

Repeated Games and Sequential Games

The games that we’ve studied are played just once. In contrast, many real-world games are played repeatedly. This feature of games turns out to enable real-world duopolists to cooperate, collude, and make a monopoly profit.

Another feature of the games that we’ve studied is that the players move simultaneously. But in many real-world situations, one player moves first and then the other moves—the play is sequential rather than simultaneous. This feature of real-world games creates a large number of possible outcomes.

We’re now going to examine these two aspects of strategic decision-making.

A Repeated Duopoly Game

If two firms play a game repeatedly, one firm has the opportunity to penalize the other for previous “bad” behavior. If Gear cheats this week, perhaps Trick will cheat next week. Before Gear cheats this week, won’t it consider the possibility that Trick will cheat next week? What is the equilibrium of this game?

Actually, there is more than one possibility. One is the Nash equilibrium that we have just analyzed. Both players cheat, and each makes zero economic profit forever. In such a situation, it will never pay one of the players to start complying unilaterally because to do so would result in a loss for that player and a profit for the other. But a **cooperative equilibrium** in which the players make and share the monopoly profit is possible.

A cooperative equilibrium might occur if cheating is punished. There are two extremes of punishment. The smallest penalty is called “tit for tat.” A *tit-for-tat strategy* is one in which a player cooperates in the current period if the other player cooperated in the previous period, but cheats in the current period if the other player cheated in the previous period. The most severe form of punishment is called a trigger strategy. A *trigger strategy* is one in which a player cooperates if the other player cooperates but plays the Nash equilibrium strategy forever thereafter if the other player cheats.

In the duopoly game between Gear and Trick, a tit-for-tat strategy keeps both players cooperating and making monopoly profits. Let’s see why with an example.

Table 15.5 shows the economic profit that Trick and Gear will make over a number of periods under two alternative sequences of events: colluding and cheating with a tit-for-tat response by the other firm.

If both firms stick to the collusive agreement in period 1, each makes an economic profit of \$2 million. Suppose that Trick contemplates cheating in period 1. The cheating produces a quick \$4.5 million economic profit and inflicts a \$1 million economic loss on Gear. But a cheat in period 1 produces a response from Gear in period 2. If Trick wants to get back into a profit-making situation, it must return to the agreement in period 2 even though it knows that Gear will punish it for cheating in period 1. So in period 2, Gear punishes Trick and Trick cooperates. Gear now makes an economic profit of \$4.5 million, and Trick incurs an economic loss of \$1 million. Adding up the profits over two periods of play, Trick would have made more profit by cooperating—\$4 million compared with \$3.5 million.

What is true for Trick is also true for Gear. Because each firm makes a larger profit by sticking with the collusive agreement, both firms do so and the monopoly price, quantity, and profit prevail.

In reality, whether a cartel works like a one-play game or a repeated game depends primarily on the

TABLE 15.5 Cheating with Punishment

Period of play	Collude		Cheat with tit-for-tat	
	Trick’s profit (millions of dollars)	Gear’s profit (millions of dollars)	Trick’s profit (millions of dollars)	Gear’s profit (millions of dollars)
1	2	2	4.5	-1.0
2	2	2	-1.0	4.5
3	2	2	2.0	2.0
4

If duopolists repeatedly collude, each makes a profit of \$2 million per period of play. If one player cheats in period 1, the other player plays a tit-for-tat strategy and cheats in period 2. The profit from cheating can be made for only one period and must be paid for in the next period by incurring a loss. Over two periods of play, the best that a duopolist can achieve by cheating is a profit of \$3.5 million, compared to an economic profit of \$4 million by colluding.

number of players and the ease of detecting and punishing cheating. The larger the number of players, the harder it is to maintain a cartel.

Games and Price Wars A repeated duopoly game can help us understand real-world behavior and, in particular, price wars. Some price wars can be interpreted as the implementation of a tit-for-tat strategy. But the game is a bit more complicated than the one we've looked at because the players are uncertain about the demand for the product.

Playing a tit-for-tat strategy, firms have an incentive to stick to the monopoly price. But fluctuations in demand lead to fluctuations in the monopoly price, and sometimes, when the price changes, it might seem to one of the firms that the price has fallen because the other has cheated. In this case, a price war will break out. The price war will end only when each firm is satisfied that the other is ready to cooperate again. There will be cycles of price wars and the restoration of collusive agreements. Fluctuations in the world price of oil might be interpreted in this way.

Some price wars arise from the entry of a small number of firms into an industry that had previously been a monopoly. Although the industry has a small number of firms, the firms are in a prisoners' dilemma and they cannot impose effective penalties for price cutting. The behavior of prices and outputs in the computer chip industry during 1995 and 1996 can be explained in this way. Until 1995, the market for Pentium chips for IBM-compatible computers was dominated by one firm, Intel Corporation, which was able to make maximum economic profit by producing the quantity of chips at which marginal cost equaled marginal revenue. The price of Intel's chips was set to ensure that the quantity demanded equaled the quantity produced. Then in 1995 and 1996, with the entry of a small number of new firms, the industry became an oligopoly. If the firms had maintained Intel's price and shared the market, together they could have made economic profits equal to Intel's profit. But the firms were in a prisoners' dilemma, so prices fell toward the competitive level.

Let's now study a sequential game. There are many such games, and the one we'll examine is among the simplest. It has an interesting implication and it will give you the flavor of this type of game. The sequential game that we'll study is an entry game in a contestable market.

A Sequential Entry Game in a Contestable Market

If two firms play a sequential game, one firm makes a decision at the first stage of the game and the other makes a decision at the second stage.

We're going to study a sequential game in a **contestable market**—a market in which firms can enter and leave so easily that firms in the market face competition from *potential* entrants. Examples of contestable markets are routes served by airlines and by barge companies that operate on the major waterways. These markets are contestable because firms could enter if an opportunity for economic profit arose and could exit with no penalty if the opportunity for economic profit disappeared.

If the Herfindahl-Hirschman Index (p. 238) is used to determine the degree of competition, a contestable market appears to be uncompetitive. But a contestable market can behave as if it were perfectly competitive. To see why, let's look at an entry game for a contestable air route.

A Contestable Air Route Agile Air is the only firm operating on a particular route. Demand and cost conditions are such that there is room for only one airline to operate. Wanabe Inc. is another airline that could offer services on the route.

We describe the structure of a sequential game by using a *game tree* like that in Fig. 15.6. At the first stage, Agile Air must set a price. Once the price is set and advertised, Agile can't change it. That is, once set, Agile's price is fixed and Agile can't react to Wanabe's entry decision. Agile can set its price at either the monopoly level or the competitive level.

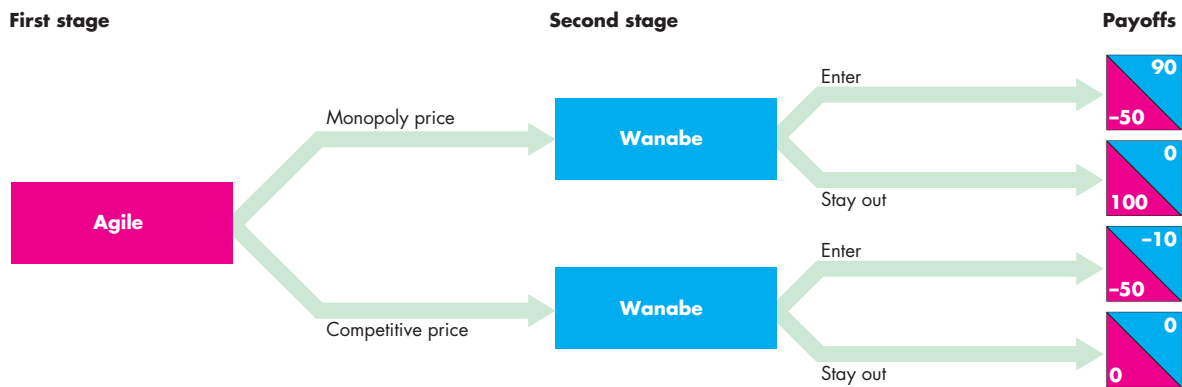
At the second stage, Wanabe must decide whether to enter or to stay out. Customers have no loyalty (there are no frequent-flyer programs) and they buy from the lowest-price firm. So if Wanabe enters, it sets a price just below Agile's and takes all the business.

Figure 15.6 shows the payoffs from the various decisions (Agile's in the red triangles and Wanabe's in the blue triangles).

To decide on its price, Agile's CEO reasons as follows: Suppose that Agile sets the monopoly price. If Wanabe enters, it earns 90 (think of all payoff numbers as thousands of dollars). If Wanabe stays out, it earns nothing. So Wanabe will enter. In this case Agile will lose 50.

Now suppose that Agile sets the competitive price. If Wanabe stays out, it earns nothing, and if it enters,

FIGURE 15.6 Agile Versus Wanabe: A Sequential Entry Game in a Contestable Market



If Agile sets the monopoly price, Wanabe makes 90 (thousand dollars) by entering and earns nothing by staying out. So if Agile sets the monopoly price, Wanabe enters.

If Agile sets the competitive price, Wanabe earns nothing if it stays out and incurs a loss if it enters. So if Agile sets the competitive price, Wanabe stays out.



it loses 10, so Wanabe will stay out. In this case, Agile will make zero economic profit.

Agile's best strategy is to set its price at the competitive level and make zero economic profit. The option of earning 100 by setting the monopoly price with Wanabe staying out is not available to Agile. If Agile sets the monopoly price, Wanabe enters, undercuts Agile, and takes all the business.

In this example, Agile sets its price at the competitive level and makes zero economic profit. A less costly strategy, called **limit pricing**, sets the price at the highest level that inflicts a loss on the entrant. Any loss is big enough to deter entry, so it is not always necessary to set the price as low as the competitive price. In the example of Agile and Wanabe, at the competitive price, Wanabe incurs a loss of 10 if it enters. A smaller loss would still keep Wanabe out.

This game is interesting because it points to the possibility of a monopoly behaving like a competitive industry and serving the social interest without regulation. But the result is not general and depends on one crucial feature of the setup of the game: At the second stage, Agile is locked in to the price set at the first stage.

If Agile could change its price in the second stage, it would want to set the monopoly price if Wanabe stayed out—100 with the monopoly price beats zero with the competitive price. But Wanabe can figure out what Agile would do, so the price set at the first stage

has no effect on Wanabe. Agile sets the monopoly price and Wanabe might either stay out or enter.

We've looked at two of the many possible repeated and sequential games, and you've seen how these types of games can provide insights into the complex forces that determine prices and profits.

REVIEW QUIZ

- 1 If a prisoners' dilemma game is played repeatedly, what punishment strategies might the players employ and how does playing the game repeatedly change the equilibrium?
- 2 If a market is contestable, how does the equilibrium differ from that of a monopoly?

You can work these questions in Study Plan 15.3 and get instant feedback.



So far, we've studied oligopoly with unregulated market power. Firms like Trick and Gear are free to collude to maximize their profit with no concern for the consumer or the law.

But when firms collude to achieve the monopoly outcome, they also have the same effects on efficiency and the social interest as monopoly. Profit is made at the expense of consumer surplus and a deadweight loss arises. Your next task is to see how U.S. antitrust law limits market power.

◆ Antitrust Law

Antitrust law is the law that regulates oligopolies and prevents them from becoming monopolies or behaving like monopolies. Two government agencies cooperate to enforce the antitrust laws: the Federal Trade Commission and the Antitrust Division of the U.S. Department of Justice.

The Antitrust Laws

The two main antitrust laws are

- The Sherman Act, 1890
- The Clayton Act, 1914

The Sherman Act The Sherman Act made it a felony to create or attempt to create a monopoly or a cartel.

During the 1880s, lawmakers and the general public were outraged and disgusted by the practices of some of the big-name leaders of American business. The actions of J.P. Morgan, John D. Rockefeller, and W.H. Vanderbilt led to them being called the “robber barons.” It turns out that the most lurid stories of the actions of these great American capitalists were not of their creation of monopoly power to exploit consumers but of their actions to damage each other.

Nevertheless, monopolies that damaged the consumer interest did emerge. For example, John D. Rockefeller had a virtual monopoly in the market for oil.

Table 15.6 summarizes the two main provisions of the Sherman Act. Section 1 of the act is precise:

TABLE 15.6 The Sherman Act of 1890

Section 1:

Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is hereby declared to be illegal.

Section 2:

Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony.

Conspiring with others to restrict competition is illegal. But Section 2 is general and imprecise. Just what is an “attempt to monopolize”?

The Clayton Act The Clayton Act, which was passed in response to a wave of mergers that occurred at the beginning of the twentieth century, provided the answer to the question left dangling by the Sherman Act: It defined the “attempt to monopolize.” The Clayton Act supplemented the Sherman Act and strengthened and clarified the antitrust law.

When Congress passed the Clayton Act, it also established the Federal Trade Commission, the federal agency charged with the task of preventing monopoly practices that damage the consumer interest.

Two amendments to the Clayton Act—the Robinson-Patman Act of 1936 and the Celler-Kefauver Act of 1950—outlaw specific practices and provide even greater precision to the antitrust law. Table 15.7 describes these practices and summarizes the main provisions of these three acts.

TABLE 15.7 The Clayton Act and Its Amendments

Clayton Act	1914
Robinson-Patman Act	1936
Celler-Kefauver Act	1950

These acts prohibit the following practices *only if* they substantially lessen competition or create monopoly:

1. Price discrimination
2. Contracts that require other goods to be bought from the same firm (called *tying arrangements*)
3. Contracts that require a firm to buy all its requirements of a particular item from a single firm (called *requirements contracts*)
4. Contracts that prevent a firm from selling competing items (called *exclusive dealing*)
5. Contracts that prevent a buyer from reselling a product outside a specified area (called *territorial confinement*)
6. Acquiring a competitor’s shares or assets
7. Becoming a director of a competing firm

Price Fixing Always Illegal

Colluding with competitors to fix the price is *always* a violation of the antitrust law. If the Justice Department can prove the existence of a price fixing cartel, also called a *horizontal price fixing agreement*, defendants can offer no acceptable excuse.

The predictions of the effects of price fixing that you saw in the previous sections of this chapter provide the reasons for the unqualified attitude toward price fixing. A duopoly cartel can maximize profit and behave like a monopoly. To achieve the monopoly outcome, the cartel restricts production and fixes the price at the monopoly level. The consumer suffers because consumer surplus shrinks. And the outcome is inefficient because a deadweight loss arises.

It is for these reasons that the law declares that all price fixing is illegal. No excuse can justify the practice.

Other antitrust practices are more controversial and generate debate among lawyers and economists. We'll examine three of these practices.

Three Antitrust Policy Debates

The three practices that we'll examine are

- Resale price maintenance
- Tying arrangements
- Predatory pricing

Resale Price Maintenance Most manufacturers sell their products to the final consumer indirectly through a wholesale and retail distribution system.

Resale price maintenance occurs when a distributor agrees with a manufacturer to resell a product *at or above a specified minimum price*.

A resale price maintenance agreement, also called a *vertical price fixing agreement*, is *not* illegal under the Sherman Act provided it is not anticompetitive. Nor is it illegal for a manufacturer to refuse to supply a retailer who doesn't accept guidance on what the minimum price should be.

In 2007, the Supreme Court ruled that a handbag manufacturer could impose a minimum retail price on a Dallas store, Kay's Kloset. Since that ruling, many manufacturers have imposed minimum retail prices. The practice is judged on a case-by-case basis.

Does resale price maintenance create an inefficient or efficient use of resources? Economists can be found on both sides of this question.

Inefficient Resale Price Maintenance Resale price maintenance is inefficient if it enables dealers to charge the monopoly price. By setting and enforcing the resale price, the manufacturer might be able to achieve the monopoly price.

Efficient Resale Price Maintenance Resale price maintenance might be efficient if it enables a manufacturer to induce dealers to provide the efficient standard of service. Suppose that SilkySkin wants shops to demonstrate the use of its new unbelievable moisturizing cream in an inviting space. With resale price maintenance, SilkySkin can offer all the retailers the same incentive and compensation. Without resale price maintenance, a cut-price drug store might offer SilkySkin products at a low price. Buyers would then have an incentive to visit a high-price shop for a product demonstration and then buy from the low-price shop. The low-price shop would be a free rider (like the consumer of a public good in Chapter 16, p. 377), and an inefficient level of service would be provided.

SilkySkin could pay a fee to retailers that provide good service and leave the resale price to be determined by the competitive forces of supply and demand. But it might be too costly for SilkySkin to monitor shops and ensure that they provide the desired level of service.

Tying Arrangements A **tying arrangement** is an agreement to sell one product only if the buyer agrees to buy another, different product. With tying, the only way the buyer can get the one product is to also buy the other product. Microsoft has been accused of tying Internet Explorer and Windows. Textbook publishers sometimes tie a Web site and a textbook and force students to buy both. (You can't buy the book you're now reading, new, without the Web site. But you can buy the Web site access without the book, so these products are not tied.)

Could textbook publishers make more money by tying a book and access to a Web site? The answer is sometimes but not always. Suppose that you and other students are willing to pay \$80 for a book and \$20 for access to a Web site. The publisher can sell these items separately for these prices or bundled for \$100. The publisher does not gain from bundling.

But now suppose that you and only half of the students are willing to pay \$80 for a book and \$20 for a Web site and the other half of the students are willing

to pay \$80 for a Web site and \$20 for a book. Now if the two items are sold separately, the publisher can charge \$80 for the book and \$80 for the Web site. Half the students buy the book but not the Web site, and the other half buy the Web site but not the book. But if the book and Web site are bundled for \$100, everyone buys the bundle and the publisher makes an extra \$20 per student. In this case, bundling has enabled the publisher to price discriminate.

There is no simple, clear-cut test of whether a firm is engaging in tying or whether, by doing so, it has increased its market power and profit and created inefficiency.

Predatory Pricing **Predatory pricing** is setting a low price to drive competitors out of business with the intention of setting a monopoly price when the com-

petition has gone. John D. Rockefeller's Standard Oil Company was the first to be accused of this practice in the 1890s, and it has been claimed often in antitrust cases since then. Predatory pricing is an attempt to create a monopoly and as such it is illegal under Section 2 of the Sherman Act.

It is easy to see that predatory pricing is an idea, not a reality. Economists are skeptical that predatory pricing occurs. They point out that a firm that cuts its price below the profit-maximizing level loses during the low-price period. Even if it succeeds in driving its competitors out of business, new competitors will enter as soon as the price is increased, so any potential gain from a monopoly position is temporary. A high and certain loss is a poor exchange for a temporary and uncertain gain. No case of predatory pricing has been definitively found.

Economics in Action

The United States Versus Microsoft

In 1998, the Antitrust Division of the U.S. Department of Justice along with the Departments of Justice of a number of states charged Microsoft, the world's largest producer of software for personal computers, with violations of both sections of the Sherman Act.

A 78-day trial followed that pitched two prominent MIT economics professors against each other, Franklin Fisher for the government and Richard Schmalensee for Microsoft.

The Case Against Microsoft The claims against Microsoft were that it

- Possessed monopoly power
- Used predatory pricing and tying arrangements
- Used other anticompetitive practices

It was claimed that with 80 percent of the market for PC operating systems, Microsoft had excessive monopoly power. This monopoly power arose from two barriers to entry: economies of scale and network economies. Microsoft's average total cost falls as production increases (economies of scale) because the fixed cost of developing an operating system such as Windows is large while the marginal cost of producing one copy of Windows is small. Further, as the number of Windows users increases, the range of Windows applications expands (network economies), so a potential competitor would need to produce not

only a competing operating system but also an entire range of supporting applications as well.

When Microsoft entered the Web browser market with its Internet Explorer, it offered the browser for a zero price. This price was viewed as predatory pricing. Microsoft integrated Internet Explorer with Windows so that anyone who uses this operating system would not need a separate browser such as Netscape Navigator. Microsoft's competitors claimed that this practice was an illegal tying arrangement.

Microsoft's Response Microsoft challenged all these claims. It said that Windows was vulnerable to competition from other operating systems such as Linux and Apple's Mac OS and that there was a permanent threat of competition from new entrants.

Microsoft claimed that integrating Internet Explorer with Windows provided a single, unified product of greater consumer value like a refrigerator with a chilled water dispenser or an automobile with a CD player.

The Outcome The court agreed that Microsoft was in violation of the Sherman Act and ordered that it be broken into two firms: an operating systems producer and an applications producer. Microsoft successfully appealed this order. In the final judgment, though, Microsoft was ordered to disclose to other software developers details of how its operating system works, so that they could compete effectively against Microsoft. In the summer of 2002, Microsoft began to comply with this order.

Mergers and Acquisitions

Mergers, which occur when two or more firms agree to combine to create one larger firm, and *acquisitions*, which occur when one firm buys another firm, are common events. Mergers occurred when Chrysler and the German auto producer Daimler-Benz combined to form DaimlerChrysler and when the Belgian beer producer InBev bought the U.S. brewing giant Anheuser-Busch and created a new combined company, Anheuser-Busch InBev. An acquisition occurred when Rupert Murdoch’s News Corp bought Myspace.

The mergers and acquisitions that occur don’t create a monopoly. But two (or more) firms might be tempted to try to merge so that they can gain market power and operate like a monopoly. If such a situation arises, the Federal Trade Commission (FTC) takes an interest in the move and stands ready to block the merger.

To determine which mergers it will examine and possibly block, the FTC uses guidelines, one of which is the Herfindahl-Hirschman Index (HHI) (see Chapter 10, pp. 238–239).

A market in which the HHI is less than 1,000 is regarded as competitive. An index between 1,000 and 1,800 indicates a moderately concentrated market, and a merger in this market that would increase the

index by 100 points is challenged by the FTC. An index above 1,800 indicates a concentrated market, and a merger in this market that would increase the index by 50 points is challenged. You can see an application of these guidelines in the box below.

REVIEW QUIZ

- 1 What are the two main antitrust laws and when were they enacted?
- 2 When is price fixing not a violation of the antitrust laws?
- 3 What is an attempt to monopolize an industry?
- 4 What are resale price maintenance, tying arrangements, and predatory pricing?
- 5 Under what circumstances is a merger unlikely to be approved?

You can work these questions in Study Plan 15.4 and get instant feedback.



◆ Oligopoly is a market structure that you often encounter in your daily life. *Reading Between the Lines* on pp. 360–361 looks at a game played in the market for high-tech razors.

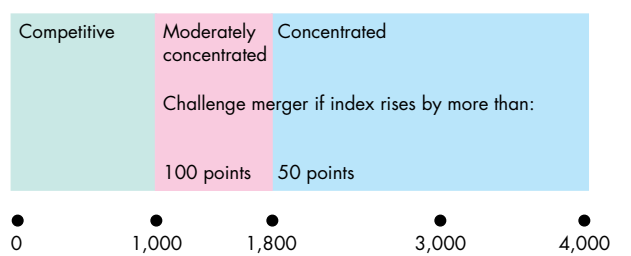
Economics in Action

FTC Takes the Fizz out of Soda Mergers

The FTC used its HHI guidelines to block proposed mergers in the market for soft drinks. PepsiCo wanted to buy 7-Up and Coca-Cola wanted to buy Dr Pepper. The market for carbonated soft drinks is highly concentrated. Coca-Cola had a 39 percent share, PepsiCo had 28 percent, Dr Pepper was next with 7 percent, followed by 7-Up with 6 percent. One other producer, RJR, had a 5 percent market share. So the five largest firms in this market had an 85 percent market share.

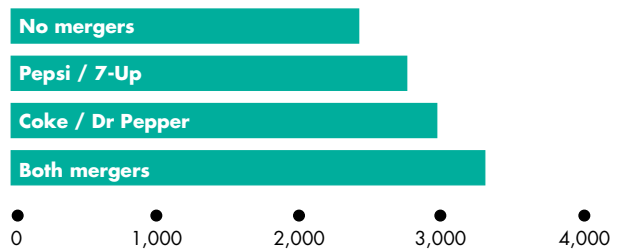
The PepsiCo and 7-Up merger would have increased the HHI by more than 300 points. The Coca-Cola and Dr Pepper merger would have increased it by more than 500 points, and both mergers together would have increased the index by almost 800 points.

The FTC decided that increases in the HHI of these magnitudes were not in the social interest and blocked the mergers. The figure summarizes the HHI guideline and HHIs in the soft drinks market.



Herfindahl-Hirschman Index (HHI)

Figure 1 The Merger Guidelines



Herfindahl-Hirschman Index (HHI)

Figure 2 Product Mergers in Soft Drinks

Gillette and Schick in a Duopoly Game

Battle for Beards Heats Up

St. Louis Public Radio

June 4, 2010

The battle for the American beard is heating up. After months of hype, Gillette's latest razor finally hits store shelves this Sunday. This skirmish pits a consumer products behemoth against a much smaller, but formidable, challenger.

This latest version of Gillette's Fusion, the ProGlide, still has just six blades. But you wouldn't know it from the hundreds of millions of dollars Gillette pumped into the razor's design and its marketing.

The ProGlide features thinner blades and better lubrication. But Damon Jones, with Procter & Gamble, says even the loudest ads aren't enough to make men switch brands.

"It's one thing to watch a commercial, but when we put the razor in the hands of guys and they try it, they tell us wow," Jones said. "So we're really going to depend on the word of mouth."

Meanwhile Schick, owned by St. Louis-based Energizer, is pushing its new Hydro razor just as aggressively. Its selling point is a reservoir of water-activated gel. ...

"This product has a four-blade disposable on one end. It has a hair cutting tool on the other end. Its operated by a Triple-A battery."

Lindell Chew, ... a marketing professor at the University of Missouri, ... says Schick has always been more innovative ... But despite Schick's technical wizardry, Chew says "it'll have to fight hard for shelf space because Gillette's Procter & Gamble dominates the consumer products industry."

"They're going very aggressive with these billion dollar brands that they have, and carving out deals that will often wipe out the number two brand, not just the 3, 4, 5, and 6 brand," Chew says. ...

Transcript from "Gillette, Schick go blade-to-blade" from American Public Media's Marketplace © , © (p) 2010 American Public Media. Used with permission. All rights reserved.

ESSENCE OF THE STORY

- Procter & Gamble (P&G) has developed a new razor, the Gillette Fusion ProGlide.
- P&G has spent "hundreds of millions of dollars" on the design and marketing of the new razor.
- The ProGlide has thinner blades and better lubrication than its predecessor.
- Energizer has also developed a new razor, the Schick Hydro.
- The Hydro has a reservoir of water-activated gel, a four-blade shaver, and a hair cutting tool.
- The Hydro is expected to have to fight hard for shelf space in stores because P&G dominates the market.

ECONOMIC ANALYSIS

- The global market in high-tech razors (razors with multiple blades, a battery, and other aids to comfort) is dominated by two brands and firms: Gillette, made by Procter & Gamble, and Schick, made by Energizer.
- Figure 1 shows the shares in this market. You can see that Gillette has 70 percent of the market, Schick 20 percent, and others only 10 percent.
- In 2010, P&G and Energizer increased the intensity of their competition by spending hundreds of millions of dollars developing and marketing more advanced razors: the Gillette ProGlide and the Schick Hydro.
- We can interpret this competition as a prisoners' dilemma game.
- Table 1 shows the payoff matrix (millions of dollars of profit) for the game played by P&G and Energizer. (The numbers are hypothetical.)
- This game is a prisoners' dilemma like that on p. 345 and has a dominant-strategy Nash equilibrium.
- If P&G develops and markets a new razor, Energizer makes a larger profit by also developing and marketing a new razor (+\$30 million versus -\$60 million); and if P&G *doesn't* develop and market a new razor, Energizer again makes a larger profit by developing and marketing a new razor (+\$90 million versus +\$50 million).
- So Energizer's best strategy is to develop and market a new razor.

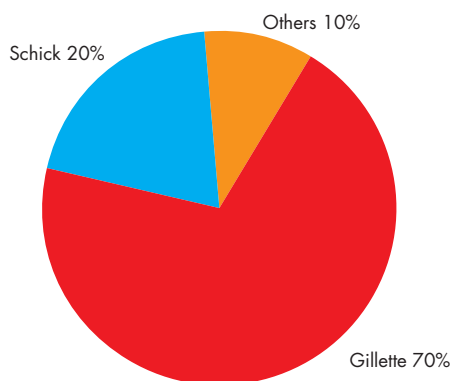


Figure 1 Market shares in the high-end razor market

- If Energizer develops and markets a new razor, P&G makes a larger profit by also developing and marketing a new razor (+\$75 million versus -\$40 million); and if Energizer *doesn't* develop and market a new razor, P&G again makes a larger profit by developing and marketing a new razor (+\$275 million versus +\$175 million).
- So P&G's best strategy is to develop and market a new razor.
- Because both firm's best strategy is to develop and market a new razor, that is the equilibrium of the game.
- The firms are in a prisoners' dilemma because each would be better off avoiding the costly development and marketing costs and continuing to sell large quantities of their older style razor.
- With neither firm bringing the new razor to market, P&G would gain \$100 million (\$175 million versus \$75 million) and Energizer would gain \$20 million (\$50 million versus \$30 million).
- But each firm can see that if it doesn't bring a new razor to market, the other firm will and the consequence for the one that doesn't have a new razor will be a large loss.

		P&G (Gillette) strategies	
		Develop and market new razor	Don't develop and market new razor
Energizer (Schick) strategies	Develop and market new razor	\$75 / \$30	-\$40 / \$90
	Don't develop and market new razor	\$275 / -\$60	\$175 / \$50

Table 1 P&G and Energizer in a prisoners' dilemma



SUMMARY

Key Points

What Is Oligopoly? (pp. 342–343)

- Oligopoly is a market in which a small number of firms compete.

Working Problems 1 to 3 will give you a better understanding of what oligopoly is.

Oligopoly Games (pp. 344–352)

- Oligopoly is studied by using game theory, which is a method of analyzing strategic behavior.
- In a prisoners' dilemma game, two prisoners acting in their own self-interest harm their joint interest.
- An oligopoly (duopoly) price-fixing game is a prisoners' dilemma in which the firms might collude or cheat.
- In Nash equilibrium, both firms cheat and output and price are the same as in perfect competition.
- Firms' decisions about advertising and R&D can be studied by using game theory.

Working Problems 4 to 7 will give you a better understanding of oligopoly games.

Repeated Games and Sequential Games (pp. 353–355)

- In a repeated game, a punishment strategy can produce a cooperative equilibrium in which price and output are the same as in a monopoly.

- In a sequential contestable market game, a small number of firms can behave like firms in perfect competition.

Working Problem 8 will give you a better understanding of repeated and sequential games.

Antitrust Law (pp. 356–359)

- The first antitrust law, the Sherman Act, was passed in 1890, and the law was strengthened in 1914 when the Clayton Act was passed and the Federal Trade Commission was created.
- All price-fixing agreements are violations of the Sherman Act, and no acceptable excuse exists.
- Resale price maintenance might be efficient if it enables a producer to ensure the efficient level of service by distributors.
- Tying arrangements can enable a monopoly to price discriminate and increase profit, but in many cases, tying would not increase profit.
- Predatory pricing is unlikely to occur because it brings losses and only temporary potential gains.
- The Federal Trade Commission uses guidelines such as the Herfindahl-Hirschman Index to determine which mergers to investigate and possibly block.

Working Problems 9 to 11 will give you a better understanding of antitrust law.

Key Terms

Antitrust law, 356

Cartel, 343

Collusive agreement, 346

Contestable market, 354

Cooperative equilibrium, 353

Dominant-strategy equilibrium, 345

Duopoly, 342

Game theory, 344

Limit pricing, 355

Nash equilibrium, 345

Oligopoly, 342

Payoff matrix, 344

Predatory pricing, 358

Resale price maintenance, 357

Strategies, 344

Tying arrangement, 357



STUDY PLAN PROBLEMS AND APPLICATIONS



You can work Problems 1 to 12 in MyEconLab Chapter 15 Study Plan and get instant feedback.

What Is Oligopoly? (Study Plan 15.1)

- Two firms make most of the chips that power a PC: Intel and Advanced Micro Devices. What makes the market for PC chips a duopoly? Sketch the market demand curve and cost curves that describe the situation in this market and that prevent other firms from entering.

2. Sparks Fly for Energizer

Energizer is gaining market share against competitor Duracell and its profit is rising despite the sharp rise in the price of zinc, a key battery ingredient.

Source: www.businessweek.com, August 2007

In what type of market are batteries sold? Explain your answer.

3. Oil City

In the late 1990s, Reliance spent \$6 billion to build a world-class oil refinery at Jamnagar, India. Now Reliance is more than doubling the size of the facility, which will make it the world's biggest producer of gasoline — 1.2 million gallons of gasoline per day, or about 5% of global capacity. Reliance plans to sell the gasoline in the United States and Europe where it's too expensive and politically difficult to build new refineries. The bulked-up Jamnagar will be able to move the market and Singapore traders expect a drop in fuel prices as soon as it's going at full steam.

Source: *Fortune*, April 28, 2008

- Explain why the news clip claims that the global market for gasoline is not perfectly competitive.
- What barriers to entry might limit competition in this market and give a firm such as Reliance power to influence the market price?

Oligopoly Games (Study Plan 15.2)

- Consider a game with two players who cannot communicate, and in which each player is asked a question. The players can answer the question honestly or lie. If both answer honestly, each receives \$100. If one player answers honestly and the other lies, the liar receives \$500 and the honest player gets nothing. If both lie, then each receives \$50.

- Describe the strategies and payoffs of this game.
- Construct the payoff matrix.
- What is the equilibrium of this game?
- Compare this game to the prisoners' dilemma. Are the two games similar or different? Explain.

Use the following information to work Problems 5 and 6.

Soapy Inc. and Suddies Inc. are the only producers of soap powder. They collude and agree to share the market equally. If neither firm cheats on the agreement, each makes \$1 million profit. If either firm cheats, the cheat makes a profit of \$1.5 million, while the complier incurs a loss of \$0.5 million. If both cheat, they break even. Neither firm can monitor the other's actions.

- What are the strategies in this game?
 - Construct the payoff matrix for this game.
- What is the equilibrium of this game if it is played only once?
 - Is the equilibrium a dominant-strategy equilibrium? Explain.

7. The World's Largest Airline

On May 3, 2010, United Airlines and Continental Airlines announced a \$3 billion merger that would create the world's biggest airline. The deal was completed in a remarkably short three weeks, and would give the airlines the muscle to fend off low-cost rivals at home and to take on foreign carriers abroad. For consumers, the merger could eventually result in higher prices although the new company does not intend to raise fares. One of the rationales for airline mergers is to cut capacity.

Source: *The New York Times*, June 7, 2010

- Explain how this airline merger might increase air travel prices.
- Explain how this airline merger might lower air travel production costs.
- Explain how cost savings arising from a cut in capacity might get passed on to travelers and might boost producers' profits. Which do you predict will happen from this airline merger and why?

Repeated Games and Sequential Games

(Study Plan 15.3)

8. If Soapy Inc. and Suddies Inc., repeatedly play the duopoly game that has the payoffs described in Problem 5, on each round of play:
 - a. What now are the strategies that each firm might adopt?
 - b. Can the firms adopt a strategy that gives the game a cooperative equilibrium?
 - c. Would one firm still be tempted to cheat in a cooperative equilibrium? Explain your answer.

Antitrust Law (Study Plan 15.4)**9. Price Cuts Seen for Apple's New iPhone**

AT&T plans to sell the new iPhone for \$200. The lower-priced phone would give AT&T an attractive weapon to win new subscribers.

AT&T's revenue is an average of \$95 a month from each iPhone customer, nearly twice the average of its conventional cell phone user. AT&T has a revenue-sharing agreement with Apple that requires it to give Apple 25% of its iPhone customers' monthly payments.

AT&T offers a \$200 subsidy to customers who lock into the carrier for two years. It's a small investment for AT&T for a large return. After giving Apple its cut of the revenue, AT&T receives between \$70 and \$75 a month per iPhone user, totaling more than \$1,700 over the life of the two-year contract.

Source: *Fortune*, June 2, 2008

- a. How does this arrangement between AT&T and Apple regarding the iPhone affect competition in the market for cell-phone service?
 - b. Does the iPhone arrangement between AT&T and Apple violate U.S. antitrust laws? Explain.
- 10. Congress Examines Giant Airline Merger**
- Congress examined a proposed merger between Delta Airlines and Northwest Airlines that would discourage competition, reduce service, and result in higher fares. Delta claims that the merger would not limit competition because the carriers primarily serve different geographic regions. Witnesses scheduled to testify before the House Subcommittee were likely to focus on whether the merger would result in lower airfares or reduced competition.

Source: CNN, May 14, 2008

Explain the guidelines that the Federal Trade Commission uses to evaluate mergers and why it might permit or block this merger.

11. AT&T's New Pricing Takes Smartphones to the Masses

AT&T, the second largest U.S. wireless carrier and only operator offering the iPhone, plans to attract average consumers to sign up for data service by cutting its prices: A \$15 a month plan for 200 megabytes of data; \$25 a month plan for 2 gigabytes of data. Verizon Wireless, the largest U.S. wireless operator, wouldn't comment on AT&T's new pricing plans. But if history is any indication, it won't take long before Verizon, operator of the HTC Incredible, a smartphone that looks very similar to an iPhone, begins offering tiered data service.

Source: Cnet News, June 3, 2010

- a. Describe the basis of the competition between AT&T and Verizon.
- b. Is AT&T likely to be using predatory pricing?
- c. If a price war develops in the market for data services, who benefits most?

Economics in the News (Study Plan 15.N)**12. Starbucks Sued for Trying to Sink Competition**

Penny Stafford, owner of the Seattle-based Belvi Coffee and Tea Exchange Inc. filed the lawsuit, which contends that Starbucks exploited its monopoly power. Starbucks used predatory practices such as offering to pay leases that exceeded market value if the building owner would refuse to allow competitors into the same building; having its employees offer free coffee samples in front of her store to lure away customers; and offering to buy out competitors at below-market prices and threatening to open nearby stores if the offer is rejected.

Source: CNN, September 26, 2006

- a. Explain how Starbucks is alleged to have violated U.S. antitrust laws in Seattle.
- b. Explain why it is unlikely that Starbucks might use predatory pricing to permanently drive out competition.
- c. What information would you need that is not provided in the news clip to decide whether Starbucks had practiced predatory pricing?
- d. Sketch the situation facing Belvi Coffee and Tea Exchange Inc. when the firm closed.



ADDITIONAL PROBLEMS AND APPLICATIONS



You can work these problems in MyEconLab if assigned by your instructor.

What Is Oligopoly?

13. An Energy Drink with a Monster of a Stock

The \$5.7 billion energy-drink category, in which Monster holds the No. 2 position behind industry leader Red Bull, has slowed down as copycat brands jostle for shelf space. Over the past five years Red Bull's market share in dollar terms has gone from 91 percent to well under 50 percent and much of that loss has been Monster's gain.

Source: *Fortune*, December 25, 2006

- Describe the structure of the energy-drink market. How has that structure changed over the past few years?
- If Monster and Red Bull formed a cartel, how would the price charged for energy drinks and the profits made change?

Oligopoly Games

Use the following information to work Problems 14 and 15

Bud and Wise are the only two producers of aniseed beer, a New Age product designed to displace root beer. Bud and Wise are trying to figure out how much of this new beer to produce. They know:

- If they both limit production to 10,000 gallons a day, they will make the maximum attainable joint profit of \$200,000 a day—\$100,000 a day each.
- If either firm produces 20,000 gallons a day while the other produces 10,000 a day, the one that produces 20,000 gallons will make an economic profit of \$150,000 and the other one will incur an economic loss of \$50,000.
- If both increase production to 20,000 gallons a day, each firm will make zero economic profit.

- Construct a payoff matrix for the game that Bud and Wise must play.
- Find the Nash equilibrium of the game that Bud and Wise play.

16. Asian Rice Exporters to Discuss Cartel

The rice-exporting nations Thailand, Cambodia, Laos, and Myanmar planned to discuss a proposal by Thailand, the world's largest rice exporter, that they form a cartel. Ahead of the meeting, the countries said that the purpose of the rice cartel would be to contribute to ensuring food stability, not just in an individual country but also to address food shortages in the region

and the world. The cartel will not hoard rice and raise prices when there are shortages. The Philippines says that it is a bad idea. It will create an oligopoly, and the cartel could price the grain out of reach for millions of people.

Source: CNN, May 6, 2008

- Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, explain how they would influence the global market for rice and the world price of rice.
 - Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, draw a graph to illustrate their influence on the global market for rice.
 - Even in the absence of international antitrust laws, why might it be difficult for this cartel to successfully collude? Use the ideas of game theory to explain.
- Suppose that Mozilla and Microsoft each develop their own versions of an amazing new Web browser that allows advertisers to target consumers with great precision. Also, the new browser is easier and more fun to use than existing browsers. Each firm is trying to decide whether to sell the browser or to give it away. What are the likely benefits from each action? Which action is likely to occur?
 - Why do Coca-Cola and PepsiCo spend huge amounts on advertising? Do they benefit? Does the consumer benefit? Explain your answer by constructing a game to illustrate the choices Coca-Cola and PepsiCo make.
- Use the following information to work Problems 19 and 20.
- Microsoft with Xbox 360, Nintendo with Wii, and Sony with PlayStation 3 are slugging it out in the market for the latest generation of video game consoles. Xbox 360 was the first to market; Wii has the lowest price; PS3 uses the most advanced technology and has the highest price.
- Thinking of the competition among these firms in the market for consoles as a game, describe the firms' strategies concerning design, marketing, and price.
 - What, based on the information provided, turned out to be the equilibrium of the game?
 - Can you think of reasons why the three consoles are so different?

Repeated Games and Sequential Games

21. If Bud and Wise in Problem 15 play the game repeatedly, what is the equilibrium of the game?
22. Agile Airlines' profit on a route on which it has a monopoly is \$10 million a year. Wanabe Airlines is considering entering the market and operating on this route. Agile warns Wanabe to stay out and threatens to cut the price so that if Wanabe enters it will make no profit. Wanabe determines that the payoff matrix for the game in which it is engaged with Agile is shown in the table.

		Agile	
		High price	Low price
Wanabe	Enter	5, 7	0, 1
	Don't enter	0, 10	0, 5

Does Wanabe believe Agile's assertion? Does Wanabe enter or not? Explain.

23. **Oil Trading Probe May Uncover Manipulation**
Amid soaring oil prices the Commodity Futures Trade Commission (CFTC) is looking into manipulation of the oil market—withholding oil in an attempt to drive prices higher. The CFTC has found such evidence in the past and it's likely it will find evidence again. But it is unlikely that a single player acting alone would be able to run the price up from \$90 to \$135.

Source: CNN, May 30, 2008

What type of market does the news clip imply best describes the U.S. oil market?

Antitrust Law

Use the following news clip to work Problems 24 and 25.

Gadgets for Sale ... or Not

How come the prices of some gadgets, like the iPod, are the same no matter where you shop? No, the answer isn't that Apple illegally manages prices. In reality, Apple uses an accepted retail strategy called minimum advertised price to discourage resellers from discounting. The minimum advertised price (MAP) is the absolute lowest price of a product that resellers can advertise. MAP is usually enforced through marketing subsidies offered by a manufacturer to its resellers that keep the price at or above the

MAP. Stable prices are important to the company that is both a manufacturer and a retailer. If Apple resellers advertised the iPod below cost, they could squeeze the Apple Stores out of their own markets. The downside to the price stability is that by limiting how low sellers can go, MAP keeps prices artificially high (or at least higher than they might otherwise be with unfettered price competition).

Source: *Slate*, December 22, 2006

24. a. Describe the practice of resale price maintenance that violates the Sherman Act.
b. Describe the MAP strategy used by iPod and explain how it differs from a resale price maintenance agreement that would violate the Sherman Act.
25. Why might the MAP strategy be against the social interest and benefit only the producer?

Economics in the News

26. After you have studied *Reading Between the Lines* on pp. 360–361 answer the following questions.
- What are the strategies of P&G and Energizer in the market for high-tech razors?
 - Why, according to the news article, would Energizer have a hard time competing with P&G?
 - Why wouldn't Energizer stick with its old razor and leave P&G to incur the cost of developing and marketing a new one on its own?
 - Could Energizer do something that would make the Schick Hydro the market leader? Would that action maximize Energizer's profit?
27. **Boeing and Airbus Predict Asian Sales Surge**
Airlines in the Asia-Pacific region are emerging as the biggest customers for aircraft makers Boeing and Airbus. The two firms predict that over the next 20 years, more than 8,000 planes worth up to \$1.2 trillion will be sold there.

Source: BBC News, February 3, 2010

- In what type of market are big airplanes sold?
- Thinking of competition between Boeing and Airbus as a game, what are the strategies and the payoffs?
- Set out a hypothetical payoff matrix for the game you've described in part (b). What is the equilibrium of the game?
- Do you think the market for big airplanes is efficient? Explain and illustrate your answer.

Managing Change and Limiting Market Power

Our economy is constantly changing. Every year, new goods appear and old ones disappear. New firms are born, and old ones die. This process of change is initiated and managed by firms operating in markets.

When a new product appears, just one or two firms sell it: Apple and IBM were the only producers of personal computers; Microsoft was (and almost still is) the only producer of the PC operating system; Intel was the only producer of the PC chip. These firms had enormous power to determine the quantity to produce and the price of their products.

In many markets, entry eventually brings competition. Even with just two rivals, the industry changes its face in a dramatic way. *Strategic interdependence* is capable of leading to an outcome like perfect competition.

With the continued arrival of new firms in an industry, the market becomes competitive. But in most markets, the competition isn't perfect: it becomes *monopolistic competition* with each firm selling its own differentiated product.

Often, an industry that is competitive becomes less so as the bigger and more successful firms in the industry begin to swallow up the smaller firms, either by driving them out of business or by acquiring their assets. Through this process, an industry might return to oligopoly or even monopoly. You can see such a movement in the auto and banking industries today.

By studying firms and markets, we gain a deeper understanding of the forces that allocate resources and begin to see the invisible hand at work.

PART FOUR

UNDERSTANDING FIRMS AND MARKETS

John von Neumann was one of the great minds of the twentieth century. Born in Budapest, Hungary, in 1903, Johnny, as he was known, showed early mathematical brilliance. He was 25 when he published the article that changed the social sciences and began a flood of research on **game theory**—a flood that has not subsided. In that article, von Neumann proved that in a zero-sum game (such as sharing a pie), there exists a best strategy for each player.

Von Neumann did more than invent game theory: He also invented and built the first practical computer, and he worked on the Manhattan Project, which developed the atomic bomb during World War II.

Von Neumann believed that the social sciences would progress only if they used their own mathematical tools, not those of the physical sciences.

"Real life consists of bluffing, of little tactics of deception, of asking yourself what is the other man going to think I mean to do."

JOHN VON NEUMANN, told to Jacob Bronowski (in a London taxi) and reported in *The Ascent of Man*



Professor Hubbard, why did you decide to become an economist and what attracted you to the empirical study of firms and markets? And why your special interest in the role of information?

I became an economist a little bit by accident. My first job coming out of undergrad was in an economic consulting firm. I'd never considered doing a Ph.D. in economics before then. I didn't know any Ph.D.s growing up. I don't come from an academic background. But working with Ph.D. economists, I noticed that they were doing some pretty interesting things. They were looking at anti-competitive practices and regulatory stuff associated with the television and casino industries. What I saw when doing this work made me think that an academic job would be even better. I figured I'd go to graduate school to think about all of these interesting things.

When I went to graduate school I got interested in industrial organization. Now I did take a side trip. After doing my first year of graduate school, I took a year off. I spent it on the President's Council of Economic Advisers. That was loads of fun because it reminded me about what I like most about economics—applying it to understanding real world problems. A typical first-year Ph.D. program doesn't give you that sense. You are learning a lot of method and technique. But being thrust into a world where you have to skilfully use Econ concepts has you very quickly using them and applying them to real world policy discussions. I worked on the policy discussion surrounding environmental issues and that led to my dissertation.

Some economists who specialize in the study of firms and markets focus on theory and in particular game theory. Others, like you, have an empirical, data-driven approach. How do you see these two ways of studying, and seeking to understand, how firms and markets work?

I don't think my approach is all that data driven. It's problem driven. I think the core of economics is theory, not data. I think what I try to do is to be a strong consumer of theory, at least the theory that is relevant to the problems that I'm interested in. What I try to do with respect to my research is to find a circumstance where the theory is a good fit for the data and the data are a good fit for the theory. Both are good fits for the general question at hand.



My dissertation was about the expert services market. Famous examples of these are doctors and lawyers, but I looked at auto repair guys. In these markets, doctors know more than their patients about the patient's condition; lawyers know more than their clients about the client's condition. A lot of people have tried to study these markets in these contexts—especially the medical context.

Well, coming out of my experience at the Council of Economic Advisers, I was exposed to a lower-brow expert service market—the market for auto emissions inspection.

The basic economic issues for auto repair are pretty similar to the set of issues that doctors face. But data on auto repairers are far superior to data on physicians' services. When you investigate a specific expert services question with lots of good data you can discover how the organizational structure of firms and

The core of economics is theory, not data. I try to be a consumer ... of the theory that is relevant to the problems that I'm interested in

THOMAS HUBBARD is the John L. and Helen Kellogg Distinguished Professor of Management and Strategy at the Kellogg School of Management, Northwestern University and a research fellow at the National Bureau of Economic Research.

Professor Hubbard is an empirical economist. His work is driven by data. The central problems that unify much of his work are the limits to information and the fact that information is costly to obtain. Professor Hubbard studies the ways in which information problems influence the organization of firms; the extent to which firms make or buy what they sell; and the structure and performance of markets.

His work appears in the leading journals such as the *American Economic Review*, the *Quarterly Journal of Economics*, and the *Rand Journal of Economics*. He is a co-editor of the *Journal of Industrial Economics*.

Michael Parkin talked with Thomas Hubbard about his research and what we learn from it about the choices that firms make and their implications for market structure and performance.

the information environment affect the economic outcome. Doing things like that appeals to me.

Same way with trucking: I wrote a whole mass of papers about trucking. I was interested in the organization of firms and the organizational tradeoffs in the context of trucking happen to be manifested in very easy-to-understand and obvious ways. And you could get extremely good data, essentially close to the level of individual transactions.

Some people are good at creating theory and we need that work. But as I see it, good problem-driven economics needs three things: understanding the theory, understanding the institutional structure and evidence at hand, and integrating theory with institutional structure and data. It's fascinating when you can triangulate.

You have made important contributions to our understanding of the factors that determine whether a firm will make or buy. Can you summarize what you we know about this question?

If there is one thing that Coase (Ronald Coase, see p. 413) taught us about the boundaries of the firm, it is

that thinking about whether to do something internally or to outsource it, a very useful starting point is to make the decision on a transaction-by-transaction basis.

Most firms probably don't think at that level of detail. But still it's the right starting point because it gets you to think about the useful fact that activities have to be performed and they have to be performed either internally or externally. The way I like to think about it is to boil it down to the theory of markets and incentives.

Markets provide strong incentives but not necessarily good incentives. So when you outsource something, you rely on a market mechanism rather than on something within a firm that is less than a market mechanism. By outsourcing, you expose people to a strong market incentive. Now that can be good, and it is good most of the time. Strong market incentives get people to do things that the market rewards. Market rewards are generally quite valuable, but in some circumstances what the market rewards isn't what the buyer would want to reward. So there's a tradeoff. Strong incentives are sometimes good and sometimes bad. Therefore, keeping things inside the firm provides a weaker incentive. Sometimes that is good.

Markets provide strong incentives but not necessarily good incentives.

Can you provide an example?

Think about McDonald's. McDonald's is not one firm. It is many firms because a lot of the outlets are owned and managed by franchisees and some are owned and managed internally by McDonald's.

McDonald's thinks about whether to run one of its restaurants itself or franchise it out. One thing that it has in mind is if it franchises it out, then the franchisor is going to be exposed to very strong market incentives. Now under some circumstances this is great. The franchisee treats the business as if he owns it. So the good part about it is the franchisee works hard to try to develop his business.

But there is a flip side to the franchisee treating the business as his own that can be harmful for the chain. For example, a franchisee might want to install a menu item that is locally popular but not globally accepted. Or putting this item on the menu might cause logistical problems elsewhere. There could be

externalities in other words. So a restaurant owned by a franchisee might not be the best option even though it provides good incentives in one dimension. Therefore, you might bring it inside and own the place yourself.

You've used the construction of the interstate highway system as a natural experiment through which to study the structure of the market for gasoline. Can you describe the question you posed and what you discovered?

The question is really pretty simple: How does an industry respond to an anticipated increase in demand? And how does this response differ depending on whether demand is in the same place—new demanders have the same preferences as older demanders did—or is in a different place—new demanders have different preferences than what the existing demanders have?

So I got thinking about this question and realized that the construction of the interstate highways provided a way of addressing it. The U.S. interstate highway system, an enormous public works project, was built slowly and steadily over the course of 20 years. Sometimes a new interstate highway would be close and parallel to an existing road and sometimes it would be several miles away from the road it replaced. So when a new highway was opened, it did either one or two things: When it was close by, it increased demand; when it was far away, it both increased demand and shifted demand spatially.

If the new highway was parallel to an existing road, it increased the volume of traffic along the route and increased the demand for gasoline in the corridor in which the highway was built. But when a new highway was some miles distant from the route it replaced, it shifted demand as well as increasing demand.

The unique thing about this research is we know exactly when a new highway opened, so we know the exact day that demand changed. We also know how many gas stations there were in that area and the time and the distribution of those gas stations. We can watch this over time. We can do this not just for one town. We can do this for hundreds of places as the highways developed over time.

So what we found is that the timing and the margin of the adjustment differed depending on whether the new highway was close to or far away from the old highway. When the highway was close, all the adjustment in demand was in larger firms, larger service stations. You didn't see any new service stations. You just

saw bigger service stations. And when the new highway was far away, you saw the adjustment to be in more service stations. So if you are a business person you're thinking about changes in demand and if entry opportunities occur when new demand comes, will they tend to occur when the new demanders have different demands than the existing ones?

As far as timing goes we saw something a little surprising. When the highway was opened near the existing route, you see that the adjustment takes place before the highway even opened. When I said that you saw larger gas stations once the highway is opened close to the old route, you saw this starting to happen two to three years before the highway actually opened. By the time the highway opened, most of the adjustments had already taken place.

But when the highway was opened far from the existing road, the opposite was true—all the action happened after the highway opened.

You've given us a wonderful glimpse into the fascinating research of a problem-driven economist who creatively finds rich data. Let's end with your advice to a student who is just starting to study economics. What makes it a good subject in which to major?

Watch what I do, not what I say! When I took my first economics course in my freshman year my reaction to it was "Wow, this explains everything." I took an undergraduate micro course. Just seeing supply curves and demand curves was wonderful. I thought economics explained things in ways that other disciplines didn't do. And the truth is

although I'm a specialist in industrial organization and we've been talking about game theory and so on and so forth, the power of introductory micro is astounding. In

most of the economic questions that I encounter outside of my role as a researcher, essentially I'm deploying undergraduate introductory microeconomics but at a real high level. So understanding microeconomics extremely deeply is going to be useful to anybody that works for a living. You always have to deal with your demanders. You always have to deal with prices and competition. You'll take your first course and you'll have some ability to use these tools. But understanding at some extraordinary deep level takes a career to do really well, but the returns are always positive.

... understanding microeconomics is useful to anybody that works for a living.