CHAPTER 18

Auctions

In 1932, Edwin Land established Land-Wheelwright Laboratories to commercialize his inventions of filters capable of polarizing light. After some early success, the company was renamed in 1937, and the Polaroid Corporation released its first instant camera in 1948, creating one of the most famous brand names of the twentieth century. In the early 1990s sales peaked at $3 billion before competition slowly ate away the company's advantage. After a short stint in bankruptcy in 2001, the company was sold to Tom Petters of Petters Worldwide Group in 2005 for $426 million.

The company appeared to be turning around as Petters used the Polaroid brand name to sell a more diverse product line including TVs, DVD players, and printers. The turnaround, however, came to an abrupt halt in October 2008 when Petters and four other individuals were charged with fraud, money laundering, and conspiracy related to an alleged $3.5 billion Ponzi scheme. After the company was placed into bankruptcy in December 2008, the court, uncertain over the value of the remaining assets, decided to sell the assets, notably the Polaroid name, with an auction. Bidding started at around $40 million, less than 10% of the company's stock value in 2005. Successive rounds of bidding pushed the final price to over $75 million.

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 have 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 Polaroid'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 rival bids to negotiate a deal (i.e., they gave her a good outside alternative).

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 for a price at, or slightly above, the second-highest value.

For example, suppose there are five bidders with different values: \$5, \$4, \$3, \$2, and \$1. In this case, the \$5 bidder will win at a price close to \$4. Note that the winning bidder earns one dollar's worth of surplus—he's willing to pay \$5, but he has to bid only \$4 to outbid the losing bidders. Significantly, 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 our simple auction to the fixed price scheme used by a retail store uncertain about whether customers would be high value (\$8) or low value (\$5). Recall that the store faced the familiar trade-off: price high and sell to only high-value consumers, or price low and sell to everyone. For MC = \$3, we showed that a high price generated more *expected* profit per consumer [\$2.50 = (0.5)(\$8 − \$3)] than a low price [\$2 = (1.0)(\$5 − \$3)].

Suppose instead that the store decides to use an auction and two bidders show up. They could be either high-value (\$8) or low-value (\$5) bidders. As above, the probability of seeing a high-value bidder is 0.5. What is the expected revenue from the auction?

You can see the possible outcomes of the auction listed in Table 18-1. The last column shows the winning bid, which 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 \$8. However, this outcome occurs only 25% of the time. The other 75% of the time, the second-highest value is just \$5. The *expected* revenue of the auction is the weighted average of these two outcomes, where the weights are the probabilities of each: (0.75)(\$5) + (0.25)(\$8) = \$5.75. Compared to a fixed price of \$8, the auction gives the seller higher *expected* revenue.

Now suppose that three bidders show up at an auction. As before, they could be either high-value (\$8) or low-value (\$5) bidders. What is the *expected* revenue from the auction?

TABLE 18-1 Oral Auction with Two Bidders

Bidder 1	Bidder 2	Probability	Winning Bid
$5	$5	.25	$5
$5	$8	.25	$5
$8	$5	.25	$5
$8	$8	.25	$8

TABLE 18-2 Oral Auction with Three Bidders

Bidder 1	Bidder 2	Bidder 2	Probability	Winning Bid
$5	$5	$5	.125	$5
$5	$5	$8	.125	$5
$5	$8	$5	.125	$5
$8	$5	$5	.125	$5
$5	$8	$8	.125	$8
$8	$5	$8	.125	$8
$8	$8	$5	.125	$8
$8	$8	$8	.125	$8

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 $8. 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 $5. *Expected* revenue is $(0.5)(\$8) + (0.5)(\$5) = \$6.50$.

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 only 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

[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 (June 2007): 223–233.

only whether they win, *not* the price they pay. The price is determined by the bid of the second-highest bidder. Under these conditions, it is an optimal strategy[2] for bidders to bid their true values.

If all bidders bid their values, the high-value bidder wins the item and pays a price equal to the second-highest value. This outcome is identical to the outcome from an oral auction, so auctioneers end up making just as much money as they would in an oral auction,[3] with the advantage that second-price auctions are easier to run. Bidders do not have to show up at the same time, or at the same place, to compete in a second-price auction.

William Vickrey, together with James A. Mirrlees, shared the 1996 Nobel Prize in Economics for his work in 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.[4] 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!

Internet auction sites eBay, Yahoo!, and Amazon.com use formats[5] that resemble second-price auctions because they employ "bidding agents" that automatically raise bids for you. Bidders simply tell the computer, which acts as a bidding agent, how much they are willing to pay. The bidding agents automatically raise bids to just above what rivals are willing to pay. This feature allows these auctions to be run remotely and asynchronously over the Internet. More than one million auctions close each day on eBay and Amazon.[6]

Second-price auctions are also useful for auctioning off multiple units of the same item—say, 10 laptop computers. As in a single-unit second-price auction, the highest losing bid determines the price—in this case, the highest losing bid is the 11th-highest.[7] As in the second-price auction, it is optimal to bid your value and wait for the outcome because the bid determines only whether you win, not the price you pay.[8]

FIRST-PRICE AUCTIONS

*In a **sealed-bid first-price auction**, the highest bidder gets the item at a price equal to the highest bid.*

[2]This strategy weakly dominates all other strategies.
[3]The so-called revenue equivalence theorem requires risk neutrality.
[4]See http://www.u.arizona.edu/~dreiley/papers/VickreyHistory.pdf
[5]See http://www.u.arizona.edu/~dreiley/papers/InternetAuctions.pdf for more on Internet auctions.
[6]In 2001, Amazon began a withdrawal from its auction business.
[7]If bidders can bid for multiple items, then the price is the highest rejected bid, not made by one of the winning bidders.
[8]See http://www.u.arizona.edu/~dreiley/papers/DemandReduction.pdf for experimental evidence on how to design multiunit second-price auctions.

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 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

To illustrate the effects of *collusion* or *bid rigging*, let's return to our simple oral auction in which bidders have values of $5, $4, $3, $2, and $1; but in this case, 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 high-value bidders, those willing to pay $5 and $4, decide not to bid against each other. To win the auction, they have to outbid the highest non-cartel member, whose value is $3. Profit to the cartel is $1, computed as the difference between $4 (what the price would have been without the cartel) and $3 (the price with the cartel). The cartel members typically split the $1 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 bid-rigging scheme, 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 profit that the cartel members split among themselves.

A more common type of collusion is the informal *quid pro quo* bidding behavior associated with a bid-rotation scheme. In these cartels, bidders refrain from bidding against one another, or submit very weak bids, in exchange for similar consideration when it's their "turn" to win. This kind of scheme is also much more difficult to prosecute as it may not require communication among the cartel members.

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 sealed-bid auctions.

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 navy with frozen fish. The price dropped 23% after the conspiracy collapsed. 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.

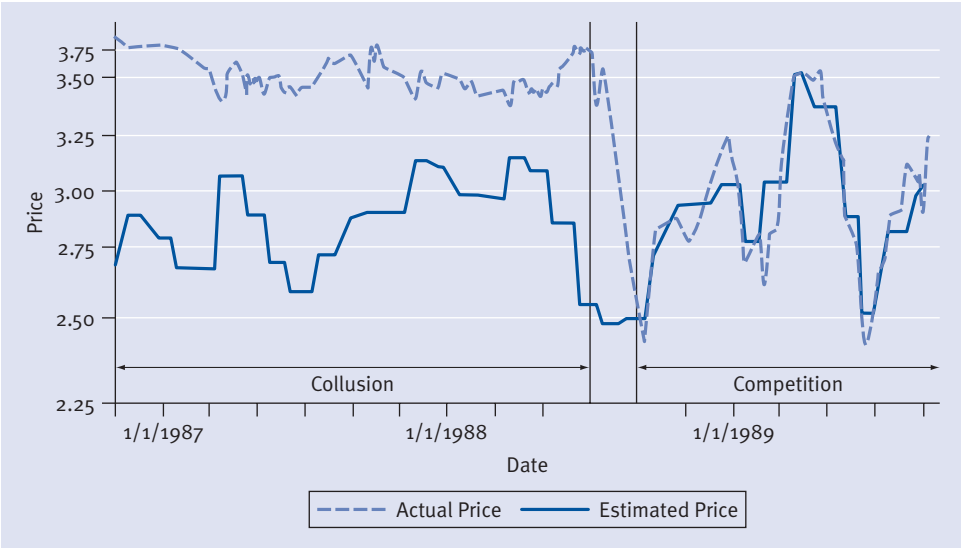

FIGURE 18-1 Collusion in Frozen Fish Bidding

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.[9]

The government is a frequent victim of bid rigging because of the way they run auctions. We can draw several lessons about how to avoid collusion from their experience:[10]

- Do not rely on purchasing agents (those running the auction) who have little interest in buying at a low price. Instead, reward agents for making good (high-quality and low-price) purchases.
- Do not entangle purchasing agents with masses of red tape. Instead, permit them to negotiate (e.g., to bargain with the bidders) if they suspect bid rigging.
- Do not use the procurement process to further a social agenda (small business set-asides, public lands, national defense, etc.) that is irrelevant to the goal of purchasing goods at low prices.
- Keep cartels in the dark, so it is difficult for them to organize and to punish cheaters.
- If you suspect collusion,
  - do not hold open auctions;
  - do not hold small and frequent auctions;
  - do not disclose information to bidders—do not announce who the other bidders are, who the winners are, or what the winning bids are.

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.*

Offshore oil tracts, for instance, have a common value because the amount of oil on the tract determines the value of the tract—and it is the same for all bidders. However, no one knows how much oil is in the tract; each bidder has only an estimate of the unknown quantity.

Winning in a common-value auction is bad news: It means that yours was the highest and most optimistic estimate of the unknown value of the item. This is known as the **winner's curse.** To avoid the curse (losing money), you must bid as if your information is too optimistic and reduce or shade your estimated value.

[9]The cartel and its collapse are described in L. Froeb, R. Koyak, and G. Werden, "What Is the Effect of Bid-Rigging on Prices?" *Economics Letters* 42 (1993): 419–423.
[10]Luke Froeb, "Bid Rigging Against the Government," *Owen Manager* (Spring, 1994).

To avoid the winners' curse, you bid less aggressively as the number of bidders increases.

Remember, your bid matters only when you win, and you win only when you have the highest estimate. So to avoid the winners' curse, you have to bid as if you are going to win (i.e., as if everyone else's estimate is below your own). And the more bidders there are, the bigger the winner's curse, and the more you have to shade your estimate.

The winner's curse is especially bad when rival bidders have better information about the unknown common value than you do. For example, some bidders for offshore oil tracts own neighboring tracts and have better estimates of the amount of oil in the tract than those without neighboring tracts. 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 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. We see this illustrated in some eBay auctions. If the auction has a common-value component, rivals learn something about the item's value by observing rival bids. To hide their information, bidders wait until the last second of the auction to submit bids, called "sniping."[11] By submitting bids at the last second bidders can turn an oral auction into a sealed-bid auction. To combat this strategy, some auctioneers automatically extend the auction for five minutes following the receipt of a last-second bid.

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.

[11] See http://slate.msn.com/id/22998/

- 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 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. Such collusion or bid rigging is more likely to occur in open auctions and in small, frequent auctions. If collusion is suspected,
  - do not hold open auctions;
  - do not hold small and frequent auctions;
  - do not disclose information to bidders—do not announce who the winners are, who else may be bidding, or what the winning bids were.
- In a **common-value auction,** bidders bid below their estimates to avoid the winner's curse. Oral auctions return higher prices in common-value auctions because they release more information.

Multiple-Choice Questions

1. Six bidders in an oral auction place the following values on a good: ($6, $5, $4, $3, $2, $1). In an oral competitive auction, what is the winning price?
   a. $3
   b. $4
   c. $5
   d. $6
2. Suppose that the second, third, and fourth bidders from the preceding oral auction form a cartel. What is the new winning price?
   a. $3
   b. $4
   c. $5
   d. $6
3. If a bidder were interested in getting a lower price in an open auction, he or she should:
   a. Bid in auctions that last for longer periods of time
   b. Wait until the last possible moment to submit a bid
   c. Bid on the item immediately
   d. Generate more attention to the auction, drawing in more buyers

4. If a seller can make any of the following changes to her auction format but her only goal is to increase the price paid, which changes should the seller make?
   a. Increase the time allowed for buyers to make a bid from one week to one month.
   b. Hide the values being offered from the other buyers.
   c. Prevent overexposure of information about the good being sold.
   d. Limit the number of buyers allowed to place a bid on your product.
5. You're considering holding a closed-bid auction for a new technology your company has developed. One of your assistants raises a concern that the potential for a winner's curse may encourage bidders to shade their bid values. How might you address this concern?
   a. Release more information about the technology.
   b. Switch to an oral auction.
   c. Use a second-price auction.
   d. All of the above.

Individual Problems

18-1 Two-Bidder Auction

You hold an auction on eBay and expect two bidders to show up. You estimate that each bidder has a value of either $5 or $8 for the item, and you attach probabilities to each value of 50%. Your own value for the item is zero. You can set a reserve price, a price below which you will not accept bids for the item. What reserve price should you set, and what is your expected revenue from auctioning the item with a reserve price?

18-2 Three-Bidder Auction

You now expect three bidders to show up. What reserve price should you set, and what is your expected revenue from auctioning the item with a reserve price?

18-3 Effects of Collusion or Merger

In the three-bidder auction, suppose that bidders two and three collude or merge. What is the expected effect of the merger?

18-4 Vickrey Auction

Suppose after submitting your sealed bid in a Vickrey auction you find out that you have lost the auction (you were not the highest bidder); however, you have the opportunity to revise your bid. Would you go ahead and change your bid? Why or why not?

18-5 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?

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.

CHAPTER 19

The Problem of Adverse Selection

In 2007, Internet shoe retailer Zappos.com sold over $800 million in merchandise. Customer service is a key differentiator for Zappos, and its number-one 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.

But 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 $2,000 to any new hire who will quit that day. About three percent take the offer. The ones who are left are the ones with the ability to deliver WOW. Zappos has discovered that the $2,000 "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.[2]

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

[1]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]Adverse selection problems are often characterized as being problems of "hidden information."

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 ($0, $100) lottery for $40, whereas a risk-neutral consumer would be willing to pay $50 for the same lottery. If the two of them transact at a price of, say $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, say 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 $\$5 = 0.2 \times (\$75) + 0.8 \times \$25$.

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 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 risks, 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 Washington, D.C., government 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 to only high-risk purchasers. The insurance companies, if not the D.C. government, correctly anticipated adverse selection and realized they could not make money selling to only 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—the adverse selection problem disappears.

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[3] (IPOs) of less

[3] 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.

than $100 million lose money, 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 profitably transact with them.

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 risks. 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 two states, California 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 sometimes 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[4] or a co-payment.[5]

[4]The customer is liable for the deductible (e.g., $50), while the insurance company pays the remainder.
[5]The customer pays the co-payment (e.g., 50%), while the insurance company pays the remainder.

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, and consumers reveal information about their risks 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 the 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.[6]

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 co-payment. 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 co-payment. Likewise, if you purchase insurance with a small deductible or co-payment, 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.

So, 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

[6]Every time the insurance company sells partial insurance for $15 to a high-risk individual, it loses $5 (cost is $20 = 0.4 × $50).

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 warranties like this.

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 $2,000 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 sell only 50 units per week. The asymmetric information means that workers know which type they are but you don't. 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 higher compensation for sales above 50 units. 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.[7]

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 hard-working 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 party (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

[7]Under this plan, good workers expect to earn $1,000 ($500 + (100 expected sales − 50 sales base) × $10), which is $200 more than their minimum acceptable wage of $800. Lazy workers expect to earn $500 (they earn no commission because they only sell 50 units), which is $300 less than their minimum acceptable wage of $800.

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.

Advertising and branding can also serve as signals. By branding a product and advertising it, firms signal to consumers that theirs is a high-quality product. Consequently, consumers are willing to pay more for branded and advertised goods. Low-quality firms won't mimic this signal because, once consumers try the product, they'll 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.

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 refuses to suspend MrWatch from the site, noting that he has had 1,800 positive responses from customers and only eight negative responses.[8]

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. An increase in a seller's rating by 10% leads to a 1.3% higher expected price.[9] 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.

[8]Barbara Whitaker, "If a Transaction Goes Sour, Where Do You Turn?" *New York Times,* August 20, 2000, section 3, p. 1.

[9]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 (June 2007): 223–233.

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—anticipate it, and, if you can, figure out how to consummate the unconsummated wealth-creating transaction (e.g., between a low-risk customer and an insurance company).
- The adverse selection problem disappears if the asymmetry of information 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. If a life insurance company knows that smoking increases the risk of death but is unable to determine which applicants smoke, the problem of _____ refers to _____ being more likely to buy insurance.
   a. adverse selection, nonsmokers'
   b. screening, nonsmokers'
   c. adverse selection, smokers'
   d. screening, smokers'

2. An insurance company offers doctors malpractice insurance. Assume that settling malpractice claims against careful doctors costs $5,000 and settling malpractice claims against reckless doctors costs $30,000. Doctors themselves know whether they are reckless or careful, but the insurance company can only assume that 10% of doctors are reckless. How much do insurance companies have to charge for malpractice insurance to break even (assume that every doctor will be sued for malpractice once during the term of the policy)?
   a. $5,000
   b. $7,500
   c. $27,500
   d. $30,000

3. To combat the problem of adverse selection, _____ informed parties can employ _____ techniques.
   a. more; signaling
   b. less; signaling
   c. equally; screening
   d. equally; signaling
4. Which of the following is *not* an example of adverse selection?
   a. A business bets the proceeds of a bank loan on the over/under 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.
5. To overcome the problem of adverse selection, employers can use _____ techniques, such as _____ .
   a. signaling; monitoring employee performance
   b. screening; monitoring employee performance
   c. screening; checking employee references
   d. signaling; checking employee references

Individual Problems

19-1 Bicycle Insurance and Information Asymmetry

If bicycle owners do not know whether they are high- or low-risk consumers, is there an adverse selection problem?

19-2 IPOs and Adverse Selection

Should owners of a private company contemplating an IPO (a sale of stock to the public) release information about the company, or keep as much of it as they can to themselves?

19-3 "Soft Selling" and Adverse Selection

Soft selling occurs when a buyer is skeptical of the quality or usefulness of a product or service. For example, suppose you're trying to sell a company a new accounting system that will reduce costs by 10%. Instead of asking for 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.

19-4 Student Work Groups

You'll complete a number of your school assignments in small groups, many of which will be student selected. Assume group members are rational and select fellow group members based

on their assessment of teammates' intellectual and productive capabilities. Someone you don't know invites you to join a group. Should you accept? (*Hint*: Think about the information asymmetry.)

19-5 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	.25
$60,000	.25
$70,000	.25
$80,000	.25

What is the expected value of 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.

CHAPTER 20

The Problem of Moral Hazard

In 2004, in Minnesota, the Progressive Direct Group of Insurance Companies introduced a new car insurance product called TripSense™. The service includes a free device that plugs into a car's diagnostic port that records mileage totals, speeds driven, and the times when the vehicle is driven. Once downloaded and transferred to the company, Progressive uses this information to offer renewal discounts to customers who drive fewer miles at slower speeds during off-peak times. The program quickly attracted 3,000 participants who received discounts averaging 12 to 15%. Over the next five years, the renamed MyRate℠ program has been extended to customers in Missouri, Kentucky, Oregon, Michigan, Alabama, New Jersey, Louisiana, and Maryland. New customers earn an initial discount of up to 10% just for signing up. Renewal discounts vary from 25% to an *increase* 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 but also 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.

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 sky divers 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).[2] Both problems can be addressed by getting rid of the information asymmetry. This is what the TripSense™ program tries to accomplish.

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.[3]

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.*

In this case, the insurance company should anticipate that the probability of theft will rise to 40% and price its policies accordingly; that is, it should price the insurance at \$45 instead of \$35.

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[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] Unlike adverse selection problems, which are characterized by hidden *information*, moral hazard problems are characterized by "hidden *action*."

[3] We thank Mark Cohen for the bicycle insurance example.

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 MyRate[SM] 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 (note that that buying an air bag is analogous to purchasing insurance).

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 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. 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 information 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).

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 employee behavior *after* a firm has hired them. Without good information, ensuring high levels of effort becomes more difficult.

Suppose, for example, a 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.[4]

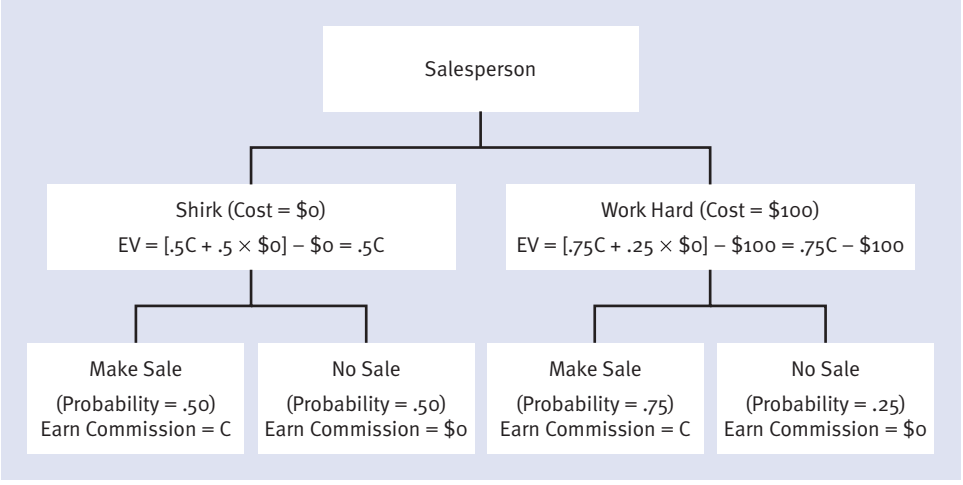

FIGURE 20-1 Choice between Shirking and Working

[4] .75C – $100 > .5C; equivalently
.75C – .5C > $100; equivalently
.25C > $100; equivalently
C > $400

Unless the company's contribution margin ($P - MC$) is at least $400, the company cannot afford to pay a commission that big. 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. Our discussion of "framing" in Chapter 12 suggests that a carrot is likely to be a more effective motivator for the employees.

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

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 = 0.5$)	Investment Returns $0 ($p = 0.5$)	Expected Payoff
Payoff to borrower	$940	$0	$47
Payoff to bank	$60	$0	$3

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).

This is an example of moral hazard—the bank cannot observe the borrower's risky investment behavior. 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 original purposes.

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. And 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. So, 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 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.

We are also likely to see moral hazard when companies become "too big to fail." The classic example is AIG. One of AIG's main business lines was selling credit default swaps. These swaps allowed banks that purchased them to reduce their risk profiles by transferring the risk to AIG. AIG, however, did not hedge any of their own swaps, which had a notional value of around half a trillion dollars at their peak (notional value refers to what AIG would have owed if all its bets went bad). A lot of these loans did go bad, and now the U.S. taxpayer is paying off AIG's debts.

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, are now watching 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 occurs in a variety of circumstances: Anticipate it, and (if you can) figure out how to consummate the implied wealth-creating transaction (i.e., ensuring that consumers continue to take care even when the benefits of doing so exceed the costs).
- 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.

- 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. After employees sign up for the company health plan that covers all doctors' visits, they start going to the doctor every time they get a cold.
2. Moral hazard means that a borrower would be more likely to use loan proceeds to invest in which of the following?
   a. A blue chip stock
   b. A mutual fund
   c. A corporate bond fund
   d. A start-up biotechnology company
3. 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.
4. Due to the problems associated with _____, one would expect a doctor to spend _____ time with patients after buying malpractice insurance.
   a. moral hazard; more
   b. adverse selection; more
   c. moral hazard; less
   d. adverse selection; less

5. A moral hazard explanation would tell us that homeowners are _____ likely to lock their houses at night after buying insurance.
   a. less
   b. more
   c. equally
   d. None of the above

Individual Problems

20-1 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.

20-2 Usage-Based Insurance

With a GPS system attached to each insured vehicle, insurance companies are able to charge "usage-based insurance rates," depending on how much, when, and where the insured vehicle is driven. Autograph, a firm that was awarded a U.S. patent in 2001, was shown to save policy holders in Houston an average of 25% of what they were previously paying. Why are usage-based insurance rates lower than flat-rate insurance fees? Give two separate reasons.

20-3 AIDS Insurance

Suppose your company is considering three health insurance policies. The first policy requires no tests and covers all preexisting illnesses. The second policy requires that all covered employees test negative for the HIV virus. The third policy does not cover HIV- or AIDS-related illnesses. All insurance policies are priced at their actuarially "fair" value. All individuals are slightly risk averse. An individual with the HIV virus requires, on average, $100,000 worth of medical care each year. An individual without the virus requires, on average, $500 worth of medical care each year.

a. Suppose that the incidence of HIV in the population is 0.005. Calculate the annual premium of the first policy. (*Hint:* Adverse selection.)
b. If you don't have insurance that covers HIV-related illnesses, the probability of getting HIV is 1%. If you have insurance that covers HIV-related illness, suppose that the probability of getting HIV is 2%. Calculate the premium of the second policy. Show your calculations. (*Hint*: Moral hazard.)

c. In Question 20-3b, suppose the insurance company wants to encourage low-risk behavior by individuals who have insurance. On average, it "costs" individuals $100 to engage in low-risk behavior. Assume that if people get HIV, they pay the deductible; and if they do not get HIV, they do not pay the deductible. How high must the deductible be to encourage low-risk behavior?
d. Calculate the premium of the third policy. Show your calculations.

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? (*Hint:* Remember that there are state laws forcing individuals to purchase auto liability insurance.)

20-5 Moral Hazard in Bank Loans

Suppose that, as an owner of a federally insured S&L in the 1980s, the price of real estate falls, and most of your loans go into default. In fact, so many loans go into default that the net worth of the S&L is negative ($5 million). Federal regulators haven't realized this yet, but they will shortly. As a last-ditch attempt to save the bank, you attract $1 million in new deposits with very generous interest rates to depositors. You have two possible investments you can make with the $1 million. You can invest in the stock market, which will pay $4 million with probability 0.5 and $2 million with probability 0.5. Alternatively, you can invest in junk bonds, which pay off $10 million with probability 0.1 and $0.5 million with probability 0.9.

a. Which investment has the highest expected value to an ordinary investor? Show your calculations.
b. Which investment has the highest expected value to you, the S&L owner? Show your calculations. (*Hint*: Federal deposit insurance limits an S&L's losses to zero.)

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.

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SECTION VI

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 should they want 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 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 he 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 package. 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% rate 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.

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—a circumstance 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, we call the costs associated with moral hazard and adverse selection **agency costs** because we often analyze them using principal–agent models. A well-run firm will find ways to reduce agency costs; poorly run firms often blindly incur such costs or unwittingly make decisions that increase agency costs.

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 began to exchange rate reductions 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' self-interested 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, 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 consider 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 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, you can 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. Thus, we associate the first option with *centralization* of decision-making authority and the second with *decentralization*.

In the ASI example, the art expert had better information about what rates art owners were willing to pay. Giving pricing discretion to 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 ensure that he is motivated to make choices in the firm's best interest. At ASI, the weak incentives were obvious—the art experts had rate-setting discretion, but they were given no incentive to set profitable rates. The CEO should have adopted an incentive compensation scheme to encourage profitable decision making.

It's useful to think of incentives as having two parts: Before you can reward good behavior, you have to be able to measure it. You can judge performance informally, with some kind of subjective performance evaluation, or formally, using sales or profitability as performance measures. Once you have an adequate performance measure, you create incentives by linking compensation to performance measures. Here, we speak very generally about compensation: Compensation can be pay, increased likelihood of promotion, bonuses, or anything else 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.

Even if you can create a good incentive compensation scheme, decentralization isn't always the best solution for controlling incentive conflict. Although decision makers near the top of the

[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/

hierarchy may have less information, it's easier to motivate upper-level employees to work in the firm's overall interests. Because their decisions are more likely to affect the entire organization, you can more easily align their incentives with organizational goals just by tying their compensation to the firm's profitability. But, remember, incentives are only half the solution.

> *When you centralize decision-making authority, make sure that the decision maker has enough information to make good decisions.*

The CEO of ASI lacked the critical information about how much art owners were willing to pay. Without this information, it was costly to set prices centrally. By setting a uniform (albeit collusive) price, the CEO gave up the ability to price discriminate.

In this case, 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, for example, 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 in conflict 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. But since agents typically have better information, controlling the incentive conflict is costly.

To see why, put yourself in the place of a marketing manager who is overseeing a salesperson. He 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, we have to wonder why this kind of incentive compensation is not more widely used. Most salespeople will tell you they prefer evaluations based on revenue because revenue is what they directly control. They 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 compensation so that it's "revenue-neutral." 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 they can earn more money if they change behavior (by pricing less aggressively), which raises their compensation.

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 $MR - MC > 0$.

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 with evidence that the price reduction is necessary. If done well, this solution can ensure that enough information is transferred to the marketing manager so that she can prevent sales agents' making unprofitable price reductions.

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 restaurant is worth more to the franchisee than it is to the chain, 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 firm 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 lazy managers rarely want 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 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 store could be more valuable to the company than it is to the franchisee.[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. 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 franchising 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

[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.

to reduce the associated agency costs. Then choose the alternative that gives you the highest profit.

To analyze principal–agent problems, begin with the decision that is causing the problem; then ask three questions:

1. Who is making the (bad) decision?
2. Does the employee have enough information to make a good decision?
3. Does he have the incentive to do so—that is, how is the employee 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 were opening unprofitable stores.
2. *Did they have enough information to make a good decision?* Yes. The development agents probably had access to information about whether the new stores would be profitable.
3. *Did they have the incentive to do so?* No. The agents got 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's 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. 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 fact, 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. In this case, the model predicted well, and the problem disappeared.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- **Principals** want **agents** to work for their (the principals') best interests, but agents typically have different goals than do principals. This is called **incentive conflict**.
- Incentive conflict leads to moral hazard and adverse selection problems when agents have better information than principals.
- Three approaches for controlling incentive conflicts are
  - fixed payment and monitoring (shirking, adverse selection, and monitoring costs),
  - incentive pay and no monitoring (must compensate agents for bearing risk), or
  - sharing contract and some monitoring (some shirking 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:
  - Who is making the (bad) decisions?
  - Does the employee have enough information to make good decisions?
  - Does the employee 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. 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.

3. 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.
4. 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
5. 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

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 Incentive Compensation

Firm X is a small environmental consulting firm. The firm pays employees according to how much time they bill on projects. Because they are out in the field, in close contact with clients, employees also have opportunities to recognize client demands for new projects and to "sell" more projects to the clients. However, none of the employees makes the effort to do so. How would you change the organizational architecture of the firm to raise profitability?

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 bonding costs.

21-4 British Physicians

The British government offered physicians incentive pay to offer better customer (patient) service, such as managing appointments better. In particular, physicians can score "points" by seeing a patient within 48 hours after making an appointment. This year, each point brings £75; next year, it will be £120. Do you think this is a good incentive payment scheme?

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. 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.
b. Discuss how these two components help address the incentive conflict.

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?

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 agency costs 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)?

CHAPTER 22

Getting Divisions to Work in the Firm's Best Interests

In 1997, Acme's Paper Division was trying to decide what to do with its black liquor soap, a by-product of paper manufacturing. The Paper Division normally sold the soap to Acme's Resins Division, which converted it into crude tall oil, an input into resin manufacturing. Since a low transfer price increased the Resins Division's profit, its managers spent a lot of effort trying to persuade the managers of the parent company to set a low transfer price. Lobbying against them, the Paper Division argued for a high transfer price.

The Resins Division "won" this lobbying battle, but theirs was a hollow victory. Instead of transferring the soap, the Paper Division decided to burn it for fuel. This raised Paper Division's profit because the value of soap as a fuel was higher than the transfer price, but the Resins Division was forced to purchase higher-priced soap on the open market. On net, burning the soap decreased parent 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. When I heard this story in the fall of 1998, I can't say that I was hoping for an explosion, but it would have added some drama to the topic of this chapter, incentive conflict between divisions. Fortunately, however, corporate headquarters recognized the danger, but their "solution" 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 mangers 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. To identify the cause of problems, we ask the same three questions:

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 managers' 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.*

The virtue of a profit center is that it largely runs by itself. The parent company looks at division revenue, subtracts division costs, and rewards managers based on the difference. Because the parent company has a good performance evaluation metric, division managers are given a lot of discretion because 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 with black liquor soap:

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

[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.

management that would allow them to set a better transfer price. But where does senior management at 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 almost invites competition between the two divisions to see who can 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.[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 that forces one division to buy from another. 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

[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.

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 operate below capacity.

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.

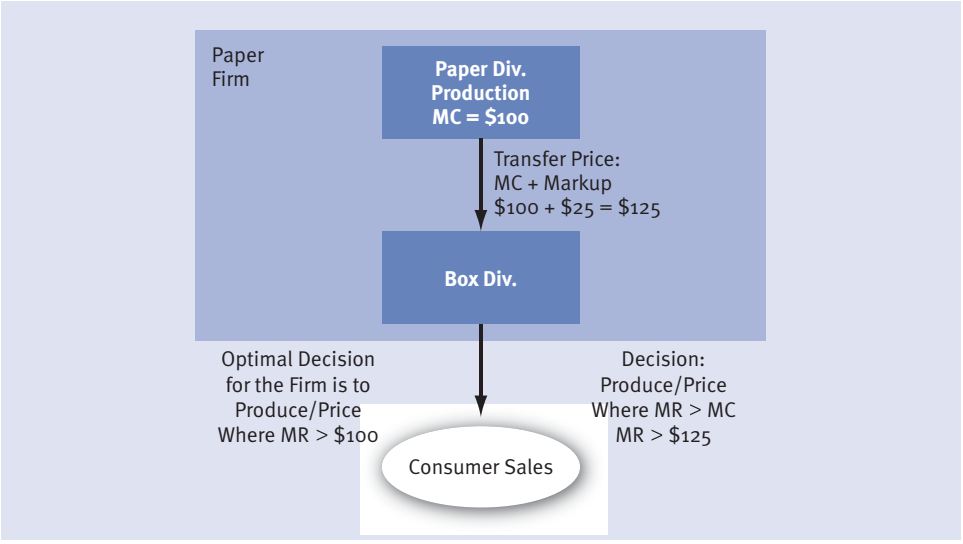

FIGURE 22-1 Transfer Pricing

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 gladly transfer 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.[4] This underscores another lesson for would-be reformers—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.

[4]See Mikhael Shor and Hui Chen. "Decentralization, Transfer Pricing and Tacit Collusion," June 1, 2006. AAA 2007 Management Accounting Section (MAS) Meeting; Contemporary Accounting Research, Forthcoming. Available at SSRN: http://ssrn.com/abstract=921379

*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. 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 cost of the engine, it discovered that the new engines were much more expensive than rival engines, even after accounting for the expected fuel savings. The lack of coordination between the divisions resulted in a product whose 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.
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, but it may take many years before a bank knows whether loans are unprofitable, and then only when borrowers don't repay them.

[5]For one example of the challenge of organizing economists, see Luke M. Froeb, Paul A. Pautler, and Lars-Hendrik Röller, "The Economics of Organizing Economists," Vanderbilt Law and Economics Research Paper No. 08-18, July 3, 2008. Available at SSRN: http://ssrn.com/abstract=1155237

We could adopt a solution similar to the one used by the General Store 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 company:

> *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.

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.

[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).

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. Their compensation may even include stock options, whose value rises with the underlying stock price. But even in cases without explicit incentive compensation, top management labors 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, because her bonus is tied to reaching her profitability goal, she always has an incentive to try to reduce the goal to make it easier to reach. 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; and 5% of sales occurred on the first day of the quarter, as salespeople give 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 22-3 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.

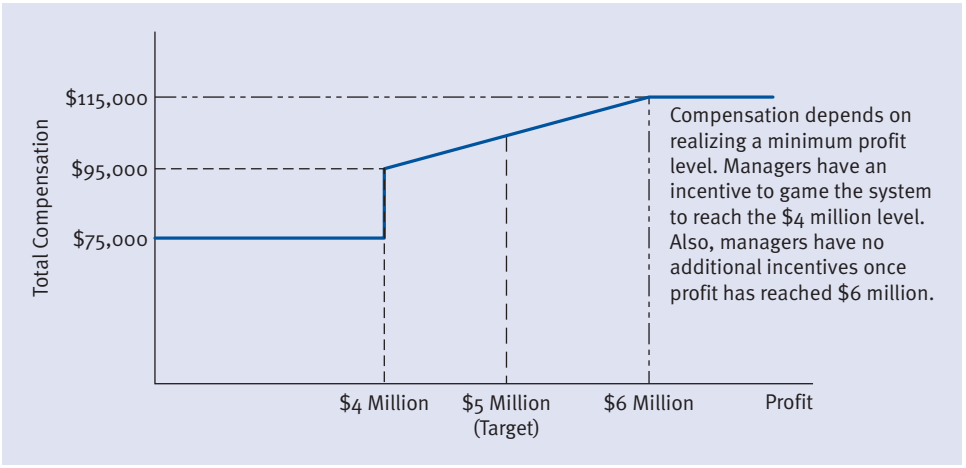

FIGURE 22-2 Typical Incentive Compensation Scheme

[7]Ian I. Larkin, "The Cost of High-powered Incentives: Salesperson Gaming in Enterprise Software," Working Paper. Harvard University.

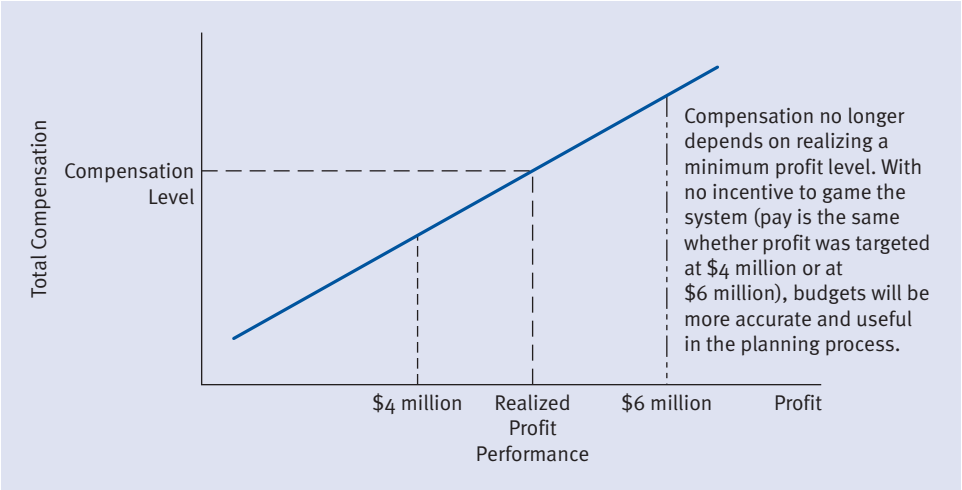

FIGURE 22-3 A Better Compensation Scheme

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 result in moving assets to lower-value uses. 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 fall.
   b. Profits will rise.
   c. Profits may either rise or fall.
   d. The conflict has no potential to affect overall profit.
2. 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
3. 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
4. Which of the following organizational forms requires the strongest management oversight?
   a. Profit centers
   b. Functional organizations
   c. M-form organizations
   d. Functional and M-form organizations likely require similar oversight.
5. Which of the following actions is consistent with a manager whose compensation reflects a specific 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

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 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?

22-4 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?

22-5 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 $7, 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.

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.

CHAPTER 23

Managing Vertical Relationships

The managers of United Consolidated (UC) Power & Light, a regulated power company, have a clever plan to make money. They want to purchase their upstream supplier (a coal mine), form a multidivisional company, and then raise the price of coal sold to the Power Division (the old UC Power & Light). Ordinarily, increasing the price of coal would raise the profit in the Coal Division and simultaneously reduce it in the Power Division, providing no net benefit to the company as a whole. But in this case, the move allows the merged company to evade the regulation that limits its profit.

Here's how it works. Government regulations allow the Power Division to charge its power customers just enough to earn a 9% return on its invested capital. With $1 billion invested in capital equipment, the Power Division can earn $90 million each year, computed as the contribution margin (price minus marginal cost) multiplied by the amount of electricity sold. When the price of coal increases, costs go up, and the Power Division's profit falls below $90 million. Under the regulation, the Power Division is allowed to raise the price of electricity until its profit goes back up to $90 million. The net effect of the higher coal price is that the Coal Division earns more, and the Power Division profit doesn't change. Because the power company can use the acquisition to evade regulation, the coal mine is worth more to UC Power than it is to its current owners.

If this were an economics textbook, we might spend a lot of time trying to figure out whether this kind of regulatory evasion is a good or a bad thing.[1] But the focus of this chapter is on business, not public policy. We study regulatory evasion because it offers one of the simplest and most readily understood reasons for vertical integration. It is obvious why the vertically integrated firm (Coal+Power) is more profitable than two independently run firms who buy from, or sell to, each other. In addition, regulatory evasion is not uncommon and should be anticipated—especially if you're a customer of a regulated utility.

[1]Some regulations are worth evading—especially those erected to protect incumbent firms from the forces of competition. Sales-below-cost laws that prevent new competitors, like Walmart, from selling gasoline at low prices fall into this category. State legislators typically pass these laws at the request of incumbent gas stations to make it difficult for new competitors to enter a market and reduce price.

In this chapter, we examine acquisitions and other kinds of contractual relationships between firms located at adjacent stages along the vertical supply chain, running from raw materials down to finished goods. We examine the means and motives for vertical relationships, as well as the laws governing such relationships. Vertical relationships can increase profit by giving firms a way to evade regulation, exclude competitors, eliminate the double-markup problem, better align the incentives of manufacturers and retailers, or price discriminate.

DO *NOT* BUY A CUSTOMER OR SUPPLIER SIMPLY BECAUSE THEY ARE PROFITABLE

Before we turn to the circumstances that make vertical acquisitions profitable, let's begin with a warning—one that most of you will forget when you face 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 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—so they 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.[2] Based on the stock price reactions following acquisition announcements, it appears that about half of all acquisitions are unprofitable. The shareholders of the acquired firm gain a little, but the shareholders of the acquiring firm lose a lot.

But 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

[2]For more on this topic, see Luke Froeb , "If Merger is the Answer, What is the Question?," *M&A Journal*, March 2006, reprinted in *Owen Manager* (2006) and in *Proceedings of the I Lisbon Conference on Competition Law and Economics* (Kluwer Law International, forthcoming).

cable lines. Three years later, the technology failed to develop as expected, so AT&T sold the old TCI cable assets to Comcast for only $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.

More typically, purchasing firms underestimate the costs of aligning the incentives of the newly acquired assets with the goals of the organization. An acquisition creates a more complex organization, which increases the cost of running the organization. As Chapter 22 has illustrated, these costs may be considerable. For example, acquisitions often result in big changes to the organizational design of the company, for example, by changing some divisions from profit centers to cost centers. The cost of these changes can more than offset the anticipated merger synergies.

EVADING REGULATION, BUNDLING, TYING, AND EXCLUSION

Not only does regulatory evasion offer one of the simplest and most easily understood reasons for vertical integration, it also illustrates how a variety of related strategies can accomplish the same thing.

> *If unrealized profit exists at one stage of the vertical supply chain—as often happens when regulations limit profit—a firm can capture some of the unrealized profit by integrating vertically, by tying, by bundling, or by excluding competitors.*

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.

Preventing rival furniture sellers from selling to the tenant—**exclusion**—could accomplish the same thing. If a building owner can make it costly or difficult for rival furniture sellers to sell to the tenant, the tenant is forced to purchase furniture from the landlord. The landlord can capture 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, a regulated local phone company that also sells long-distance service has an incentive to make it difficult for rival long-distance carriers to connect to their local customers. In one creative exclusionary tactic, repairmen put peanut butter on rival copper wires so that rats would chew through the wires, making it impossible for rival carriers to connect.

Vertically integrated multinational companies use similar schemes 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.

ELIMINATING THE DOUBLE MARKUP

Gasoline refiners, like ExxonMobil, sell branded gasoline to independently owned gas stations and to company-owned stations. Gas stations receive gasoline by truck at a delivered price, called the *dealer tank wagon (DTW)* price, or pick it up themselves at the "rack" with their own trucks and pay what is known as a *rack* or *wholesale price*.

Since the refiner marks up rack prices, the gas sold by independently owned gas stations has a double markup—one imposed by the refiner and the other by the retailer. As a consequence, the price is higher than the price that would maximize joint profit. This problem should sound familiar, as it is analogous to the pricing of commonly owned complementary products (see Chapter 12) and to the problem of setting a transfer price above marginal cost (see Chapter 22). The gasoline refiner can solve the problem by purchasing the retail outlet and setting the retail price directly.

We can analyze this problem more generally as a prisoners' dilemma faced by any two firms in the same vertical supply chain or by any two firms selling complementary goods. We often think of vertically related goods as complementary because consumers demand both together, not one or the other. In this case, consumers demand the gas, as well as the retail outlet that dispenses it.

We diagram the game in Table 23-1. The unique Nash equilibrium is the upper-left cell of the table. Both firms try to capture a bigger piece of the profit pie by pricing high; but when both price high, they reduce joint profit.

> *When firms selling complementary products compete with each other, they price too high.*

TABLE 23-1 Vertical Pricing Dilemma

		Refiner	
		Price High	**Price Low**
Gas Station	Price High	0, 0	4, −2
	Price Low	−2, 4	2, 2

The firms could increase their joint profit by coordinating to reduce price (which would take them to the lower-right cell); fortunately, such coordination is both legal and common, at least in the United States.[3] Vertical integration solves the double-markup problem. In the gasoline industry, for example, refiners purchase gas stations for this reason, although some states have laws preventing this. In these states, consumers pay three cents per gallon more. This differential translates into hundreds of millions extra that consumers in these states have to pay.[4] The Federal Trade Commission (FTC) spends time pointing out the perverse consequences of these laws to state legislators, which sometimes shames them into not passing them. If you live in Hawaii, Connecticut, Delaware, Maryland, Nevada, Virginia, or the District of Columbia, you may want to tell your state legislator that you are tired of paying higher gas prices caused by your state's *vertical divorcement* laws.

ALIGNING RETAILER INCENTIVES WITH THE GOALS OF MANUFACTURERS[5]

When a manufacturer's profit margin is large relative to the retailer's (as is often the case for branded products), the retailer has less of an incentive to provide demand-enhancing services that generate additional sales. In other words, there is an incentive conflict between retailers and manufacturers over the level of demand-enhancing services.[6] To address this incentive conflict, manufacturers put limits on competition between retailers to guarantee them a higher margin. The higher margin better aligns their incentives with the manufacturer's profitability goals.

Restrictions on intra-brand competition can enhance inter-brand competition.

[3]In Europe, the antitrust authorities are only beginning to treat such vertical constraints with tolerance. See http://europa.eu/rapid/pressReleasesAction.do?reference=IP/99/286&format=HTML&aged=0&language=EN&guiLanguage=en

[4]Michael G. Vita, "Regulatory Restrictions on Vertical Integration and Control: The Competitive Impact of Gasoline Divorcement Policies," *Journal of Regulatory Economics* 18, no. 3 (November 2000): 217–233.

[5]Adapted from the writings of Michael Vita.

[6]For example, one study reports that apparel manufacturers' average gross profit margin is 46% compared with just 9% for "multiple apparel retailers." The authors note that this disparity in compensation for marginal sales "will limit the incentive of retailers to invest in developing and promoting their Web sites unless there is some form of co-op funding or restructured pricing." Robert Gertner and Robert Stillman, "Vertical Integration and Internet Strategies in the Apparel Industry," *Journal of Industrial Economics* 49 (2002): 415, 427.

For example, consider the plight of a manufacturer of high-end electronic equipment, such as cameras or computers, whose potential customers require expert assistance to select the proper product. Without such assistance from retailers, consumers frequently choose not to purchase. The manufacturer's problem is how to design incentives to induce retailers to invest in training for its salespeople. Then, once the retailer has trained its salespeople, the manufacturer must find ways to motivate those same salespeople to provide in-store assistance for the manufacturer's products.

A similar incentive conflict arises over the costs of maintaining product quality. Because retailers do not reap all of the benefit from a brand's reputation, they have less incentive to incur the costs necessary to maintain it.[7] A brewer, for instance, may insist that a retailer refrigerate its beer in a certain way to maintain freshness. Unless the beer is properly stored, *total* demand for the manufacturer's beer (not merely demand at the offending retail location) would fall because consumers associate the lower quality not with the retailer's inadequate storage but rather with the manufacturer's brewing ability.[8] For example, McDonald's has a tremendous reputation for clean bathrooms. The reputation encourages travelers to stop at McDonald's to use the bathrooms, and they often purchase food during their stop. To encourage the retailers to clean the bathrooms, the manufacturer could enter into a contract that spells out the services that a retailer must perform. But retail service contracts like this can be complex and difficult to enforce.

To solve this problem, a manufacturer may utilize distribution policies that insulate retailers from intra-brand competition.[9] It can do this by granting exclusive territories, thereby preventing competition among retailers for customers. Or they can fix a minimum retail price; however, minimum retail price contracts are illegal in certain states and countries. By protecting retailers from intra-brand competition, both of these policies guarantee retailers a higher profit on each sale, raising the incentive to provide demand-increasing services.

Without limited distribution policies, discounters can free ride on a full-service retailer's efforts to increase demand.[10] For example, a consumer may visit a full-service retailer to learn

[7]This phenomenon may be likely to arise in a franchise context. For example, although a restaurant franchisee using low-quality ingredients would lose repeat sales at its outlet, it may also cause fewer patrons to visit other franchisees' outlets as well. The low-quality franchisee does not internalize the full costs of actions that depreciate the brand-name capital of the franchisor. See Benjamin Klein, "The Economics of Franchise Contracts," *Journal of Corporate Finance* 2 (1995): 9; Paul H. Rubin, "The Theory of the Firm and the Structure of the Franchise Contract," *Journal of Law and Economics* 21 (1978): 223.

[8]See, e.g., *Adolph Coors Co. v. FTC*, 497 F.2d 1178 (10th Cir. 1974).

[9]See Benjamin Klein and Kevin M. Murphy, "Vertical Restraints as Contract Enforcement Mechanisms," *Journal of Law and Economics* 31 (1988): 265.

[10]See Lester G. Telser, "Why Should Manufacturers Want Fair Trade?," *Journal of Law and Economics* 3 (1960): 86. See also *Isaksen v. Vermont Castings, Inc.*, 825 F.2d 1158, 1161–62 (7th Cir.) (Posner, J.) (describing how minimum resale price maintenance can also be used to ensure dealers provide the proper level of service by preventing discounters from free riding).

about the product from a knowledgeable and attentive sales staff, and then purchase at a lower price from an online discounter that doesn't have to incur the costs of providing service. Without protection from discounters, full-service retailers wouldn't provide the level of service the manufacturer wants.[11]

Many practices that limit distribution are illegal under antitrust laws, especially if undertaken by a firm with a dominant share of the market. For example, European authorities have prohibited Coke from purchasing refrigerators for retail outlets (a demand-enhancing investment) because the practice may unfairly exclude rival soft drink manufacturers from retail outlets. In the United States, Dentsply has been convicted of excluding rival teeth manufacturers from its dealer distribution network. Similarly, 3M has been convicted of unfairly using discounts that encourage retailers to carry only 3M products. This is called *abuse of dominance* in Europe and *monopolization* or *exclusion* in the United States. To avoid running afoul of these laws, we repeat the following advice:

> *If you have significant market power, you should consider the effect any planned action will have on competitors.*[12]

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. Ironically, these laws, which were designed to protect competition, often end up protecting competitors—and hurting consumers.

PRICE DISCRIMINATION

Vertical integration into downstream sales of a product may allow a manufacturer to price discriminate. If there are two separate consumer groups who use the product differently, then buying a retailer can allow price discrimination that would otherwise be defeated by arbitrage.

[11]Empirical studies of on-line marketing strategies find that manufacturers have tended to pursue Internet retailing in a way that preserves incentives to provide retail service. For example, one study finds that high-end fragrance producers that have restrictive distribution practices in the brick-and-mortar world are more likely to practice similarly restrictive distribution strategies on-line, such as offering their product only through their own Web site at an equal or higher price than is available elsewhere. See Judith Chevalier and Dennis Carlton, "Free Riding and Sales Strategies for the Internet," *Journal of Industrial Economics* 49 (December 2001): 441; see also Robert Gertner and Robert Stillman, "Vertical Integration and Internet Strategies in the Apparel Industry," *Journal of Industrial Economics* 49 (2002): 415. More generally, the empirical literature tends to show that vertical integration and restraints like resale price maintenance and exclusive dealing/exclusive territories typically tend to reduce price and/or induce demand-increasing investments. See James C. Cooper et al., "Vertical Antitrust Policy as a Problem of Inference," *International Journal of Industrial Organization* 23 (2005): 639.

[12]John Shenefield and Irwin Stelzer, *The Antitrust Laws: A Primer*, 4th edition (Washington, D.C.: AEI Press, 2001).

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).

An herbicide manufacturer setting a single price faces the usual price–quantity trade-off: She can sell only to retailers who serve home gardeners for $5 per liter, or she can sell to retailers serving home gardeners and to retailers serving farmers for $3 per liter. If she tried 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 them to home gardeners. By vertically integrating into retail operations, the manufacturer can prevent this kind of arbitrage.

Vertical integration can also allow a firm to circumvent laws that prohibit price discrimination at the wholesale level. In the United States, for example, the Robinson–Patman Act makes it illegal to give or receive a price discount. So if you offer a discount to one retailer, another retailer who doesn't receive the discount can sue you. But if you own the retailer receiving the discount, you are less likely to have this problem. Note that economists dislike the Robinson-Patman Act because it discourages discounting.

OUTSOURCING

No discussion of vertical integration would be complete without examining its opposite—*outsourcing*. The decision to outsource follows a logic that is exactly opposite to the logic of vertical integration:

> *Outsource an activity to an upstream supplier or downstream customer if they can do it more profitably.*

You should outsource if suppliers or customers can take advantage of economies of scale or scope that are not available to you. For example, Caterpillar purchases diesel engines from Cummins for its earth-moving equipment. Cummins' costs are lower because they also sell engines to truck manufacturers. Their larger scale allows them to produce engines more cheaply than Caterpillar.

But outsourcing leaves you with less control than you might otherwise have over your upstream manufacturing process or your downstream distributors and retailers. If you outsource, you may create a double-markup problem; you may find it difficult to motivate your downstream customers or upstream suppliers to invest in activities that benefit you; and you may find it more difficult to price discriminate.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Do not purchase a customer or supplier merely because that customer or supplier is profitable. There must be a synergy that makes them more valuable to you than they are to their current owners. And do *not* overpay.
- If unrealized profit exists at one stage of the vertical supply chain—as often happens when regulations limit profit—a firm can capture some of the unrealized profit by integrating vertically, by **tying**, by **bundling**, or by **excluding** competitors.
- The double-markup problem occurs when complementary products compete with one another. Setting prices jointly eliminates the double-markup problem and is often a motive for vertical integration or maximum price contracts between a manufacturer and retailer.
- Restrictions on intra-brand competition like minimum resale price maintenance or exclusive territories provide retailers with higher profit, giving them incentives to provide demand-enhancing services to customers.
- If a product has two retail uses, a manufacturer may find it profitable to integrate downstream so that the firm can capture the profit through price discrimination. Vertical integration stops arbitrage between the two products, which allows price discrimination.
- Outsource an activity if the outsourcer can perform the activity better or more cheaply than you can.

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. 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
3. In which of the following instances would an acquisition make the most sense?
   a. The acquiree is a very profitable company.
   b. Synergies exist between the acquirer and the acquiree.
   c. Integration costs are low between the two.
   d. Synergy benefits outweigh the costs of integration.
4. 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.
5. 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

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, is this a profitable strategy?

23-2 Tape Manufacturer

A transparent adhesive tape manufacturer produces a wide array of products, including sticky notes, as well as branded and unbranded adhesive tape of different sizes and shapes. Large office supply retailers, like Office Depot and Staples, carry only the most popular SKUs (shopkeeping

units—a unique product with its own bar code). The manufacturer's managers are convinced that they could make more sales if they could convince the retailers to carry a full line of its products. How could the manufacturer induce its retailer to carry a fuller line of products?

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 Copier Service

Suppose a copy machine manufacturer uses independent service operators (ISOs) to service its copiers. Recently, its machines have become more complex and difficult to service, and the manufacturer is concerned that the ISOs lack the necessary expertise to service the machines correctly. The manufacturer is especially concerned that customers who receive lousy service will blame the manufacturer if the machine breaks down, not the ISOs. How should the manufacturer address this problem?

23-5 Herbicide Integration

Suppose the herbicide manufacturer mentioned in the chapter can vertically integrate into just one of the downstream retail businesses, either home gardening or farming, but not both. Which one would allow the manufacturer to price discriminate?

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 (regulatory evasion, elimination of double markup, goal alignment, or price discrimination), and describe how to exploit it. Estimate the gain in profit from the change.

G23-2 Undoing Vertical Relationships

Identify a vertical relationship in your company, and determine whether it could be managed more profitably by untying, unbundling, inclusion of rivals, or vertical disintegration. Clearly identify the source of the profitability (regulatory evasion, elimination of double markup, goal alignment, or price discrimination), and describe how to exploit it. Estimate the gain in profit from the change.

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SECTION VII

Wrapping Up

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.

Avoid the trap of identifying a problem as simply a failure to implement a specific solution. This approach locks you into a specific solution and may cause you to miss alternate, and better, solutions. Instead, identify a problem as an asset in a lower-valued use. For example, the problem facing the paper company in Chapter 22 was not that the transfer price for black liquor soap was set too low; rather, it was that the Paper Division burned the soap for fuel instead of using it for resin manufacturing. If you define the problem as a low transfer price, you are already locked into the solution of raising the transfer price. This may cause you to overlook better solutions—like turning the Paper Division into a cost center and setting the transfer price at marginal cost.

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. In addition, 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 health care 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 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, 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 former 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 latter option would mean that Operations would be given a *ratification* role in estimating the target hospital's EBITDA. Operations must OK or ratify the purchase price of each acquired hospital. Operations has an obvious incentive to make sure the earnings are not overestimated.

[1]EBITDA—earnings before interest, taxes, depreciation, and amortization.

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.

LARGE E&O CLAIMS AT AN INSURANCE COMPANY

An insurance brokerage has more than 40 retail offices, each run as an independent profit center. The profit centers earn money by selling insurance to clients on behalf of several insurance carriers. The insurance company pays the brokerage 15% of the revenue it earns on insurance. In the case of an accident that is covered by the insurance policy, the insurance carrier pays for the resulting loss. The brokerage firm acts only as an intermediary between the insurance carrier and the client. At least that's how it's supposed to work.

Too often, however, disputes arise over exactly what the policy covers. For example, a small business owner whose store has burned down may claim *replacement value*, the amount of money it would take to replace the store and the merchandise. The insurance company, however, may offer *book value*, what the owner originally paid for the store and merchandise. Ordinarily, replacement value is much higher than book value. The brokerage that sold the policy then finds itself in the middle of a dispute between the small business owner and the insurance carrier.

If a client's insurance carrier fails to pay a claim for loss and the client attributes that failure to misrepresentation[2] by the broker who sold the policy, the client files an errors & omission (E&O) claim against the brokerage that employs the broker. The brokerage must either litigate the case in court or settle with the client. If the brokerage decides to settle, the local retail office whose brokers sold the policy pays the first $250,000 of the claim and the parent company assumes responsibility for losses above that limit. The broker who actually sold the policy pays no part of the settlement.

The local retail offices have broad authority to negotiate settlements below $250,000, and they often hire local attorneys to represent them in these matters. For matters above $250,000, the local offices are supposed to refer the case to headquarters. Typically, however, they make this report very late in the process, long after the local brokers have made damaging statements that could harm the company in court.

Compared with similar insurance companies, our particular insurance brokerage seems to suffer a disproportionately high number of E&O losses. After several seven-figure jury

[2]Failing to procure appropriate coverage or failing to inform client properly.

verdicts, the brokerage asks you to advise them on how to reduce its E&O losses. What do you recommend?

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?* Local brokers are settling too many E&O small claims in favor of the client. Also, the statements they make to small clients open them up to larger losses when they litigate large cases. Brokerage employees appear more sympathetic to the client than to the brokerage that employs them.
2. *Do the local brokers have enough information to make a good decision?* Yes. The local brokers know whether the E&O claims are valid, but they're slow in passing this information along to the parent company.
3. *Do the local brokers have the incentive to make a good decision?* No. Brokers are evaluated based on how much insurance they sell, not on E&O losses. This gives them an incentive to devote all of their effort into pleasing clients, regardless of the merits of the claim.

The problem should now be fairly clear. The brokerage wants their employees to do two things—sell insurance *and* resolve disputes over E&O claims—but the brokerage rewards brokers for doing only one of these tasks. It's no surprise that the brokers devote most of their effort to selling and developing relationships with their clients. So, when disputes threaten their relationships with clients, they side with the clients. In general, it's very difficult to balance incentive payments to motivate employees to perform two separate, but conflicting, tasks. One management tool, the *balanced scorecard*, promises to show you how to do this; the trouble is that it seems to confuse employees as often as it encourages them to give both tasks appropriate attention. How would you solve the brokerage's problem?

There are two obvious solutions to this problem. First, you could make the brokers bear the costs of resolving E&O claims in favor of their clients, say by subtracting the cost of E&O claims from the broker's commission. But sometimes E&O claims are not the broker's fault, and the size of just one claim could easily exceed the broker's entire income.

The second obvious solution is to split the tasks—let the brokers sell, and let the attorneys handle E&O disputes. In 1995, the company decided to give its legal department responsibility for all claims, both large and small. To make sure that the attorneys had enough information to know whether to settle or litigate the claims, the brokerage firm's managers created processes to transfer information about cases to the legal department as quickly as possible. They also performed regular audits to ensure that the local offices were not trying to settle claims on their own.

The early reporting of claims gave the legal department an opportunity to investigate matters at an early stage—before anyone could make damaging admissions or offers to resolve the client's loss. The early reporting also preserved critical documentary evidence that raised the probability of success at trial. In the first two years following the change, E&O losses decreased

by more than 60%—a savings of more than $5 million. This figure includes neither the costs of transferring the information to the legal department nor the cost of periodic audits, so it probably overstates the savings.

Note that this solution involved taking decision rights away from those with the best information. Although this authority transfer increased the costs of transmitting specific information to centralized decision makers, it also reduced the incentive costs of settling bogus claims just to keep clients happy.

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 that they might have.

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. compute break-even quantities to make investment decisions;
5. compute break-even prices to make shutdown and pricing decisions;
6. set optimal prices and price discriminate;
7. predict industry-level changes using demand–supply analysis;
8. understand the long-run forces that erode profitability;
9. develop long-run strategies to increase firm value;
10. predict how your own actions will influence others' actions;
11. bargain effectively;
12. make decisions in uncertain environments;
13. solve the problems caused by moral hazard and adverse selection;
14. motivate employees to work in the firm's best interests;
15. motivate divisions to work in the best interests of the parent company; and
16. manage vertical relationships with upstream suppliers or downstream customers.

Now go forth and move assets to higher-valued uses.

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 no sticks or carrots 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, the majority 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, 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.

Finally, manage yourself. Do not let your "In" box run your life. Put yourself on a schedule where you do the routine tasks at the same time every day. Exercise daily. 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. 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.

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).

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

Break-even price the price that you must charge to at least break even (make zero profit). It is equal to average avoidable cost per unit.

Break-even 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.

Discount rate the interest rate used to discount future cash flows. It converts future dollars into present value by the formula $C_0 = C_t/(1+r)^t$, where r is the discount rate, C_t measures cash "t" periods in the future, and C_0 measures cash in the present.

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 costs 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 (MC) 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 (MR) 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.

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 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 variable 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.

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 contract 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), consumers demand larger quantities of the good at the same price. If demand decreases (shifts down), 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.

Specific investments investments that lack value 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 costs 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.

Unit elastic If $|e| = 1$, demand is unit price elastic, where e is the price elasticity of demand.

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 costs 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.

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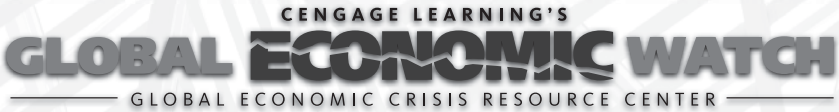

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