13

Predatory Conduct: More Recent Developments

The central issue in the antitrust suit against Microsoft was the government's contention—eventually upheld by the courts—that Microsoft had abused its market power in an effort to stifle competition. Microsoft was accused of a variety of anticompetitive actions, including the bundling of its web browser, Internet Explorer, with its Windows operating system in an effort to drive Netscape's Navigator out of the market.

Fears of predatory behavior are not new. To the contrary, they lie at the heart at the foundation of the antitrust laws. It was precisely such a fear that led to the first major "trust-busting" in the *Standard Oil* case. The belief that large firms could drive out competitors by pricing low today with a view tomorrow to raising prices to monopoly level was given forceful expression by Supreme Court Justice Louis Brandeis, a member of the *Standard Oil* court. Brandeis warned in 1913 that: "Americans should be under no illusion as to the value of price-cutting. It is the most potent weapon of monopoly—a means of killing the small rival to which the great trusts have resorted most frequently. Far-seeing organized capital secures by this means the cooperation of the shortsighted consumer to his own undoing. Thoughtless or weak, he yields to the temptation of trifling immediate gain; and selling his birthright for a mess of pottage, becomes himself an instrument of monopoly."[1]

In the previous chapter, we focused on predatory practices aimed at keeping potential entrants out. In this chapter we explore some modern variations on that theme. However, we start by addressing the much more common charge of predatory actions aimed at driving out existing rivals as in the *Microsoft* case. That this sometimes happens there can be little doubt. In the late nineteenth and early twentieth century, the Mogul Steamship Company appears to have maintained its market power in trade with China by quoting shipping rates so low that rivals were forced from the business.[2] The Sugar Trust case (see Reality Checkpoint) offers another example of predatory action. Whether more recent similar charges against modern firms such as Wal-Mart[3], AT&T,[4] Toyota and Mazda[5] and American Airlines are equally warranted remains in question. But the issue of predatory conduct is real.

[1] L. Brandeis, L., "Cutthroat Prices—The Competition That Kills," *Harpers Weekly*, 15 (November 1913), pp. 10–12.

[2] This case is discussed in Yamey (1972) and more recently in Scott Morton (1997).

[3] *Economist*, "Slinging Pebbles at Wal-Mart," 10-23-93.

[4] *Wall Street Journal*, "AT&T Discounts Signal a National Price War," 5-80-96, B1

[5] Note though that the International Trade Commission subsequently ruled that U.S. auto makers were not in fact harmed by the pricing policies of Toyota and Mazda.

At the same time, it must be recognized that while predatory attacks happen, they may not be as common as alleged. The logic of the dynamic games in the last two chapters implies that it takes some work to make a plausible charge of explicit predation and of predatory pricing, in particular. The predator's rival must somehow be convinced of the predator's commitment to pursue the tactic in order to induce the rival to exit. Even if the rival does leave,

Reality Checkpoint

Sweet (Sugar) and Low (Price): Predation in the Sugar Refining Industry

In the late nineteenth and early twentieth centuries, the American Sugar Refining Company, originally the U.S. Sugar Trust, dominated U.S. sugar refining. The company was first formed in 1887 as a consolidation of 18 firms that then controlled 80 percent of the domestic market for refined sugar. The consolidation was quickly followed by a rationalization in which the 20 plants brought together by the merger were reduced to only 10, and the price of refined sugar rose by 16 percent. However, many owners of the plants that were bought and also other entrepreneurs each then began to operate a new plant so that a growing number of small sugar refineries emerged. Consistent with our earlier observations on entry, these new firms were small—each about 1/50th the size of ASRC. Some succeeded but most failed, though not as a result of any obvious predation by ASRC.

The first attempt at large scale entry was made by Claus Spreckels, Senior, a West Coast refiner. Spreckels opened a new refinery on the East Coast with a capacity twice that of the largest of the small refiners and with an announcement of plans to double capacity shortly. This threat did invoke an aggressive ASRC response. A price war soon erupted in which the difference between the prices of refined and raw sugar—which had been about 70 cents per 100 pounds before the Spreckels plant opened—quickly fell to between 19 and 31 cents. Given the costs of other inputs besides raw sugar, this price decline implied prices well below marginal cost. Industry trade publications of that time estimated that ASRC and its rivals were losing about 10 cents per 100 pounds of refined sugar, which implied substantial losses in total. The price war ended when Spreckels exited the market by selling his plants to ASRC.

Several years later, two new large entrants emerged. The Arbuckle Brothers who also controlled a large segment of the U.S. coffee roasting market operated one. The other was the Doschler company. Each firm opened up a plant of roughly the same size as the earlier Spreckels plant so that together, the two possessed the capacity that Spreckels had claimed as his short-run goal. Once again a price war emerged in which it is again generally agreed that prices fell below short run marginal cost and all firms were losing money. The war came to an end when Doschler merged with two other small firms in a deal arranged by ASRC. One possible motive for this action was that ASRC feared that with the end of the war, Doschler would use start to use its profits to expand capacity. When this was added to the existing industry capacity, it would exert downward pressure on prices. However, if Doschler expanded by purchasing existing plants, no net increase in industrial capacity would arise. Of course, the price war also worked to limit such expansion by eliminating the profits of both Arbuckle and Doschler. Estimates suggest that the profit ASRC secured by limiting entry were probably sufficient to justify the losses incurred in the price wars.

Source: D. Genesove and W. Mullin, "Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890–1914," *Rand Journal of Economics*, 14 (Summer, 1998), 355–77.

then what? Any attempt by the predator to raise price may well attract new rivals negating the whole purpose of the predation.

In this chapter, we investigate the logic of predation more deeply. We focus on the credible commitment that predation requires and the role of information in making that commitment possible. As it turns out, information, specifically "who knows what" plays a key role in predatory behavior. To understand predatory strategies, it is important to examine very carefully the information that each player has about the other players and about the market.

The logic of predation requires at least two periods—the first period to get or keep the rival out and the second to reap the benefit. Often it is assumed that the transactions an incumbent firm has with its customers are simple ones. The incumbent sets the price for its product in each period and consumers buy at that price in that period. This can be too simplistic. There may be an advantage to the incumbent firm from having a longer-term contract with its customers that binds them to a contract to buy its product in both periods. In turn, this raises the possibility that such a long-term contract might lock out rivals from the market. Later in this chapter, we explore possible predatory strategies based on the use of long-term contracts. Lastly, we examine alleged cases of predatory behavior and the role of public policy.

13.1 PREDATORY PRICING: MYTH OR REALITY?

For many economists, the term predatory pricing conjures up the image of John Rockefeller and Standard Oil. The famed antitrust case against Standard Oil occurred at the turn of the century. Between the years 1870 and 1899 Standard Oil built a dominant 90 percent market share in the U.S. petroleum refining industry. It did this by acquiring more than 120 rival companies. The conventional story is that Rockefeller would first make an offer to acquire a rival refiner and, when rebuffed, would cut prices until the rival exited the market.[6] After achieving its market dominance in oil refining capacity and distribution, Standard raised prices to oil producers. This eventually led to its federal prosecution and dissolution in 1911 under the Sherman Antitrust Act of 1890.

On the face of it there seems little doubt that Standard Oil did engage in fierce price competition with its rivals and that rival firms in the refining business did leave the market. There is some doubt however whether this is in fact evidence of *predatory* pricing. Such doubt has foundations in both theory and evidence.

There are two arguments that imply predatory pricing is not an optimal strategy and therefore we should not expect a firm to practice it. The first argument is basically that predatory pricing as in the Chain Store Paradox is not subgame perfect.

To understand the power of this argument we will review the Microhard Newvel game that we introduced in Chapter 12. However, we will add some new twists that make the game more like the real-world setting facing a dominant incumbent firm, such as Standard Oil, and a smaller rival. The game is again a two-period one. In the first period, Newvel, the new firm has already entered the market. Microhard is the long-established incumbent who has the first move and must decide whether or not to engage in predatory practices. One important new twist is that now we assume that each firm incurs a fixed cost of $115 million in

[6] There is an extensive literature on the varied business practices used by Standard Oil during this period. Other practices include securing discriminatory rail freight rates and rebates, foreclosing crude oil supplies to competitors by buying up local pipelines and allegedly blowing up competing pipelines. See Yergin (1991).

each market period. This amount must be paid up front at the start of each period. Unlike Microhard, which has internal retained earnings from its long track record in the market, Newvel has no internal funds. Therefore, Newvel must borrow such funds from a competitive banking sector.

Next we introduce some uncertainty into the market. Independent of Microhard's actions, there is a 50 percent chance in any period that Newvel will be successful and enjoy a high operating profit of $200 million. There is also a 50 percent chance that it will not be successful and earn a lower profit of $100 million. In the former case, Newvel's net profit for the period is $200 million less what it must pay to the bank for its loan. In the second case, Newvel does not earn enough to repay even the principal, equal to $115 million, of the loan. As a result, Newvel will simply default and turn over the $100 million it earned to the bank.

Since the banking sector is competitive any bank should expect to earn roughly zero profit on the loan it makes to Newvel. We assume that the discount factor R between periods is equal to one (the interest rate $r = 0$). To earn zero profit the bank, or more generally the investor, must ask for a repayment of $130 million when Newvel's operating profit is high and $100 million when its profit is low. With such a contract, the bank will be paid $130 million half the time and $100 million the other half of the time when Newvel defaults. On average, such a contract would result in the bank earning $115 million and hence, just covering its loan. To give the bank some incentive to take on the risk, it may need to do a bit better than this. So, we assume that it can demand a repayment of $132.5 million in the event that Newvel's operating profit is high. This gives the bank an expected net return of $0.5[\$132.5 + \$100] - \$115 = \$1.25$ million each period. In contrast, Newvel will either net $(\$200 - \$132.5) = \$67.5$ million with probability 0.5 or nothing, also with probability 0.5. Hence, Newvel's expected net income in any period is $33.75 million.

Now consider the incumbent Microhard. Suppose that in any period that Newvel is in the market Microhard earns an operating profit of $150 million, but that it would earn a monopoly profit of $325 million if Newvel exits. Suppose further that by cutting prices and sacrificing $30 million of profit in any period, Microhard could raise the probability to 70 percent that Newvel is not successful and hence would earn only $100 million in that same period. Will Microhard have an incentive to cut prices and worsen Newvel's chances?

Let's begin by analyzing the second period of the game. First, Microhard will not engage in predation and cut prices in period two. As there is no "next period" this would only sacrifice profit with no prospect of recovering the loss at a later date. Hence, if Newvel stays after the first round, the outcome in the last period has to be a duopoly in which each earns an expected $150 million in operating or gross profit. Thus regardless of what happened in the first period, Newvel will be able to get a loan for its fixed cost at the start of the second period. Even if Newvel defaulted in the first period, and the bank lost $15 million, Newvel and the bank would still have an incentive to renegotiate another loan for the second period. Because Microhard will not engage in predation the bank has an expectation of earning $1.25 million, which will at least help a little in covering its first period loss. Similarly, Newvel can expect to earn $33.75 million.

Will Microhard engage in predation and try to drive Newvel out of the market in the first period? Again the answer is no. No matter what happens in the first period, we know that Newvel will want to stay for the second period. Hence, no amount of predation by Microhard in the first period can prevent Newvel from operating in the second. Microhard will recognize that Newvel is here to stay in which case there is no reason to pursue predatory pricing and lose revenue in the first period. Predation will not occur.

13.1 Practice Problem

Suppose that Newvel's chance of success worsens and the probability that it will earn a high operating profit of $200 million falls to 40 percent. For a loan of $115 million what would be the contingent contract demanded by a bank in a competitive banking sector? In other words how much would repayment would the bank demand when operating profits were high and when they were low? Does the worsening of Newvel's prospects affect Microhard's incentive to price low in the first period? Explain why or why not?

If the foregoing scenario is close to capturing the reality of the corporate battlefield, then predatory tactics such as selling below cost don't seem to make sense, and so should not be observed in practice. The argument is even stronger than that just presented because we simply assumed that if Microhard were somehow successful in driving out Newvel then it would then enjoy full monopoly power. Yet there is no reason to believe that a new rival would not emerge at that time. If such later entry is a possibility, then there is even less for Microhard to gain from predation.

Beyond the reasoning that predation is not a subgame perfect strategy, there is a second argument implying that predatory strategies should not be used. This argument is due to the economist John McGee (1958, 1980) who reviewed the Standard Oil case extensively and argued that the firm was ***not*** engaged in predation. In his classic 1958 article, "Predatory Price Cutting: The Standard Oil Case," McGee argued that predatory pricing only makes sense if two conditions are met. The first is that the increase in post-predatory profit (in present value terms) is sufficient to compensate the predator for the loss incurred during the predatory price war. This amounts, of course, to a requirement that the predation be subgame perfect. However, if this requirement were met, McGee also noted that there was a second requirement that a predation strategy would have to meet. This is that there is *no more profitable strategy* to achieve the same outcome. It was this second point that drew McGee's attention. He argued that a merger is always more profitable than predatory pricing. Hence, predatory pricing should not occur.

McGee's reasoning is straightforward and can be understood in a game theoretic framework. Basically the point is that predatory pricing is a dominated strategy and hence, one that will never be used. We can illustrate this point using the Stackelberg model. The Stackleberg leader is the potential predator, and the follower is the intended prey. Suppose that each firm has a constant average and marginal cost c. The inverse market demand curve is: $P = A - BQ = A - B(q_L + q_F)$. Here, q_L is the output of the Stackelberg leader and q_F is the output of the follower. In Chapter 11 we found that the Nash equilibrium outcome is $q_L = (A - c)/2B$, and $q_F = (A - c)/4B$, which leads to an industry price $p = (A + 3c)/4$. At this price, each firm earns a positive profit. The leader earns the profit $(A - c)^2/8B$, while the follower earns half this amount. Large as it may be however, the leader's profit is still less than that earned by a pure monopolist, namely, $(A - c)^2/4B$.

The leader would obviously prefer to be alone in the market. Let's now allow for two market periods, thus giving scope to the leader to engage in predatory behavior. All we need do is imagine that for the first market period, the leader is fully committed to producing an output so large that it can only all be sold at a price just equal to its average cost of c. Since the follower can only sell additional units by driving the market price below c, and therefore losing money, the follower will exit or not enter. If we suppose that this experience is enough to keep the follower out forever it will mean that, in the second market period, the leader is now a monopolist and can set the monopoly price and earn the monopoly profit, $(A - c)^2/4B$.

Apart from the issue of subgame perfection, the trouble with this strategy, as McGee pointed out, is that a better one is available. Under the predatory strategy just described, the leader or predator earns a stream of profit of 0 in the first market period and then $(A - c)^2/4B$ in the second. The follower or victim can look forward to a stream of 0 profit in both periods. McGee's point is that it would be more profitable for the leader to buy out or merge with the follower at the start of the first period. The merged firms can then act as a monopoly and earn the monopoly profit $(A - c)^2/4B$ in both market periods. Even if the leader has to share this first period profit with the follower, say on a 50–50 basis, *both* firms still do better than they did under predation when both the predator and prey earned a zero profit in period one. Since the second period profit is unchanged by the merger, it seems clear that the merger strategy dominates the predatory one.

There are some weaknesses in the McGee (1958) argument that merging is a preferred strategy to predatory pricing. To begin with, any such merger between rival firms is a public event. The antitrust authorities, who may easily disapprove and prevent the merger, will know about it. The authorities may, in fact, be more concerned about such a merger than they would be about predatory pricing since the merger would eliminate even the short, predatory period in which consumer prices are low. Second, and perhaps most importantly, the logic of McGee's merging strategy begins to weaken when we extend the analysis to include additional potential entrants. Once a dominant firm such as Standard Oil is seen as willing to buy out any rival, it will likely face a stream of entrants who enter just for the profitability of being purchased.[7] That is, the merger tactic may actually encourage entry—the last thing the dominant firm wishes to do. In this light, predatory pricing may be more attractive because it not only encourages existing rivals to exit but can deter subsequent entrants as well.[8]

13.2 Practice Problem

Suppose that there are two firms in a market. One firm is a dominant firm and behaves like a Stackelberg leader. The other rival firm is the follower. The firms compete in quantities and face market demand described by $P = 100 - Q$. Assume that marginal production cost is constant and equal to 10.

a. Solve for the single market period equilibrium outcome; that is, the quantity produced by each firm and the firms' respective profits.
b. Now consider a two market period game. One possibility is that the two firms play the Stackelberg game twice, once in each market period. The other possibility is that the dominant firm chooses an output level so great in the first market period that the rival firm exits the market or sells zero output. In the second market period the dominant firm is alone in the market and acts like a monopoly. Solve for the dominant firm's first and second market period output choices under this scenario, and the firm's overall profit.
c. Suppose that we allow the dominant firm the option of making an offer at the beginning of the first market period to the rival firm to buy it out. What is the maximum amount the dominant firm will have to pay the rival firm to buy it out? Show that the dominant firm is better off buying out its rival in the first period and monopolizing the market through merging than through predation.

[7] Rasmusen (2007) explores this possibility.

[8] This point was made by Yamey (1972): "the aggressor will, moreover, be looking beyond the immediate problem of dealing with its current rival. Alternative strategies for dealing with that rival may have different effects on the flow of future rivals."

Reality Checkpoint

Getting to the Heart of the Matter: McGee on Drugs

Millions of Americans, including Vice-President Dick Cheney, suffer from hypertension (high blood pressure) and coronary heart disease or angina. Two major prescription drugs used to treat these conditions are Cardizem CD, produced by Aventis (formerly Hoechst Marion Roussel) and Hytrin, produced by Abbott Laboratories. These drugs are protected by patents and therefore protected from competition by generic or unbranded substitutes. However, the Hatch-Waxman Act of 1984 does provide some conditions under which a firm is permitted to market a generic substitute to a patented drug even before the patent expires. The generic producer must claim either that the new substitute does not really infringe on the patent or that the patent was not really valid in the first place. If the patent holder challenges this claim, then entry of the generic drug is automatically delayed for 30 months to decide the issues. Such delay clearly makes life more difficult for the generics. As partial compensation aimed at promoting generic entry, the Hatch-Waxman Act has another provision. The *first* generic to enter obtains, after entry, a 180-day immunity against all other generics. That is, once one firm is granted the right to sell a generic substitute to the patented product, no other firm is allowed to do so for at least 180 days.

In the mid 1990s, the pharmaceutical firm, Andrx, applied for permission to market a generic substitute for Cardizem CD. Another firm, Geneva (a division of Novartis), requested authorization to market a generic substitute for Hytrin. Both Aventis and Abbott challenged these applications and the automatic 30-month delay began. As the end of the 30 months drew near and with the cases still not resolved, each incumbent was faced with the imminent entry of a rival. Presumably, each firm could have pursued predatory pricing to deter such entry. But each instead went the route proposed by McGee. They bought out the potential competitor.

Aventis forged an agreement to pay Andrx $10 million per quarter in return for *not* entering the Cardizem market starting in July, 1998 when Andrx gained FDA approval. Aventis also agreed to pay an additional $60 million per year from 1998 until the end of the ongoing patent trial if Andrx eventually won that litigation. A similar agreement between Abbott and Geneva required that Abbott pay $4.5 million per month in return for Geneva agreeing to stay out of the Hytrin market. A common feature of both agreements was that Andrx and Geneva each also agreed not to transfer their 180-day immunity to any other firm. Since no other generic could enter the relevant market until 180 days after Andrx or Geneva entered, and since each of these two firms had agreed not to enter at all, these agreements had the effect of blocking all generic entry in these markets. Thus, neither Aventis nor Andrx had to face the prospect of paying off an endless stream of entrants.

A somewhat related case involves Mylan laboratories, the maker of two major anti-anxiety drugs, Lorazepam and Clorazepate. Both drugs use a key ingredient produced by a European firm, Cambrex. Starting in 1998, Mylan paid Cambrex not to sell this ingredient to any other firm. As a result, no other firm could compete with Mylan. Once in effect, Mylan raised the price of its drugs on the order of 2,000 percent to 3,000 percent.

Pursuant to a complaint filed by the FTC, Abbott agreed to terminate its agreement with Geneva. Mylan also settled with the FTC and agreed to pay $100 million into a fund designed to reimburse those who paid the exorbitant prices. Aventis pursued the matter in the courts but both a federal district court and an appellate court found its agreement with Andrx to be a violation of the antitrust laws. It has so far paid out over $200 million in settlements with drug wholesalers and individual states.

Sources: J. Guidera and R. T. King, Jr., "Abbott Labs, Novartis Unit Near Pact with FTC Over Agreement on Hytrin," *Wall Street Journal*, March 14, 2000, p. B6; M. Schroeder, "Mylan to Pay $100 Million to Settle Price-Fix Case," *Wall Street Journal*, July 13, 2000, p. A4. See also various press releases at the FTC website, www.ftc.gov.

Although there are some qualifications to the McGee's reasoning, the existence of a less costly alternative means of eliminating rivals and doubt about the credibility of predatory pricing are two good reasons to be suspicious of rivals alleging predatory pricing by a dominant firm. There is also a third reason. Business is tough and it will inevitably be the case that some firms lose market share or even to go out of business entirely. Such outcomes may simply reflect vigorous competition and not "cutthroat" pricing. Vigorous prosecution of predation allegations may lead to the prosecution of a competent firm on behalf of inefficient ones.

For example, consider the famous *Utah Pie*[9] case decided by the U.S. Supreme Court in 1967. Utah Pie was a producer of frozen dessert pies operating out of Salt Lake City and selling to supermarkets in the Utah and surrounding states. In 1957, it had over two-thirds of the Salt Lake City market. However, three national firms, Continental Bakeries, Pet, and Carnation all began to compete vigorously in the Salt Lake City area. Over the next three years, this resulted in a prices falling by over a third and Utah Pie's market share declining to as low as 33 percent, though it later climbed to nearly 45 percent. Utah Pie filed suit arguing that the three national firms were selling at prices in the Salt Lake City market below those that they charged in other cities and that the three firms were therefore engaged in illegal price discrimination with a predatory objective.

However, Utah Pie's sales grew steadily throughout the period of alleged predation as did its net worth. Moreover, except for the first year of the intensified competition, Utah Pie also continued to earn a positive net income. To many economists, it appeared that Utah Pie's real complaint was more about preserving its initial near monopoly position and the high prices that monopoly power permitted, than it was about predatory tactics. In the end, however, the Supreme Court found in favor of Utah Pie in a decision that was widely decried and since, largely repudiated. Yet the point remains. Company officials will inevitably wish to claim that the source of their profit and market share decline is illegal activity by rivals who are "not playing fairly" rather than confess to their own inefficiencies. For that reason, charges of predatory pricing must be taken with at least a few grains of salt.

The deep skepticism that predation—especially predatory pricing—ever occurs is a view closely associated with the Chicago School. This view has had a profound effect on both public policy and court judgments regarding predatory pricing cases. However, since the 1990s, a new view—sometimes called the Post-Chicago School—has emerged. In this alternative view, predatory tactics are not seen as a theoretical impossibility and real world predation is not an idle threat.

13.2 PREDATION AND IMPERFECT INFORMATION

Much of the Post-Chicago literature on the topic of predation is based on two-period games in which one firm knows something and the other firm does not, and both firms understand that there is asymmetry in information.[10] In this section, we present two important models that build on this feature of asymmetric information. The first is due to Bolton and Scharfstein (1990) and focuses on the informational asymmetry between the new rival, such as Newvel, and the bank from which it borrows. The second is due to Milgrom and Roberts

[9] *Utah Pie Co. v. Continental Baking Co. et al.*, 386 U.S. 685 (1967).

[10] Early important papers in this vein included Milgrom and Roberts (1982), Benoit (1984), and Fudenberg and Tirole (1988).

(1982) and focuses on the information asymmetry between the new rival, in our case Newvel and the dominant incumbent rival, Microhard.

13.2.1 Predatory Pricing and Financial Constraints

Recall the two-period model above in which Microhard is the incumbent and Newvel is the new firm that must borrow \$115 million at the start of each period in order to operate. Following Bolton and Schaferstein (1990) we make one fundamentally important change. We now assume that at the end of any period *only* Newvel, and *not* its bank or lender, knows whether Newvel's operating profit is \$100 million or \$200 million. To make clear how this informational asymmetry affects both Newvel's incentives in its dealing with the bank and the bank's incentive to lend to Newvel we introduce the bank as an explicit player in the game. Figure 13.1 illustrates the interaction between the bank and Newvel for just a single market period. The bank first makes a loan. Then Nature chooses whether Newvel's profit is high or low. Subsequently, Newvel chooses whether to report high or low operating profit. For each outcome, both the net profit to the bank and to Newvel are shown; since the bank moved first its payoff is shown first.

Focusing on the game for just one period is insightful because, as Figure 13.1 makes clear, the bank would never lend Newvel the required \$115 million if the game were only one period long. The reason is straightforward. At the end of the period, only Newvel knows what its profit is. Accordingly, it has every incentive to say that it was only \$100 million, pay that amount to the bank and default on any remaining amount. Obviously, if operating profit really was \$100 million this is all Newvel can do. However, if actual profit was \$200 million, lying and reporting that profit was only \$100 million allows Newvel to walk away with \$100 million for itself. In other words, because only Newvel know the truth it has an incentive to exploit this informational asymmetry to its own advantage. Anticipating this, however, the bank would realize that in a one-period setting it would never get more than \$100 million in return for the \$115 million that it lent. Therefore, it would never agree to the loan.

The one-period analysis carries two immediate insights for a two-period model. The first is that whatever repayment R the bank gets at the end of the first period, it can never get more than \$100 million at the end of the second period. When the second period comes about, it will simply be a replay of the one-period game just described. The other and related insight is that if the bank is actually to make a loan, it will have to write a contract that extends

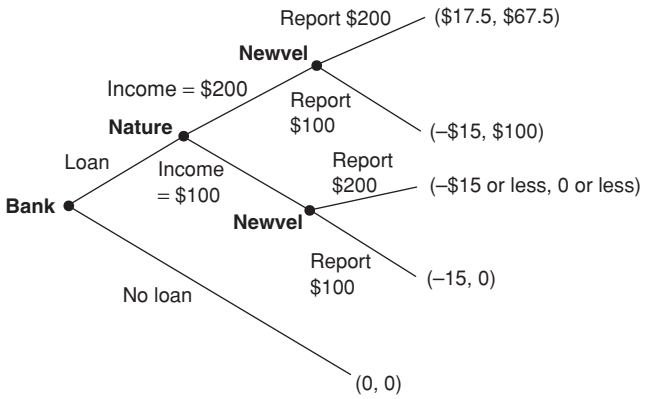

Figure 13.1 The bank and Newvel for just one period

over both periods. Two one-period contracts will just run into the same problem twice. Somehow, the bank and Newvel will have to agree on a contract that links the repayment over both market periods.

Bolton and Scharfstein (1990) show that the optimal contract has the following terms. First, recognizing that it will never get paid more than $100 million at the end of period two, the bank will contract for a high repayment at the end of period one. Second, to give Newvel an incentive to report a high income at the end of the first period, the bank will cut funding, i.e., refuse to make a loan for the second period if Newvel reports low first-period income. Since Newvel will only ever pay $100 million to the bank at the end of the second period, it can therefore expect to earn $150 − $100 = $50 million at that time, and this contractual feature gives Newvel a real interest in making sure that the second period happens.

In our example the lending contract might look as follows. The bank loans the required $115 million at the start of the first period. At the end of that period, if Newvel reports the higher profit of $200 million, then it is required to repay $150 million—its average profit. When it does so the bank will lend the $115 million necessary to operate in the second period. At the end of that second period, the bank is paid $100 million whatever happens by virtue of our earlier argument about a one-period loan. Alternatively, if at the end of the first period Newvel reports only the lower profit of $100 million, the bank is paid that amount but *no* further loans are made. Newvel in this case does not survive into the second period.

Figure 13.2 describes the nature of the loan contract. After the bank makes an initial loan, Nature's choice of profit outcome occurs. This is not shown in the diagram because at the end of the first period Newvel's incentive is to report Nature's draw accurately, and the bank understands this. If it is low, the loan is terminated and Newvel exits. If it is high, the loan is extended for a second period, after which Nature again draws a profit outcome. As we know, at the end of the second period Newvel has an incentive always to report a low profit. The payoff pair shows the total payoff for the bank and Newvel over the two periods, with the bank's shown first.

Note that both parties do well with this contract. Consider the bank. If first period profits are low, Newvel is liquidated and the bank walks away with only $100 million for a loss of $15 million. If, on the other hand, first period profits are high, the bank is paid $150 million, thereby netting $35 million. However, it is then obligated to lend out $115 million for a second time. At the end of the second period the bank receives only $100 million because at that point, Newvel never reports a high income. Because good luck and bad luck happen with equal probability, the bank's expected profit from the two-period contract is:

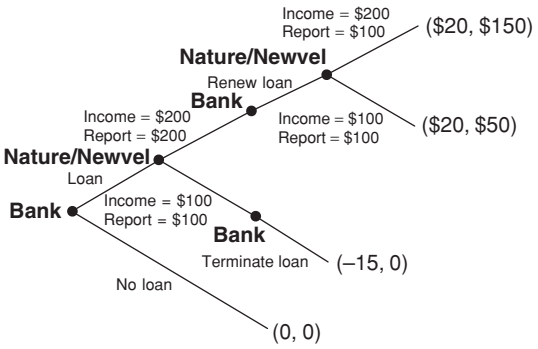

Figure 13.2 The decision tree in the two-period loan contract

0.5[$100 − $115] + 0.5[($150 − $115) + ($100 − $115)] = $2.5 million. Note that this is exactly the profit the bank earned with two, one-period contracts when it was fully informed of Newvel's income.

Newvel also earns a positive expected profit. With probability 0.5, it receives a net payment of [$200 − $150] million at the end of the first period, and with equal probability it receives nothing. Similarly, at the end of the second period, Newvel receives a net payment of either [$200 − $100] million or again zero, each with probability 0.5. Thus, the firm's expected profit under the contract is $50 million.

Yet while both players earn profit under the contract, there is a flaw. Half the time, Newvel fails after the first period and no second period loan is made. This is inefficient because that investment does have an expected profit of $35 million. Again, such inefficiency is the result of the asymmetric information that characterizes the relationship between the bank and Newvel. The only way to prevent Newvel from exploiting its informational advantage is to include a promise to stop funding Newvel should it perform badly in the first period.

Now let's think about adding Microhard to the game. Suppose again that Microhard's duopoly profit is $150 million, its monopoly profit is $325 million and by preying and cutting prices its profit is reduced by $30 million. By cutting prices low Microhard can raise the probability that Newvel fails from 50 to 70 percent. Since now Newvel exits whenever it fails to earn a first period profit of $200 million, predation results in raising Microhard's chance of being a monopolist in the second period by 20 percent. Its expected profit then rises from 0.5 × $150 million + 0.5 × $325 million = $237.5 to 0.3 × $150 + 0.7 × $325 = $272.5, a gain of $35 million—more than enough to cover the $30 million cost of predation. Unlike our earlier case, predation is now rational and therefore should be expected to occur.[11]

The intuition as to why the outcome is different with asymmetric information from what it was in our earlier analysis is straightforward. Newvel can report low first period profits for one of two reasons. Either profits really are low because it has had bad luck including being a possible victim of predation or, profits are really high but Newvel's management has hidden them by spending them on lavish offices, expensive business trips, and excessive compensation. In the absence of a contract like the one described, the lender cannot easily know the truth. If it simply believes whatever Newvel says, the lender will quickly find that Newvel constantly reports low profits in every period and blames this on bad luck and predation—leaving the lender holding the bag at a cost of ($115 − $100) or $15 million each time. The only way to prevent deception by Newvel's management is to write a two-period contract that, among other things, cuts off second period funding in the wake of a poor first-period profit. Yet while such a contract removes the potential for dishonesty, it increases the likelihood that predation will be successful and therefore raises the incentive for Microhard to engage in predatory tactics.

It is worth repeating that "pulling the plug" and killing Newvel at the start of the second period is inefficient. Because Microhard will never predate in the second period, Newvel's expected profit in that period is $150 million. This is more than enough to pay off the needed loan of $115 million. Yet the optimal contract is a two-period one that cannot look at the second period alone and that in order to keep Newvel honest must call for Newvel's premature death if it reports low profit.[12]

[11] The predation story told here is closely related to "long purse" or "deep pockets" models. See, e.g., Phlips (1995).

[12] Strictly speaking, the contract described is only optimal if it is unobserved by Microhard. If Microhard can observe the details of the loan, the contract may be written in a way that deters predation.

13.3 Practice Problem

In the above example it is worthwhile for Microhard to engage in predatory behavior because such behavior increases the odds of Newvel failing in the market from 50 to 70 percent, an increase of 20 percent. What is the lowest increase in unfavorable odds that will induce Microhard to engage in predatory behavior?

13.2.2 Asymmetric Information and Limit Pricing

In the Bolton and Scharfstein (1990) model, the upstart rival firm, Newvel, knows a lot about the market. Newvel knows not only its own profitability but it understands the profits and incentives facing Microhard as well. In reality, this is often unlikely to be the case. A new firm can typically only guess at the profits and costs of the rival incumbent. In their classic paper, Milgrom and Roberts (1982) present a model in which the assumption that the rival entrant firm is perfectly informed is relaxed. Specifically they assume that the rival entrant firm does not know the incumbent firm's cost of production. In this context charging a low price to keep the entrant out may no longer be an empty bluff. We now turn to the classic Milgrom and Roberts (1982) limit pricing model, noting that in this model we return to strategies aimed at preventing the entry of a rival and not ones aimed at eliminating an existing rival.

The setting is again a two period game in which there is a long-standing incumbent and a *potential* entrant. At the risk of repetition, let's again call the incumbent Microhard and the potential entrant, Newvel. There is no lender or other player. Microhard is alone in the market in the first period. During that time, Newvel observes Microhard's behavior, specifically the price that Microhard chooses to set for that period, and then Newvel decides whether or not to enter the market in the second period. As before, we assume the interest rate is zero so that we do not have to worry about discounting future profits.

Newvel knows its own unit cost and the market demand in each period, but Newvel does not know Microhard's unit cost. Microhard, on the other hand, knows its unit cost, Newvel's unit cost as well as market demand in each period. Both firms also know that all of this is understood by both of them. From Newvel's perspective Microhard's unit cost could be either high or low, depending on factors such as the expertise of management, the quality of equipment, or the input prices that Microhard has negotiated with its suppliers. These are all features of production costs that are in fact not easily ascertained by outsiders. And while Newvel does not know Microhard's unit cost, it does know something about how likely it is that Micohard is a high-cost or low-cost type. Specifically Newvel knows that there is a probability ρ that Microhard has a low cost and a probability $(1 - \rho)$ that it has a high cost.

In the interest of making the model easier to understand, we will work through a specific numeric example. Let's assume that when Microhard has low costs and acts like a profit-maximizing monopoly in the first period, it sets a relatively low price but, because of its low costs, earns a profit equal to \$100 million. In contrast, if it were a less efficient high-cost monopoly Microhard's profit-maximizing price would be higher but, again due to its cost inefficiency, it would earn less profit at that price, namely, \$60 million. Finally, we assume that if Microhard were a high-cost firm but, nevertheless, chose the price that is optimal for a low-cost incumbent, its profit would fall still further to \$40 million.

Microhard's second period profits depend both on its unit cost and on whether or not Newvel comes into the market. We will assume that if Microhard is alone in the second period, it

simply sets the monopoly price appropriate for its cost structure since entry is no longer a worry. It then earns either \$100 million (low cost monopoly profit) or \$60 million (high cost monopoly profit) in the second period when no entry occurs. We also assume that the potential entrant, Newvel, earns a profit of 0, whenever it stays out of the market.

If entry occurs in the second period, Microhard's profit suffers. If it is a low-cost firm, it earns only \$50 million in the second period when Newvel is present. If Microhard is a high-cost firm, it is less able to compete and earns only \$20 million. If Newvel enters and competes against an inefficient, high-cost incumbent, it earns a positive profit of \$20 million. But if the incumbent turns out to be a low-cost type, then entry results in a *loss* of \$20 million for Newvel.

The extensive form for this example of the entry game is shown in Figure 13.3. Newvel's uncertainty about Microhard's cost is modeled by introducing the player Nature who moves first and chooses the cost of the incumbent firm. With probability ρ Nature chooses a low-cost incumbent and with probability $(1 - \rho)$ Nature chooses a high-cost incumbent. Microhard moves next and sets either a high or low price when it sells output in the first period. Then Newvel decides whether to enter and to compete in period two or to stay out. At the end of each path, we show the total payoffs for each firm over the two periods depending on the choices about prices and entering. Microhard's total profit is the sum of its profit in each period. Newvel's profit is just that which it earns in the market for the final period.

Figure 13.3 shows three possibilities for Microhard. The first is that it is a high cost firm and sets a first-period monopoly price that corresponds to being high cost. The second possibility is that it is again a high cost firm but now chooses to set the lower price appropriate for a more cost-efficient firm. Finally, the third possibility is that Microhard is truly a low-cost firm and sets the lower monopoly price corresponding to being low cost. Note that we have ruled out the possibility of a low-cost Microhard charging the high-cost monopoly price. We will see in a moment that a low cost Microhard has no incentive to do so. One important point to understand is that we have captured the asymmetry of information or who knows what by circling together the nodes E_2 and E_3. This is meant to indicate that when the entrant Newvel observes a low price in the first period it does not know whether that corresponds to node E_2 or at E_3, and Microhard, the incumbent knows that the entrant firm does not know at which node it is.

You may ask at this point why a high-cost incumbent firm would ever set a sub-optimally low price that would lead to a lower level of profit. The answer is that this may influence

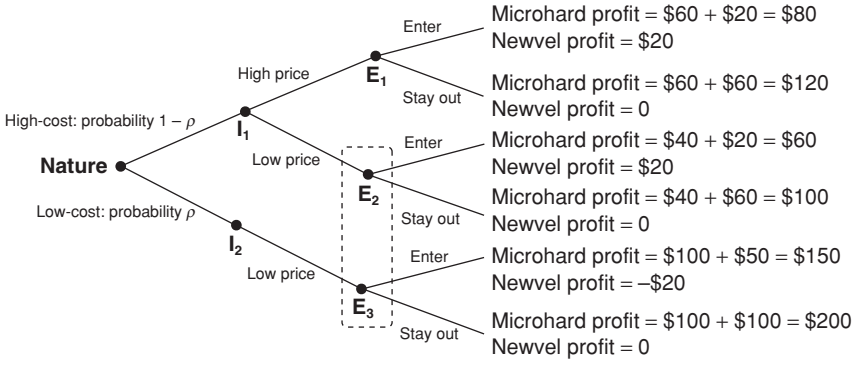

Figure 13.3 Extensive form of the Sequential Entry game with asymmetric information on cost

the entrant's decision to enter in period 2. Newvel might, for instance, reason as follows: "If Microhard charges a high price during the first period, it must be an inefficient, high-cost firm and I will enter. However, if Microhard charges a low price, it must be a cost-efficient firm and I am best to stay out of the market." In this setting, there is a considerable incentive for a high-cost incumbent initially to play against type and set the low monopoly price in period 1. True, this will mean that it earns only a profit of $40 million instead of the $60 million during the first period. Yet given the entrant firm's reasoning, this sacrifice pays off in the second period because it deters entry and thereby permits Microhard to earn a profit then of $60 million rather than the $20 million it would have earned had it initially set a high price that would have encouraged entry.

This same reasoning helps explain our assertion above that a low-cost incumbent firm will never initially set the high-cost monopoly price. Such a choice is not profit-maximizing in the short run and, in addition, serves to attract entry.

Our analysis so far makes clear that what happens in this game is sensitive to the nature of the beliefs that Newvel holds based on the behavior of Microhard observed in the first period. What we have just said above is that if the Newvel believes "low price means low-cost, high price means high-cost" its entry decision will be easily manipulated by Microhard. Accordingly, this may not be a very reasonable sort of belief for Newvel to hold. We should therefore expect that Newvel will also realize this and will adopt an alternative way to interpret the evidence observed in the first period.

The important question here is what beliefs are reasonable. Suppose that Newvel—recognizing the foregoing argument—thinks in a different way. Since Newvel understands that it is possible for both a high-cost and a low-cost type firm to play a low price strategy, it reasons that observing a low first-period price really gives no useful information as to the type of incumbent it is facing. Instead, when Newvel observes a low initial price it simply uses what it knows about the probabilities associated with different cost types. Specifically, when Newvel observes a low price it simply concludes that Microhard is a low-cost firm with probability ρ and a high-cost one with probability, $(1 - \rho)$. However, because a low-cost firm never has an incentive to charge a high price, Newvel does continue to believe that a high price in the first period means that.

Microhard has high costs. In other words, Newvel's conditional inferences are as follows:

If Microhard sets a low price in period 1, it has a low unit cost with probability ρ and a high unit cost with probability $1 - \rho$. Accordingly, second period entry will yield an expected profit of $[(1 - \rho)\$20 - \rho\$20]$ million.

If Microhard sets a high price in period 1, it has a high unit cost. Second-period entry will yield a certain profit of $20 million.

The foregoing beliefs are rational. Note, however, that they imply that if Newvel observes a low first-period price and then enters, its *expected profit* when it enters is: $-\$20\rho + \$20(1 - \rho) = 2 - 4\rho$ (in millions). If Nature's draw or the probability that Microhard is a low-cost firm is high enough, in our example, if $\rho > 1/2$, then Newvel's *expected profit* from entering is negative. Consequently, it will not enter if it observes a low price. Microhard can work this out, too. It will therefore recognize that if the probability of being a low-cost firm $\rho > 1/2$, it will do better by pretending to be a low-cost firm and setting a low price in the first period even if, in reality, it is a high-cost firm. Once again, this will lead to a profit of $40 million initially and then, in the second period when the firm is a secure monopoly, a profit of

$60 million, for a total profit of $100 million. This is better than the alternative strategy of initially charging a high price which would reveal its type to the potential entrant, invite entry, and lead to the lower total profit of $80 million. That is, when $\rho > 1/2$, a high-cost Microhard will set a limit price—one lower than its true profit-maximizing price—in order to deter an imperfectly informed entrant from entering the market. This is, of course, predatory conduct.[13]

In sum, both the Bolton and Scharfstein (1990) and the Milgrom and Roberts (1982) models show how predatory pricing can be rational or, more formally, part of a subgame perfect strategy in a dynamic game. When the players, either investors or rivals, have incomplete information, the incumbents may find that predation can be an effective tool to eliminate rival firms.

The incentive for strategic low pricing can also be shown to improve the terms of a takeover, as in Saloner (1987) in a premerger game that is somewhat similar to the Bolton and Scharfstein (1990) model.

A study of the business practices of American Tobacco from 1891 to 1906 by Burns (1986) supports this idea that predatory pricing can be used to improve the terms of a takeover. During the period of study, American Tobacco acquired some 43 rival firms. The strategy used by American Tobacco was to identify the target rival that it wished to buy and introduce a competing brand at a low price in the target's market. The resultant drop in the target firm's profit would induce it to settle for a lower acquisition price. Burns (1986) estimates that such a predatory episode preceding a takeover bid lowered the acquisition costs by about 25 percent.[14]

13.3 CONTRACTS AS A BARRIER TO ENTRY

Our discussion of the Microsoft antitrust trial has focused mostly on Microsoft's practice of bundling its *Windows* operating system with its *Internet Explorer* web browser as a means

[13] We can complicate the story by introducing uncertainty on both sides of the game. Suppose, for instance, that Newvel does not know what Microhard's payoff is from fighting an entrant, and Microhard does not know a potential entrant's payoff from entering. Specifically, from an entrant's point of view, Microhard can be one of two types: with probability p^0 Microhard is believed to be "tough" (i.e., low-cost), which means that its payoffs are such that it will always fight in every market; and with probability $1 - p^0$ Microhard is believed to be "weak" (high-cost) and more accommodating of entry. Similarly, each potential entrant is believed by Microhard to be "tough" with probability q^0, in which case the entrant's will always enter no matter what Microhard does; and to be "weak" with probability $1 - q^0$, in which case the entrant's payoffs are as in the current example. The "tough" version of Microhard always fights and so is of no interest to us. What *is* of interest is that a Microhard that knows itself to be "weak" will, as before, still have an incentive to fight entry in order to develop a reputation in the minds of potential entrants that it might, in fact, be "tough." The willingness of a "weak" incumbent to fight is an increasing function of p^0 and a decreasing function of q^0. More generally, the greater the number of markets there are the lower is the probability p^0 necessary for entry to be deterred. Simply put, a "weak" incumbent is more likely to fight entry if there are "many" of its markets remaining in which entry has not taken place than if there are "few."

[14] In 1911, immediately following the Standard Oil decision, the Supreme Court found American Tobacco guilty of monopolizing the cigarette and tobacco product market, and cited predation to induce rivals to sell out as evidence of illegal monopolistic intent. A district court ordered that American Tobacco be dissolved and reconstituted as separate firms, the big three being American Tobacco, Ligget, and Myers and Lorillard.

of pushing Netscape out of the browser market. While such behavior might well have been predatory it was not, however, the only predatory practice of which Microsoft was accused. Another crucial question in the case was whether or not Microsoft was able through its contracts with PC makers to foreclose other rivals from entering the operating systems market in which Microsoft had a virtual monopoly.

The idea that formal agreements, which impose penalties for breach of contract, between a monopoly firm and its buyers can be a predatory instrument to deter other firms from competing with the monopolist has an important place in antitrust history. It underlies the reasoning of Judge Wyzanksi in the famous United Shoe Machinery Corporation antitrust case in the early 1950s. At that time, United Shoe controlled about 85 percent of the shoemaking equipment market, and it leased its machinery to shoe manufacturers. These leasing contracts were binding and were viewed by the court as a way to foreclose effectively the market for shoe machinery.

Perhaps not surprisingly, the Chicago School has traditionally been skeptical of the use of contracts as a predatory device. The simple logic of this counter-argument is well expressed by prominent antitrust scholars Bork (1978) and Posner (1976). Buyers do not have an incentive to sign contracts that disadvantage them with respect to a monopolist. Any contract signed must give not just the supplier but also the buyer some benefit—say by way of increased service or repair—and therefore a step toward greater efficiency. These proponents of the Chicago School emphasize the efficiency grounds for observed contracts rather than the predatory motive. Again, however, more recent theory has provided consistent arguments supporting the view that predation can occur in this rational world.

13.3.1 Long-term Exclusive Contracts as Predatory Instruments

Two basic analyses have been advanced to show that buyers may voluntarily sign contracts with suppliers that, in fact, are predatory and inefficient. The first is due to Aghion and Bolton (1987). The second is due to Rasmussen, Ramseyer, and Wiley (1991). We briefly present each model in turn.

Aghion and Bolton (1987) consider a market for some essential intermediate good that extends over two periods. In the first period, there is an incumbent monopoly seller of the good whose unit cost is \$50. Each buyer of this good uses exactly one unit of the input per period and is willing to pay up to \$100 for the product. In the second period there is the possible arrival of a new entrant. This is recognized by all parties at the start of the first period. However, neither a buyer in the second period nor the monopoly seller initially in the market knows the unit cost c of this second period potential entrant. All that these initial participants know is that c is distributed randomly but uniformly on the interval between \$0 and \$100.

We begin by considering matters from the viewpoint of a buyer looking forward to the second period. We assume that if the entrant actually enters the market at that time, Bertrand or price competition will emerge between the initial monopoly supplier and the new rival. If the entrant's unit cost c exceeds \$50, however, it will lose this competition. With $c >$ \$50, the incumbent can always underbid the entrant. The entrant obviously knows this. Hence, if the entrant finds that its cost $c >$ \$50, no entry will occur. In this case, which by our assumption happens with probability 1/2, the incumbent remains a monopolist and can charge a buyer its full reservation price of \$100 for the good.

However, if $c \leq$ \$50, then entry will occur. In this case, the competition between the entrant and the incumbent will bid the price down to \$50 at which point the incumbent will drop

out. Once this happens, however, the entrant is under no additional pressure to lower its price so a buyer will end up paying \$50 for the good for any case in which $c \leq \$50$. This too happens with probability 1/2. Notice that once again, there is an element of uncertainty as well as some asymmetry. For $0 \leq c \leq 50$, only the entrant will know it's true cost as the buyer will be charged \$50 whatever that is.

One of the two scenarios just outlined must happen. Therefore, in the absence of any contract obligating a buyer to purchase from the initial incumbent, the buyer's expected price for the intermediate good in the second period is:

$$^1/_2 \times \$50 + {}^1/_2 \times \$100 = \$75 \tag{13.1}$$

Note that equation (13.1) also implies that since a buyer values the product at \$100, it should expect a surplus of \$25 in the absence of any contract with the initial monopolist supplier. To put it another way, any contract that the incumbent offers to the buyer must promise the buyer an expected surplus of at least \$25 in the second period, or the buyer will not sign it. The question then is whether the monopolist can and will offer such a contract. If it will, we would also like to know the efficiency aspects of such an arrangement.

One long-term contract that a buyer might find attractive is the following. In the first period, the buyer agrees to make its second-period purchase of the good from the incumbent at a price of \$75 with only one possible exception. The exception is that buyer can instead make its second-period purchase from the new entrant so long as it pays the initial incumbent a \$50 breach-of-contract fee.

There are several features of this proposed contract that deserve emphasis. First, observe that the entrant will now only enter the market if its cost $c \leq \$25$. The reason is that in the second period, a buyer can either buy from the incumbent for \$75 or from the entrant at some price p plus the breach-of-contract fee of \$50. Hence, a buyer will prefer to fulfill the contract rather than switch to the alternative supplier unless that supplier charges a price of \$25 or less. However, the only way that the entrant can do this is when cost $c \leq \$25$. Accordingly, the entrant will only enter the market when $c \leq \$25$. Notice that this also implies that the contract restricts entry. Without the contract, entry occurred with probability 1/2. With the contract, entry will only occurs when $c \leq \$25$, which happens only with probability 1/4.

Will the buyer actually sign the proposed contract? This is where the second noteworthy feature of the agreement becomes relevant. The contract is such that no matter what happens, the buyer will pay \$75 for the good. Three-fourths of the time, the potential rival will not enter and the buyer will pay the stipulated \$75 to the initial incumbent. One-fourth of the time, the rival will have a cost $c \leq \$25$. In this case, it will enter and charge the buyer the highest price it can while still making a sale, namely, \$25 ((or just a penny less). A buyer will then switch and purchase the good from the new entrant at \$25 but, in addition, pay a \$50 breach-of-contract fee to the initial incumbent. Again, the buyer's total payment is \$75, leaving it a surplus of \$25. Thus, a buyer's expected (in fact guaranteed) surplus with this contract is \$25. Since this is also its expected profit or surplus without the contract, a buyer will be willing to sign the agreement.

The next question is whether or not the incumbent monopoly seller will actually find it worthwhile to offer the agreement. Here again, the answer is yes. To see this, we now need to consider the monopoly seller's expected profit both without and with the contract.

In the absence of any agreement, the incumbent monopolist will sell to a buyer at a price of \$100 half the time. The other half it will be underbid by the new entrant. When it does

Reality Checkpoint

Coke Takes Out a Contract on Texas Rivals

Dangerfield, Texas gets awfully hot. The summertime temperature can regularly top 100 degrees Fahrenheit and shade is hard to find. That's probably one reason that Dangerfield residents and their neighbors drink a lot of soft drinks every year. Indeed, for convenience stores in the area, it is estimated that as much as half of their sales are from beverages. In the years just before 1992, the stores received their soft drink supplies from a number of small, soft drink firms and bottlers, as well as from Coca-Cola and Pepsi. However, that all began to change after 1992.

Bruce Hackett, a former Coke employee and owner of Hackett Beverages, supplied ice-filled barrels to a number of stores that were also stoked with his soft drink bottles. The barrels were usually displayed just outside the cash register line so that customers could easily grab a cold beverage and pay for it on the way out. However, starting in 1992, Hackett found more and more of his barrels turned upside down and left at the side of the road. In four years, he went from having barrels in 52 stores to barrels in just two. Other independent bottlers and small beverage firms had similar experiences. They found stores abandoning the refrigerator units they gave them to display their products, dumping their fresh soda dispensing and vending machines, and even refusing them any shelf space.

The reason for these changes was easy to find. Coca Cola had started an aggressive marketing campaign in which it paid store owners to display its products *exclusively* and refused to give them access even to non-Coke drinks handled by Coca-Cola bottlers if they did not. Thus, one contract offered a bonus of $2 million to a regional supermarket chain, Brookshire's, in return for just selling Coke products alone. Another contract required that "Coca Cola products will occupy a minimum of 100 percent of total soft-drink space" in the store.

The case went to trial before a Texas court in 200. Coke's defense was that the stores wanted the contract deals it was offering. They argued that the stores felt they had little to offer in the soft drink category unless they offered the national Coke brand at the best terms possible. Coke argued that the contracts it offered, allowed the stores to do just that. However, it was indisputable that as the smaller firms were driven from the market, Coke prices went up. At Nu-Way, a popular Dangerfield convenience store that still offers Royal Crown Cola, a 20-ounce container of the Royal Crown product sells for 69 cents while the same size container of Coke sells for 92 cents. However, at another convenience store, E. Z. Mart, a short distance away, there is no Royal Crown alternative and Coke sells for $1.09. Whether this was a case of predation or not is a question of judgment. However, a comment by Coca-Cola spokesperson, Polly Howes, probably did not help Coke's cause. In a widely distributed statement, Ms. Howes said that far from "a lack of competition. There was too much competition." The Texas jury found Coca-Cola guilty of violating the antitrust laws.

Source: C. Hays, "How Coke Pushed Rivals Off the Shelf," *New York Times*, August 6, 2003, section 3, p. 1.

sell at $100, the incumbent makes a profit of $50. Since this happens with probability 1/2, the monopoly seller's expected profit in the second without the contract is $1/2 \times \$50 = \$25$ per customer.

With the contract, the calculation of the incumbent's profit is slightly more complicated. With probability 3/4, the monopolist will still sell to the buyer at the pre-specified price of $75. Since the monopolist has a unit cost of $50, such a sale generates a profit of $25. With

probability 1/4, however, the monopolist makes no sale because the buyer breaks the contract and switches to the new entrant. This is not bad news, however. The switch means that the monopolist no longer has to incur the $25 unit production cost. Moreover, the buyer's breach of contract entitles the seller to a $50 fee in the one-fourth of the time that the contract is broken. In short, the contract offers the initial incumbent seller an expected surplus in period two of:

$$^3/_4 \times (\$75 - \$50) + {}^1/_4 \times \$50 = \$31.25 > \$25 \qquad (13.2)$$

As equation (13.2) makes clear, the monopoly seller's expected profit with the contract is $31.25, an amount that definitely exceeds its expected profit of $25 without the contract. Moreover, we have already shown that a typical buyer's expected surplus is the same whether the agreement is in force or not. In other words, the incumbent monopolist is made better off and the buyer is made no worse off by the contract. Accordingly, with one party desiring the contract and the other indifferent, we expect that the contract will be offered and signed.

From a social viewpoint, however, the contract is inefficient. To be sure, it does increase the expected surplus of the buyer and seller together from $50 (= $25 + $25) to $56.25 (= $25 + $31.25) for a net gain of $6.25. However, it reduces the entrant's expected surplus by more than this amount. Why?

Without the contract, the entrant will stay out of the market half the time and enter the other half. When it does enter, the entrant will sell at a price of $50 per unit. In such cases, the entrant's unit cost c will range from 0 to $50 or $25, on average. This implies that the entrant has an expected profit of $^1/_2 \times (\$50 - \$25) = \$12.50$ when there is no contract. When the incumbent binds a second period buyer with a contract the potential rival only enters the market with probability 1/4 and sells at a price of only $25. Its unit cost in such cases will range from 0 to $25 or, $12.50, on average. So, once the contract is signed, the potential rival's expected profit is only $1.4 \times (\$25 - \$12.50) = \$3.13$. From this, we can see that the issuance of a contract reduces the potential entrant's expected surplus from $12.50 to $3.13 or by $9.37. As noted, this reduction exceeds the joint gains to the buyer and seller ($6.25), so the total social surplus is less with the contract than without it.

The intuition behind the foregoing result, however, is subtle. From the buyer's perspective, the problem is that without the contract, the new entrant will never sell at a price less than $50—even if it has a cost of $0. Ideally, the buyer would like to benefit more in such cases where the entrant has such a particularly low cost. Yet, in the absence of the contract, nothing compels the new entrant to engage in such sharing. Once the price falls to $50, the initial incumbent drops out of the market and the entrant faces no further pressure to reduce its price. By offering the contract, the incumbent monopolist effectively enables the buyer to force the seller to never charge a price above $25. The buyer is, as just noted, willing to pay for this service. The point is that even though a contract may bring benefits to a monopoly supplier and its buyers, the contract is still inefficient if it achieves these gains only by reducing the surplus of the new entrant by an even greater amount. The inefficiency reflects the fact that under the contract regime some desirable entry is prevented. Specifically, entry does not occur when the new rival has a cost c satisfying $\$25 < c \leq \$50$ despite the fact that within this range, the entrant is more efficient than the initial monopoly seller. Because of the breach-of-contract clause in the long term contract, the entrant cannot break into the market.

The Rasmusen, Ramseyer, and Wiley (1991) model differs from the above in so far as it focuses on an externality in the contract rather than on an uncertainty. Suppose again that

there is one supplier with a unit cost of $50, and, say, three buyers. As before, each buyer will pay up to $100 for one unit of the input. There is also an entrant with a unit cost of $40 waiting to enter the market next period. However, the entrant also has a sunk cost—say due to market research or promotional activities—of $60. Hence, to underbid the incumbent and cover its sunk cost, the entrant has to serve at least two customers. If the new entrant serves three customers, it can charge each a price as low as $60. The $20 in operating profit that it makes on all three customers combined will then give it enough extra to cover its overhead. If it serves two customers, the entrant can still underbid the incumbent but it must now charge a price no lower than $70. If it serves only one customer, the entrant must charge a price of $100 to acquire the $60 needed to cover its sunk cost. In this case, of course, the entrant will not enter.

The incumbent can of course match any of the entrant's price offers in the second period. Still, the incumbent has to recognize that if the entrant comes in at a price of $70 and the incumbent has to match that price, the incumbent's profit will fall to $60 even if it keeps all three customers. The incumbent therefore has some incentive to stop the entrant from acquiring two or more clients with a long-term contract. To sell this contract, the incumbent engages in the following tactic. It tells two customers that each will be able to buy the input at $70 if, and only if, she signs an exclusive contract promising not to buy from any other supplier. Why might this work?

Each buyer who is offered an exclusive contract with a purchase price of $70 has to worry about what the other buyers will do. Once two sign the contract, no offer needs to be made to the third because once two buyers are bound to the incumbent, the entrant cannot profitably underbid the incumbent's price. Therefore the third buyer may well face a price of $100 once the other two have signed. In an effort to avoid such an outcome, each buyer will rush to sign the contract. In fact, by playing buyers off against each other in this way, the incumbent may be able to sign exclusive deals even if it offers a small price reduction to only $90.

Here again the contract inefficiently blocks entry. The potential entrant is a more efficient producer. The problem is that each buyer looks only to the effect that the contract has on the buyer's profit. Each ignores the impact that signing the contract has on overall competition and the profitability of other buyers (perhaps some of whom are rivals to the buyer in the downstream market).

13.3.2 Tying as a Predatory Contract

In the contracting scenarios described above, the mechanism that blocks entry is a contract that extends over two periods, i.e., a long-term contract. The contract is written in the first period, before a potential second entrant arrives and extends into the next period. When the rival does arrive in period two, it finds that potential customers are hard to come by because they have already been contractually bound to the initial monopolist.

Rather than extending a contract over two or perhaps more periods, one might instead consider extending a contract to two or more markets. That is, an incumbent seller in one market might be able to contract with its customers in a manner that effectively binds them to that same seller in a second market. This is what generally happens with a tying arrangement. As we saw in the *Magicam* and *Magifilm* parable of Chapter 9, a primary motivation for tying is the implementation of effective price discrimination—not predation. In that story, the Rowling Corp. markets a *Magicam* camera that only works with its own *Magifilm*. Tying can enable Rowling to price discriminate among its consumers.

If the *Magicam* worked equally well with film cartridges made by any firm, Rowling would still enjoy a monopoly in the *Magicam*, but its ability to extract additional surplus by means of price discrimination would be very limited. Tying the two goods together is therefore good for Rowling Corp. Indeed, it may even be good for consumers because, as we know, price discrimination often works to expand the market and increase the social surplus. This price discrimination motive was not part of the long-term contract models that we described above and, in this respect, the two contractual arrangements are not equivalent.

Even though Rowling's motive for the tying of *Magicam* and *Magifilm* is to price discriminate more effectively, the other makers of film cartridges will nonetheless find that this practice causes them to lose customers. Once again, this raises the fear that the tie-in may permit Rowling Corp. to extend its *Magicam* monopoly into the film market. This will be particularly true if, for instance, there are significant scale economies in film production so that loss of part of the market makes it more difficult for a rival maker of film to produce at minimum average cost.

Reality Checkpoint

Tied Up on the Rock

Roughly 1,500 inmates were interred in Alcatraz or "the Rock" as it was sometimes called during the 30 years of its use as a federal penitentiary from 1934 to 1963. Born in the Depression Era, the prison was envisioned as a necessary response to the violence that first, Prohibition, and later, severe economic dislocation brought to America. Law enforcement officials including J. Edgar Hoover sought to build a special institution in which the most violent and hardened criminals such as George "Machine Gun" Kelly, would be kept securely. The prison's location on an island in the middle of San Francisco harbor also made it ideal as a place to incarcerate gang leaders such as Al Capone in a manner that made it difficult for such criminals to maintain any control of their still-active criminal organizations. The prospect of imprisonment with such a hardened crew of inmates and in such an isolated place led many, if not all, prisoners to dream of escape. Indeed, many risked life and limb in such attempts. Yet no successful break out has ever been documented. Escape was impossible.

These days, getting to the island, which is now operated as a tourist attraction, is almost as difficult as escape used to be. The National Park Service issues 4,200 daily tickets to visit the tiny island and all are typically bought. Pursuant to an exclusive contract, these tickets are issued to a Blue and Gold Fleet cruise lines, the only tour boat company operator permitted to transport visitors to the island. The contract also permits Blue and Gold, if it so desires, to sell 1,800 of the Alcatraz tickets to travel agents and others who put together vacation and excursion packages. Because of the strong demand for such tickets, those operators who receive them find that they are very popular with vacationers. In turn, this gives Blue and Gold considerable leverage with the tour operators. Indeed, soon after it first received the exclusive rights, the cruise company exploited this leverage by requiring that any tour operator receiving Alcatraz tickets must also use Blue and Gold for its harbor cruises and other boating excursions. In other words, Blue and Gold tied the sale of Alcatraz tickets to the mandatory use of its other services. Of course, the other boating companies who lost customers to Blue and Gold were unhappy. Several complaints were filed with the California Attorney General's Office. In a settlement with these officials, Blue and Gold agreed to terminate its tying practices.

Source: A. Chiu, "San Francisco Tourboat Antitrust Case is Settled," *San Jose Mercury News*, September 13, 2000 p. A1.

Whether or not Rowling or any other firm has an incentive to extend its monopoly in the manner just described is however far from clear. After all, consumers are ultimately interested in *Magicam* pictures—not the *Magicam* or the *Magifilm* itself. From this perspective, a higher price for say, *Magifilm*, requires a lower price for the *Magicam*. To put it another way, Rowling has little incentive to monopolize the *Magifilm* market solely as a means to raise the price of *Magifilm* since this will reduce the demand for its *Magicam* product.

There are other factors that may affect the incentive for tying. Suppose for instance that there are economies of scope between film and camera production. Then by extending its monopoly from the *Magicam* market to that of *Magifilm*, Rowling may prevent other manufacturers from realizing such scope economies. In turn, this may prevent other firms from developing their own *Magicam* product. That is, the extension of the Rowling monopoly from one product line to another may be a means of protecting its core monopoly.

It is for this reason that whenever a firm possesses substantial market power in a tying product, and coerces the buyer to take the tied product as a condition to obtaining the desired good, the arrangement is almost always found to be a violation of the antitrust laws (see inset).

13.4 PREDATORY CONDUCT AND PUBLIC POLICY

Should there be public policies that restrain the conduct of firms who have acquired or are likely to acquire a dominant position in the marketplace? The answer to this question rests largely on three issues. The first of these is whether or not predation is a rational strategy. The second is the empirical issue as to whether there is any actual evidence of predatory behavior. The third is whether the public policy can itself be made workable. It is not too much of an exaggeration to say that little attention was paid to either of the first two issues (and possibly the third) in the years immediately following the passage of the Robinson-Patman Act in 1936, and its condemnation of discriminatory prices. For a number of years thereafter, price cuts by large firms that had the effect of severely reducing or eliminating the market share of small ones were almost routinely regarded as predatory if the prices reflected any degree of discrimination, i.e., if the large firm sold at a lower price in more competitive markets. The culmination of this period of stringent prosecution of even vague charges of predatory pricing was the *Utah Pie* case that we discussed above.

Against a history of cases such as *Utah Pie*, the work of McGee (1958, 1980), Koller (1971), Posner (1976), Bork (1978), and Easterbrook (1984), and others of the Chicago School reflected a necessary corrective. Many firms achieve dominance not because of predation but because of their superior competitive skill. Hence, policies that constrain "bigness" would have adverse incentive effects on competitive behavior. A corollary to this view is that market dominance will not persist if it is due to any factor not related to superior skill or efficiency. Indeed, these very arguments were made by Microsoft during its 1998–2001 trial and appeal. As a result of the force of these arguments, the Chicago School perspective on predatory behavior became increasingly influential. It received an official blessing in the 1986 *Matsuhita* case when the Supreme Court wrote "For this reason, there is a consensus among commentators that predatory pricing schemes are rarely tried, and even more rarely successful."[15] A few years later, in the *Brooke* case of 1993, the Court went even further

[15] See *Matsuhita Electronic Industrial Co., Ltd v Zenith Radio Corporation et al*., 475 U.S. 574 (1986).

and outlined stringent evidentiary standards that had to be met before a predation claim would be supported.[16]

The Brooke Group (also known as Ligget) was a small cigarette manufacturer that began selling a generic brand in 1980, at prices well below those of the major brands. When consumers responded favorably to the introduction of these cheap cigarettes, Brown & Williamson and other large tobacco companies responded with vigorous price cuts. In its effort to undersell Brooke, it seems clear that Brown cut prices so low that it sustained millions of dollars of losses over a period as long as a year or more. Ultimately, however, Brooke could not keep pace. It raised the price on its cigarettes. Almost immediately thereafter, Brown & Williamson and other cigarette manufacturers did the same.

The Supreme Court did not find the foregoing evidence conclusive. As noted, the court had moved to a view that there was an economics consensus that predatory pricing was irrational. The court then established two broad requirements for a successful prosecution of a predatory pricing case. The first was evidence of selling below some measure of cost. The second, and really new element introduced by the court was evidence that the predator had a reasonable expectation of recouping the losses endured during the predatory period. Just how strong the new requirements were can be seen in the fact that there was not one successful prosecution of predatory action in the first forty cases that followed the Brooke decision. It was not until the important case of Microsoft that a finding of guilty was made.

The consensus to which the Supreme Court referred in *Matsuhita* no longer exists—if it ever did. Commitment via capacity expansion, asymmetric information, and contractual exclusions are all features that can be combined to make a coherent argument for the rationality of predatory actions. Moreover, with respect to recoupment, it is important to recognize that successful predation has important reputation effects. Once a firm is successful in eliminating one rival, it sends a message to all other potential competitors. Thus, in measuring the ability of a firm to recover its losses, one has to include in the calculations all the profits secured by the deterrent effect that the firm's reputation has on other would-be entrants.

However, the court's statement of necessary evidence does speak to an important issue. The recognition that predation can be rational and can happen does not carry any clear policy implications unless we have a clear standard by which predatory actions can be identified and distinguished from conduct that is truly procompetitive. Any entry will generally evoke some reaction from the incumbent firms. Typically, this may come in the form of lower prices or other expanded consumer benefits. Most such responses are not predatory in nature. To the contrary, they are exactly the conduct that we expect and hope that markets will promote. Similarly, when any firm, large or small, first comes into a market as a new entrant, it may want to set a low initial price, lower than the short-term, profit-maximizing one, as a way to induce consumers to forego their usual brand and try the entrant's relatively unknown product. Once established the firm may then raise prices. Clearly, the intent of this kind of promotional pricing is not to drive a rival from the market. Yet, it may be difficult empirically to distinguish this pricing strategy from predatory pricing.

In other words, to the extent that antitrust enforcement seeks to prevent predatory practices, policy makers need to create workable legal standards that are able to distinguish procompetitive from anticompetitive conduct. Ideally, we would like such policy to be governed by a simple rule that could be used to detect the presence of predation. This would

[16] *Brooke Group v. Brown & Williamson Tobacco*, 509 U.S. 209 (1993). Interestingly enough, Brooke actually won the initial jury trial but lost in subsequent appeals to the federal courts.

permit all parties to understand just what is and what is not legal. Yet in the area of predation simple rules rarely work.

Of the various rules that have been proposed, the most famous is that of Areeda and Turner (1975), which essentially finds any price to be predatory if it is below the firm's short-run average variable cost standing in as a proxy for marginal cost. Unfortunately, it is not a very good proxy. In actual practice, average variable cost can be significantly less than short-run marginal cost so that a firm could set a price below its current marginal cost yet still above its average cost. In so doing, the firm would be acting within the legal range permitted by the Areeda and Turner rule even though a price below short-run marginal cost would likely judged as predatory by many economists. Hence, as Scherer (1976) was quick to point out, the use of the average cost standard could still permit serious predation.[17] Moreover, if there are important learning curve effects so that average cost falls with a firm's cumulative production over time (as opposed to scale economies in which average cost falls with the volume of production per unit of time), predation can occur by means of a vigorous output expansion without prices ever falling below cost.[18]

Another problem is that the rule ignores the strategic aspect of predatory pricing. To take a simple example, consider a market in which there is one firm operating as a monopoly. Suppose that if a new firm enters it will produce an identical good to that of the monopolist and that the game is one of Bertrand or price competition. As we saw in Chapter 11 the equilibrium of this game is price equal to unit cost. Prices fall immediately to their marginal cost. By Areeda and Turner's rule, this would not be predatory. Yet if the entrant foresees this outcome, the existence of any sunk entry cost will be enough to induce it to stay out. Here again, the Areeda and Turner rule might permit entry-deterring behavior. Whenever the threat of "cutthroat pricing" is sufficiently credible that it never is actually used, the evidence Areeda and Turner look for will not be found.

Despite its shortcomings, the Areeda and Turner rule has been applied in many U.S. antitrust cases. It has been frequently relied upon by Supreme Court Justice, Stephen Breyer.[19] It was also used to exonerate IBM against predatory price-cutting charges in *California Computer Products, Inc., et al. v. International Business Machines* [613 F. 2d 727 (9th Cir. 1979)]. Perhaps the clearest statement is that of Judge Kaufman who, in *Northeastern Telephone Company v. American Telephone and Telegraph Company et al.,* [651 F. 2d 76 (2nd Cir. 1981)], wrote: "We agree with Areeda and Turner that in the general case, at least, the relationship between a firm's prices and its marginal costs provides the best single determinant of predatory pricing."

Yet despite its frequent use, the weaknesses in the Areeda and Turner rule have led many economists to propose modified alternatives. Some of these are like the Areeda and Turner approach in that they focus essentially on the behavior of a single variable. Baumol (1979), for example, focuses primarily on the behavior of the incumbent's price before entry and after exit of a rival. Essentially, this rule requires that any price reduction by a dominant firm in the face of entry be required to be "quasi-permanent," say for a period of five years. If the price reduction that entry induced is quickly reversed following the entrant's exit, Baumol's (1979) rule would find the pricing behavior predatory.

[17] See Scherer's (1976) exchange with Areeda and Turner (1976) on this and other points.

[18] See Cabral and Riordan (1997) for an elaboration of this point.

[19] See, for example, his decision in *Barry Wright Corporation v. ITT Grinnell Corporation, et al*., 724F. 2d 227 (1st Cir. 1983).

In a recent updating of this work, Baumol (1996) also suggests comparing the predator's price with a measure of average avoidable cost (AAC). AAC is a measure of the cost that the alleged predator could have avoided had it not engaged in the predatory increase in output. Thus, if the predatory action lasted for a year, AAC would be the total amount of extra costs produced in that year divided by the extra quantity produced.

In contrast, Williamson (1977) suggests looking at the incumbent's *output* before and after entry. The idea is that a rapid expansion of output after entry would be a sign of possible predation. This rule has two advantages. First, because of the prohibition against expansion after entry, the incumbent might well expand output earlier. In turn, this eliminates some of the monopoly distortion that would otherwise occur when the incumbent is alone in the market. Second, Williamson's rule may also prevent capacity expansion as an entry-deterring strategy by making the threat to expand after entry no longer credible.

While both the Baumol (1979) and Williamson (1977) rules are insightful, both are also limited by focusing on a single variable to indicate predation. As we have emphasized, predatory conduct is part of an often complicated corporate strategy. As a result, it is unlikely to be reflected accurately in the behavior of a single variable. The Dixit (1980) model of capacity deterrence does not involve pricing at all and so would go undetected by both the Areeda–Turner and the Baumol tests. Similarly, Williamson's test would not prevent deterrence by preemption. None of these tests involve any consideration as to whether the strategic environment actually permits predation.

Joskow and Klevorick (1979) were among the first to suggest a more complete assessment of alleged predation within a strategic framework. Their rule combines the separate criteria mentioned above—below-cost pricing, output expansion, and price reversal—but requires as well that there be evidence that such actions were or at least could have been conceived as part of an overall strategy. In particular, Joskow and Klevorick (1979) propose to examine company documents to determine whether or not a firm was intentionally pursuing the aggressive policies. These authors would also examine the industry's structural features to see whether the conditions for predatory pricing exist.

Ordover and Willig (1981) and Bolton, Brodley, and Riordan (2001) also try to present a comprehensive framework for evaluating predatory accusations. The Ordover and Willig (1981) paper is important for its clear and modern definition of predatory conduct as any action for which the profitability is dependent on driving the rival out or preventing it from entering in the first place. In this view, predatory pricing is but one of a number of predation tactics. Both papers argue that an important first step is to check the market structure for the preconditions necessary to make predation worthwhile. The structural conditions so identified are that the accused predator really has significant market power and that entry be difficult so that if a rival is forced to exit it is not subsequently replaced. Bolton, Brodley, and Riordan (2001) also argue that recoupment can be demonstrated by relating the predator's actions to a clear and evidence-supported strategy of predation. In the case of predatory pricing, these authors would rely on an Average Avoidable Cost measure as a benchmark.

None of the proposed predatory standards is simple or easily translated into a courtroom proceeding. The difficulty of distinguishing between good, fierce competition, on the one hand, and predatory efforts, on the other, is substantial. Moreover, as tough as this distinction is to make in the case of pricing, it may be even more difficult to achieve in considering other actions.

For example, consider predatory product innovation which was alleged in two well-known cases, *Telex v. IBM*, and *Berkey v. Kodak*. In the former, the issue at hand was the claim by

Reality Checkpoint

Cut-rate or Cut-throat Fares?

In 1994, Sun Jet Airlines began offering service between Dallas-Fort Worth airport and a select few other cities including Tampa, Florida, and Long Beach, California. Its entry was subsequently followed by that of Vanguard Airlines flying between Dallas and Kansas City, and Western Pacific offering flights between Dallas and Colorado Springs. All three airlines are small startup carriers whose operating costs are widely recognized to be well below those of the major, established airlines. Indeed, it was this cost advantage that gave these small startups their only hope of surviving in the Dallas-Fort Worth market. This is because the Dallas-Fort Worth airport is a central hub for American Airlines. American carries 70 percent of all the passengers who travel from any city nonstop to Dallas and 77 percent of all those nonstop passengers originating in Dallas. It has concessions from local businesses and has already sunk the costs necessary to operate its gates, ticketing desks, and so on. Internal documents obtained from American by the Justice Department reveal that these and other advantages made the firm confident that its dominance would not be challenged by another major airline. However, those same documents suggest that American was concerned about the entry of low cost startups, especially after observing how much market share such firms had taken from other major carriers at their hub airports.

American responded aggressively to the three startups. It greatly expanded its flight offerings in the challenged markets and lowered its fares. In each of the three markets shown, this strategy ultimately led the startup to exit the market. Immediately thereafter, American cut its flights and raised fares back to or above earlier levels. This is shown for the case of three markets in the table below.

	Before entry		*During conflict*		*After exit*	
	Daily flights	*Price*	*Daily flights*	*Price*	*Daily flights*	*Price*
Kansas City	8	$108	14	$80	11	$147
Long Beach	0	—	3	$86	0	—
Colorado Springs	5	$150	7	$81	6	$137

Was this a case of predatory pricing? The Justice Department thought so. It claimed that during the battle with the startups, American lost money on each flight. The actual losses are claimed to be even greater because to offer the additional flights, aircraft were diverted from profitable routes to these unprofitable ones. American won an initial decision in district court. In July 2003, a three-judge Appeals Court upheld the lower court's decision.

Source: D. Carney and W. Zellner, "Caveat Predator: The Justice Department is Cracking Down on Predatory Pricing," *Business Week*, May 22, 2000, p. 116.

Telex (and others) that IBM, which at the time admittedly controlled the market for mainframe computers but faced serious competition in markets for peripheral equipment, began to develop new equipment designs so that only new IBM peripherals were compatible with IBM mainframes (a tying arrangement). In the *Berkey* case, Berkey was a photo-finisher and camera manufacturer who claimed that Kodak should have given it advance notice of Kodak's introduction of a new 110 camera so as to permit Berkey to redesign its cameras and remain viable in the market. In both cases, the courts eventually ruled against the plaintiffs and in favor of IBM and Kodak, respectively. There is perhaps good reason to believe

that the technological alterations reflected in these two cases truly were motivated by predatory considerations. However, there is also a legitimate fear that punishing such actions could have a chilling effect on all innovation.

13.5 EMPIRICAL APPLICATION
Entry Deterrence in the Pharmaceutical Industry

While legal cases and anecdotal examples of entry deterrence can be easily found, empirical work testing systematic entry deterrence has been limited. The reason for this is that the data requirements necessary to identify consistently any systematic predatory behavior across a set of market data points are fairly demanding. For example, in a paper on shipping cartels, Scott Morton (1997) finds some supportive evidence that established cartels in the late nineteenth and early twentieth century engaged in predatory pricing to deter new shipping entrants, especially when the entrants were small and/or had poor financial resources. However, in an another paper, (Scott Morton 2000), finds little evidence that pharmaceutical firms successfully use advertising to deter generic entry as the end of the incumbent's patent nears.

One reason that econometric work on predation is so tricky is that such work must somehow identify cases where an incumbent both regarded entry as a real threat *and* felt that there was a way to prevent it. Suppose for instance that the data set includes two kinds of markets. One type is characterized by a high likelihood of entry by several new firms and that by taking a costly action X the incumbent can reduce the number of entrants. The second type market is characterized by a very low probability of entry and by at most one new rival. Finally, suppose that post-entry competition is Cournot so that the fewer new entrants the better from the viewpoint of the incumbent.

In such a setting, we may find that incumbents only take action X in the first type of market because entry is so unlikely in the second kind of market that incurring the cost of action X is not worthwhile. If this is so, the data will be divided into two groups. In one set of cases, the incumbent takes action X and there is some entry (though less than otherwise would have been the case). In the other set of cases, the incumbent does not take action X, yet there is no entry. Thus, on balance, the data will show that there is *more* entry when the predatory tactic X is used than when it is not. Unless care is taken to identify such markets a priori, it will be hard to conclude from such data that predation is a serious threat.

Another difficulty that the researcher must overcome is identifying the entry-deterring strategy. This too is trickier than it may at first appear. Consider the first-mover, consumer learning-by-doing model of Gabszewicz, Pepall, and Thisse (1992) discussed in Chapter 11. Recall that in the first period of that model when the incumbent is alone, the incumbent prices low to "buy up" a cohort of customers who will be loyal to its product after the second-period entry of a rival because these customers have learned how to work with the incumbent's brand. On the one hand then, such aggressive pricing may seem as if it deters entry because it limits the number of customers for whom the later entrant can compete. On the other hand, however, the fact that it has such a loyal, and price-insensitive cohort encourages the incumbent to charge a high price when entry occurs and this allows the entrant to gain more consumers at a high price as well. Of course, this latter effect makes entry more likely.

A recent paper that tries to sort all these issues out is Ellison and Ellison (2006). They look at the advertising and pricing behavior of pharmaceutical companies in the case of 64 drugs about to lose their patents over the years 1986–92. They first do a simple regression

to determine which markets are most vulnerable to entry. For this purpose, they code each market as to whether or not there was any generic entry within three years after the expiration of the incumbent's patent. This procedure creates a 1, 0 variable for each market called Entry, where the variable is 1 if there was entry and 0 if there was not. Ellison and Ellison (2006) then try to explain this entry variable with an equation that includes three right-hand-side variables that should be related to entry. These are: Rev_i, the average annual revenue earned by the incumbent over the three years prior to patent expiration; Hosp_i, the fraction of revenues from the drug due to hospital sales in the year prior to patent expiration; and Chronic/Acute_i, which takes on the value 0 if the drug treats an acute condition but 1 if it treats a chronic condition. Their estimated equation then is:

$$\text{Entry}_i = \text{constant} + \beta_1 \text{Rev}_i + \beta_2 \text{Hosp}_i + \beta_3 \text{Chronic/Acute}_i + \varepsilon_i \qquad (13.7A1)$$

where ε_i represents random factors that may affect entry in the ith market.

Because the dependent variable is not continuous but instead, either 1 or 0, equation (13.7A1) cannot be efficiently estimated by ordinary least squares (OLS) regression. The linear feature of OLS means that it is quite likely that for plausible values of the independent variables the OLS estimates of the β_k coefficients will predict a value for entry outside the 0–1 interval.

Instead, Ellison and Ellison (2006) use an alternative regression procedure called Probit. This procedure effectively transforms the data so that for any value of the right-hand-side variables, the coefficient estimates give rise to a value for Entry_i that lies between 0 and 1. This predicted value is then a measure of the probability of entry given the market features. In turn, this allows them to classify each of their 64 markets as one of three types: (1) low probability of entry; (2) intermediate probability of entry; and (3) high probability of entry.

Ellison and Ellison (2006) next consider the strategic use of advertising to deter entry in these markets. They start by noting that in these cases, advertising by one firm has considerable spillover to the products of another. In particular, advertising by an incumbent calls attention to the specific functions of the drug, its potential benefits, its proper use, and so on, in a way that is likely to inform consumers of the benefit of later generic rivals. This is particularly the case with drugs since doctors are smart enough to realize that the active ingredients in branded medications and generics are chemically identical. It is even more the case in those states in which pharmacies are required by law to fill a prescription with a cheaper generic medication if one is available and the doctor has not explicitly forbidden it. In other words, Ellison and Ellison (2006) assume that advertising by an incumbent today will *help* tomorrow's generic entrant. Hence, if incumbents wish to deter entry, they should *reduce* advertising in the period prior to the expected emergence of a rival.

Of course, whether or not incumbents will wish to deter entry will depend in part on how likely entry is. A key insight of the Ellison and Ellison (2006) paper is that the relationship between the probability of entry and strategic deterrence efforts is likely to be nonmonotonic. This is because entry deterrence is probably not worth the cost either in markets where entry is highly probable or in ones where it is very unlikely. In the first case, no amount of deterrence is likely to prevent entry. In the second case, no deterrence is really necessary. Thus, Ellison and Ellison (2006) predict that deterrence efforts will first rise (relative to what they would otherwise be) as the probability of entry rises from a low value to an intermediate one, and then fall, as the probability of entry rises still further to a high value. In terms of advertising, this means that incumbents will *lower* their advertising in those markets that their Probit regression results characterize as having an intermediate probability of entry

Table 13.1 Detail advertising trend by category of entry probability, 64 pharmaceutical markets

Coefficient	*Estimated value*	*Standard error*
β_1	–0.007	0.013
β_2	–0.032	0.009
β_3	0.009	0.007

but exhibit no advertising response to the threat of entry in either low or high probability of entry markets. Again, this is because Ellison and Ellison (2006) assume that advertising by the incumbent also has strong benefits for the generic entrant. Reducing advertising prior to the period of potential entry can then make that entry less likely. To some extent, this is precisely what they find.

Consider so-called detail advertising. By this we mean the promotional efforts of pharmaceuticals to influence physicians' prescribing practices by visiting doctors and health care providers and making direct presentations in their offices. Ellison and Ellison (2006) look at the time trend in the value of detail advertising relative to its average in the three years prior to patent expiration for each month starting 36 months before that expiration and continuing for 12 months after by estimating the regression equation:

$$\frac{Advertising_{it}}{Average\ Advertising_i} - 1 = (\beta_1 LowEntry_i + \beta_2 IntermedEntry_i + \beta_3 HighEntry_i)Time + \varepsilon_{it} \quad (13.7A2)$$

The *Time* variable is just a trend term that increases by one as one moves a month closer to expiration date. The dependent variable is the ratio of advertising in the *i*th market in month *t* relative to average monthly detail advertising in that market. LowEntry, IntermedEntry, and HighEntry are each a 1,0 dummy variable indicating what entry category market *i* is in. The hypothesis is that β_2 will be significantly less than either β_1 or β_2, reflecting the efforts of incumbents in these markets to reduce advertising as a means of deterring entry. The estimated results are shown in the Table 13.1.

As you can see, the estimate of β_2 is noticeably smaller (algebraically) than either of the other two coefficients. That is, the results imply that while the incumbent's detail advertising declines by less than one percent per month relative to the norm in high entry markets (β_1) and actually rises a bit in low entry markets (β_3), it falls by over three percent per month in markets with an intermediate chance of entry. Thus, Ellison and Ellison (2006) provide some interesting evidence of strategic deterrence efforts in U.S. pharmaceutical markets in the late 1980s.

Summary

Allegations of pricing below cost to drive out a competitor and other comparable predatory strategies have been met in the last part of the twentieth century with increasing skepticism by the courts. This reflects the Chicago School view that predation is irrational. In the language of game theory, the Chicago view is that predation is neither a subgame perfect strategy nor a dominant strategy. Accordingly, few charges of predatory activity have been successfully prosecuted since the 1980s. The *Microsoft* case is, however, a notable exception in this regard.

At the same time, there appear to be clear cases of actual predatory conduct. As a result, an important question in contemporary industrial organization theory has been whether we can construct

plausible models in which predatory actions are rational. The answer turns out to be yes and numerous game theoretic models have now been developed that overturn the logic of the Chain Store Paradox.

An important common feature in many of these models is asymmetric information. Asymmetries between a lender and a firm regarding the firm's true profitability, or between an established firm and an upstart regarding the incumbent's cost can make predation a feasible and attractive strategy. Even without such uncertainty, long-term and/or tying contracts can also be used to deny rivals a market. Yet while the viability of predation in both theory and practice seems clear, the proper role of public policy remains clouded.

The principal problem is one of distinguishing aggressive pricing and other competitive strategies from ones that are truly predatory—profitable only if they succeed in driving a rival out of business. Some antitrust enforcement—especially those cases prosecuted under the Robinson-Patman Act in the first 35 years after it was passed—appear to have been misguided efforts to protect competitors and not competition. Both economists and the courts continue to struggle with the implementation of a workable definition of predation. Empirical work testing systematic entry deterrence has been challenged by the data requirements necessary to identify predatory behavior across a set of market data points. Nevertheless, this is an active research area in empirical industrial organization, holding promise for policy makers seeking to implement and enforce antitrust laws on predatory behavior.

Problems

1. Return to the Microhard Newvel game as discussed in section 13.1. Suppose now that Newvel's fixed costs are only \$80 million per period. What would be the loan contract that a bank in a competitive banking industry would accept to loan Newvel \$80 million in each period? Now suppose that the worst case scenario facing Newvel worsens. Specifically there is a 50 percent chance of earning \$200 million and a 50 percent chance of earning only \$40 million. Fixed costs are \$80 million per period. Now what would be the loan contract that a bank in a competitive banking industry would accept to loan Newvel \$80 million in each period?

2. An incumbent firm operates in a local computer market, which is a natural monopoly. That is, there is room for only one firm to sell profitably in this market. Market demand for the good is estimated to be $Q^D = 100 - P$. Another firm would like to enter this market, but only if the incumbent firm has a higher unit cost then it does. Specifically, there is a 25 percent chance that the incumbent is a low cost firm, with a unit cost equal to 20, and there is a 75 percent chance that the incumbent is a high cost firm with a unit cost of 30. The entrant's unit cost is 25. The entrant knows its costs but not that of the incumbent. The incumbent does know its unit cost. Market demand is common knowledge to both firms. The entrant however does get to observe the current or pre-entry market price at which the incumbent sells its good. If the entrant decides to enter the market it incurs a set-up cost of \$1,000. Does the high cost firm have an incentive to set a low price in order to masquerade as a low cost firm?

3. Suppose a buyer is willing to pay up to 200 for one unit of some good. There is currently only one supplier of the good and the cost of supplying one unit of the good is 100. Next period a rival supplier may appear in the market. The rival's cost of supplying the good is not known. It is assumed to be uniformly distributed on the interval [50, 150]. Describe a long term contract that the current supplier can offer the buyer that will be attractive to the buyer and that at the same time will strengthen the monopoly power of the current supplier.

4. An incumbent firm has a cost function: $C_I = 100 + 1.5q_I^2$. Hence, its marginal cost is given by: $MC_I = 3q_I$. Recently, an upstart firm has entered the market. The upstart has the cost function: $C_U = 100 + 110q_U$. Suppose the incumbent sets a price of 74 and meets all the demand at that price.
   a. Does the incumbent's behavior violate the Areeda-Turner rule of selling below marginal cost?
   b. Does the incumbent's behavior violate the Areeda-Turner rule when average variable cost is used as a proxy for marginal cost?

References

Aghion, P. and P. Bolton. 1987. "Contracts as a Barrier to Entry." *American Economic Review* 77 (June): 388–401.

Areeda, P. E. and D. F. Turner. 1975. "Predatory Pricing and Related Practices under Section 2 of the Sherman Act." *Harvard Law Review* 88 (February): 697–733.

——. 1976. "Scherer on Predatory Pricing: A Reply." *Harvard Law Review* 89 (March): 891–900.

Baumol, W. J. 1979. "Quasi-permanence of Price Reductions: A Policy for Prevention of Predatory Pricing." *Yale Law Journal* 89, 1–26.

——. 1996. "Predation and the Logic of the Average Variable Cost Test." *Journal of Law & Economics* 39 (April): 49–72.

Benoit, J. P. 1984. "Financially Constrained Entry in a Game with Incomplete Information." *Rand Journal of Economics* 15 (Winter): 490–9.

Bolton, P. and D. Scharfstein. 1990. "A Theory of Predation Based on Agency Problems in Financial Contracting." *American Economic Review* 80 (March): 93–106.

Bork, R. 1978. *The Antitrust Paradox*. New York: Basic Books.

Brandeis, Louis. 1913. "Cutthroat Prices: The Competition That Kills." *Harpers Weekly* (15 November): 10–12.

Brodley, J., P. Bolton, and M. Riordan. 2001. "Predatory Pricing: Strategic Theory and Legal Policy." *Georgetown Law Review* 88 (August): 2239–330

Burns, M. R. 1986. "Predatory Pricing and the Acquisition Cost of Competitors." *Journal of Political Economy* 94, (April): 266–96.

Cabral, L. M. B. and M. J. Riordan. 1997. "The Learning Curve, Predation, Antitrust, and Welfare." *Journal of Industrial Economics* 45 (June): 155–69.

Dixit, A. 1980. "The Role of Investment in Entry Deterrence." *Economic Journal* 90 (March): 95–106.

Easterbrook, F. H. 1984. "The Limits of Antitrust." *Texas Law Review* 63 (January): 1–40.

Ellison, G. and S. Ellison. 2006. "Strategic Entry Deterrence and the Behavior of Pharmaceutical Incumbents Prior to Patent Expiration." Working Paper, MIT Economics Department.

Fudenberg, D. and J. Tirole. 1986. "A Signal-jamming Theory of Predation." *Rand Journal of Economics* 17 (Autumn): 366–76.

Gabszewicz, J., L. Pepall, and J.-F. Thisse. 1992. "Sequential Entry with Brand Loyalty Caused by Consumer Entry-By-Doing." *Journal of Industrial Economics* 60 (December): 397–416.

Genesove, D. and W. Mullin. 1998. "Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890–1914." *Rand Journal of Economics* 14 (Summer): 355–77.

Gilbert, R. 1989. "Mobility Barriers and the Value of Incumbency." In R. Schamalansee and R. Willig, eds., *Handbook of Industrial Organization, Vol. 1*. Amsterdam: North-Holland.

Joskow, P. L. and A. K. Klevorick. 1979. "A Framework for Analyzing Predatory Pricing Policy." *Yale Law Journal* 89 (December): 213–70.

Koller, R. H. II. 1971. "The Myth of Predatory Pricing: An Empirical Study." *Antitrust Law & Economics Review* 4 (Summer): 105–143.

McGee, J. S., 1958. "Predatory Price Cutting: The Standard Oil (N.J.) Case." *Journal of Law and Economics* 1 (April): 137–69.

——. 1980. "Predatory Pricing Revisited." *Journal of Law and Economics* 23 (October): 289–330.

Milgrom, P. and J. Roberts. 1982. "Limit Pricing and Entry under Incomplete Information: An Equilibrium Analysis." *Econometrica* 50 (March): 443–60.

Ordover, J. A. and G. Saloner, 1989. "Predation, Monopolization and Antitrust." In R. Schmalansee and R. Willig, eds., *Handbook of Industrial Organization*. Vol. 1. Amsterdam: North-Holland, 537–95.

Ordover, J. A. and R. Willig. 1981. "An Economic Definition of Predation: Pricing and Product Innovation." *Yale Law Journal* 91 (November): 8–53.

Posner, R. 1976. *Antitrust Law: An Economic Perspective*. Chicago: University of Chicago Press.

Phlips, L. 1995. *Competition Policy: A Game Theoretic Analysis*. Cambridge: Cambridge University Press.

Rasmusen, E. 2007. *Games and Information*. 4th edition. Cambridge, MA: Blackwell.

Rasmusen, E., J. M. Ramseyer, and J. Wiley. 1991. "Naked Exclusion." *American Economic Review* 81 (December): 1137–45.

Saloner, G. 1987. "Predation, Mergers And Incomplete Information." *Rand Journal of Economics* 18 (Summer): 165–86.

Scherer, F. M. 1976. "Predatory Pricing and the Sherman Act: A Comment." *Harvard Law Review* 89 (March): 869–90.

Scott Morton, F. 1997. "Entry and Predation: British Shipping Cartels, 1879–1929." *Journal of Economics and Management Strategy* 6 (Winter): 679–724.

——. 2000. "Barriers to Entry, Brand Advertising, and Generic Entry in the U.S. Pharmaceutical Industry." *International Journal of Industrial Organization* 18 (October): 1085–1124.

Tirole, J. 1988. *The Theory of Industrial Organization*. Cambridge. MA: MIT Press.

Williamson, O. E. 1977. "Predatory Pricing: A Strategic and Welfare Analysis." *Yale Law Journal* 87 (December): 284–340.

Yamey, Basil, S. 1972. "Predatory Price Cutting: Notes and Comments." *Journal of Law and Economics* 15 (April): 129–42.

Yergin, D. 1991. *The Prize*. New York: Simon and Schuster.