firm i requires one unit of capacity input K and one unit of a variable input L. These are available at the cost of r and w per unit, respectively.

The game has two stages. In the first stage, the incumbent makes an initial capacity choice $\overline{K_1}$. The incumbent's capacity can be further increased in stage two of the game but cannot be reduced.

The potential entrant observes the incumbent's stage one capacity choice and makes its entry decision in stage two. It is only after that observation that the potential entrant makes its entry decision in stage two. If entry occurs then stage two is characterized by simultaneous quantity competition. Market demand in stage two is described by $P = A - (q_1 + q_2)$. Both firms simultaneously choose both outputs (q_1, q_2) and their *final* capacity levels (K_1, K_2) in stage two. For the incumbent, however, $K_1 \geq \overline{K_1}$. Hence, the incumbent's cost function in stage two of the game:

$$\begin{aligned} C_1(q_1, q_2; \overline{K}_1) &= F_1 + wq_1 + r\overline{K}_1 \quad \text{for } q_1 \leq \overline{K}_1; \\ &= F_1 + (w + r)q_1, \quad \text{for } q_1 > \overline{K}_1; \end{aligned} \tag{12.A1}$$

The entrant makes no initial capacity investment in stage one. Hence, its cost function in stage two is:

$$C_2(q_2) = F_2 + (w + r)q_2; \tag{12.A2}$$

implying a constant marginal cost of $w + r$ at all levels of production.

The incumbent firm's operating profit (revenue less variable cost) in stage 2 is:

$$\pi_1(q_1, q_2, \overline{K_1}) = [A - (q_1 + q_2)]q_1 - wq_1 \quad \text{for } q_1 \leq \overline{K_1} \tag{12.A3a}$$

$$\pi_1(q_1, q_2, \overline{K_1}) = [A - (q_1 + q_2)]q_1 - wq_1 - r(q_1 - \overline{K}_1) \quad \text{for } q_1 > \overline{K_1} \tag{12.A3b}$$

Maximizing either (12.A13a) or (12.A3b) with respect to q_1 yields the incumbent's best response function:

$$q_1^* = \frac{(A - w)}{2} - \frac{q_2}{2} \quad \text{when } q_1^* \leq \overline{K_1}\text{, and} \tag{12.A4a}$$

$$q_1^* = \frac{(A - w - r)}{2} - \frac{q_2}{2} \quad \text{when } q_1^* > \overline{K_1} \tag{12.A4b}$$

The incumbent's best response function makes a discrete shift at $q_1 = \overline{K_1}$ due to a change in marginal cost. Total cost remains: $wq_1 + r\overline{K_1} + F_1$ regardless of the value of $\overline{K_1}$.

If it enters, the entrant's total profit in stage two is:

$$\pi_2(q_1, q_2, \overline{K_1}) = [A - (q_1 + q_2)]q_2 - [(w + r)q_2 + F_2] \tag{12.A5}$$

Maximization with respect to q_2 yields entrant's best response function is:

$$q_2^* = \frac{(A - w - r)}{2} - \frac{q_1}{2} \tag{12.A6}$$

Equation (12.A6) applies only so long as $\pi_2(q_1^*, q_2^*, \overline{K_1}) = [A - (q_1^* + q_2^*)]q_2 - [(w + r)q_2^* - F_2] \geq 0$. If instead $\pi_2(q_1^*, q_2^*, \overline{K_1}) \leq 0$, the entrant will not enter and firm 1 will be a monopoly.

For any choice of $\overline{K}_1$ satisfying $\frac{A-w-r}{3} \leq \overline{K}_1 \leq \frac{A-w-r}{2}$ the incumbent can commit to a second-period output of $q_1 = \overline{K}_1$. The best choice within this range is for the incumbent to commit to the Stackelberg leader output of $q_1 = \overline{K}_1 = \frac{A-w-r}{2}$. Hence, the entrant (if it enters) will produce $q_2 \leq \frac{A-w-r}{4}$. This gives rise to thee cases.

***Case* 1**: F_2 is sufficiently large that the entrant earns a negative profit at $q_2^* \leq \frac{(A-w-r)}{4}$. Entry is not possible. The incumbent will choose the monopoly output $q^M = \frac{A-w-r}{2}$.

***Case* 2**: F_2 is sufficiently small that the entrant earns a nonnegative profit at an output of $q_2^* \leq \frac{A-w-2r}{3}$. No credible choice of initial capacity can prevent entry. However, the entry can be limited by the profit-maximizing choice of $\overline{K}_1$ equal to the monopoly output $\overline{K}_1 = q^M = \frac{A-w-r}{2}$.

***Case* 3:** F_2 is sufficiently small that the entrant can earn positive profit at $q_2 = \frac{A-w-2r}{3}$ but not at $q_2 = \frac{A-w-r}{4}$. There is an initial capacity choice $\overline{K}_1^{**}$ satisfying $\frac{A-w-r}{2} \leq \overline{K}_1^{**} \leq \frac{A-w+r}{3}$, such that the entrant's best response to $q_1 = \overline{K}_1^{**}$, i.e., $q_2 = \frac{A-w-r}{2} - \frac{\overline{K}_1^{**}}{2}$ yields non-positive profit. Hence, the incumbent can prevent entry by choosing initial capacity $\overline{K}_1^{**}$. It will do so if operating at $q_1 = \overline{K}_1^{**}$ as a monopoly yields more profit than operating as a Stackelberg leader at $q_1 = \frac{A-w-r}{2}$.

13

Predatory Conduct: More Recent Developments

At one level, predatory actions can be conceptually divided into two classifications: those aimed at preventing potential rivals from entering a market, and those aimed at driving existing rivals out of a market. Our discussion in Chapter 12 was largely framed in terms of the first of these categories, i.e., deterrence of potential rivals from entering. Yet it should be clear that while these two categories are conceptually distinct, in actual practice it is very difficult to distinguish them. Tactics used to prevent entry will often be identical to tactics that drive existing rivals to exit. Bundling may be a useful entry-deterring tactic. Yet it was the devastating effect on its actual rival Netscape that raised concern over Microsoft's bundling *Internet Explorer* with its *Windows* operating system. Indeed, from the 1911 *Standard Oil* case on, the vast bulk of antitrust litigation over predatory behavior has centered on cases alleging that a dominant firm abused its power to drive out competitors.

There are at least two reasons that the legal history surrounding charges of predatory behavior is so heavily dominated by cases alleging efforts of one firm to drive its rivals out of business rather than to prevent them from entering in the first place. One is that to be effective, entry deterrence requires credibility. When a firm operates in many markets or faces a number of potential entrants over time in a single market, it may be necessary (and worthwhile) to take on the expense of driving an existing rival from the market in order to establish its commitment to defend its market and thereby discourage any further entry.

A second and perhaps even more important reason, is that to accuse a firm of predatory behavior is to charge it with a criminal offense. Such a charge is a lot easier to prosecute when there is an actual victim whose losses are demonstrable rather than a potential victim whose losses may appear to be merely hypothetical. Yet this motivation also serves to point out a risk in using legal action to address claims of predatory tactics. As the data reviewed in Chapter 12 demonstrate, the truth is that life on the corporate battlefield is tough, and many firms will fail not because of predation but because they are inefficient, and/or produce low quality products. In considering claims of predation therefore, we must recognize the motivation that any unsuccessful firm has to claim that its failure is due to "bad" behavior on the part of a rival rather than its own incompetence. Accordingly, we must pay some attention to the conditions under which predatory actions to drive existing rivals out of business are truly rational if we want to separate instances of true predation from cases in which an inefficient firm is simply blaming someone else for its failure.

The most commonly alleged predation aimed at eliminating existing rivals is pricing below cost with a view to raising prices later when the competition has left. Supreme Court

Justice Louis Brandeis, a member of the *Standard Oil* court, was a particularly eloquent exponent of this theory of "predatory pricing." 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]

That the predatory pricing scenario Brandeis feared sometimes happens is largely beyond doubt. In the late 19th and early 20th 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] Likewise, the American Sugar Refining Company, also known as the Sugar Trust, responded to any significant entry attempt with a price war that drove the sugar price below cost. At the same time, it must be recognized that the logic of dynamic games emphasized earlier—and particularly the requirement for subgame perfection—casts some doubt on the rationality of the predatory pricing strategy. 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, then what? Any attempt by the predator to raise prices may well attract new rivals, negating the whole purpose of the predation. For this reason, more recent charges of predatory pricing against modern firms such as Wal-Mart,[3] AT&T,[4] Toyota and Mazda,[5] and American Airlines have provoked skeptical responses.

This chapter follows the work of Chapter 12 by further investigating strategies aimed at limiting the number of rivals. Because of its prominence, we start with the debate over predatory pricing. Thereafter, we investigate the logic of predation more deeply and, in particular, focus on the credible commitment that predation requires. 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. We therefore start with a careful analysis of the predatory pricing argument. We examine both its basic intuition and whether that intuition meets the formal rationality requirements and, in particular, the requirement of subgame perfection. We then consider variations of this theme and the ideas developed in Chapter 12 on entry deterrence and inducing the exit of rivals. One key difference between the strategies considered here and those analyzed in Chapter 12 is that virtually all of the models analyzed in this chapter are set in an environment of imperfect information so that the results of specific actions are uncertain *ex ante*.

1 Brandeis, L., 1913. "Cutthroat prices-the competition that kills," *Harper's Weekly* 15 (November): 10–12, cited in Holmes, (1996). See Ordover and Saloner (1989) for a discussion of a broad range of entry deterrence strategies, including predatory pricing.

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

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

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

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

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 US 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 11. 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. Rather than a potential entrant however, we will assume that the upstart Newvel has already entered the market in period 1, but that Microhard—perhaps based on its long-established record in other markets—nevertheless retains a first mover advantage in terms of deciding whether or not to engage in predatory practices in this first period. One important new twist is that now we assume that each firm incurs a fixed cost of \$115 million in 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 experience in other markets, 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 operating 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 loan's principal of \$115 million. As a result, Newvel will simply default and turn over the \$100 million it earned to the bank.

Because 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

[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).

million half of 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 however, 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 rather than not making the loan and earning nothing. 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 intends 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 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 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 credited 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 also 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 12 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 to do is imagine that for the first market period the leader is fully committed to producing an output so large that all of it can only be sold at a price just equal to its average cost of c. Because 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 its first period profit with the follower, say on a fifty-fifty basis, *both* firms still do better than they would under predation when both the predator and prey earned a zero profit in period one. Because the second period profit is unchanged by the merger, it seems clear that the merger strategy dominates the predatory one.

McGee's (1958) argument that predation is a dominated strategy is straightforward and compelling. Coupled with the possibility that predation may not be subgame perfect, McGee's analysis would seem to cast serious doubt on any allegation of predatory pricing.

However, there are some weaknesses in the McGee (1958) argument. To begin with, any merger between rival firms is a public event. In particular, the antitrust authorities will know about the merger and may easily file suit to prevent it. Indeed, the authorities may well be more concerned about a merger than they would be about predatory pricing because the merger would eliminate even the short, predatory period in which consumer prices are low. A second, and perhaps more important, weakness in the logic of McGee's merging strategy arises 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 to the rival firm to buy it out at the beginning of the first market period. 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.

Although there are some qualifications to 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

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

Pay for Delay—McGee on Drugs

In the 1990's two major drugs emerged to treat the millions of Americans who suffer from high blood pressure. *Cardizem CD*, produced by Sanofi (formerly Aventis), and *Hytrin*, produced by Abbott Laboratories, were both initially protected by patents. However, the 1984 Hatch-Waxman Act permits a generic producer to market its own drug by filing an Abbreviated New Drug Application (ANDA) in which the generic firm only has to show that its drug is the bioequivalent of the patented brand without replicating all the safety and efficacy tests of the original drug. The only requirement is that the generic applicant must show either that the original patent was not valid or that the new drug does not truly infringe the patent rights of the name brand product. Generic drug makers regularly do this and, of course, the patent holders reject such claims and file a countersuit claiming patent infringement. In that case, the Food and Drug Administration (FDA) cannot approve the new generic for at least thirty months or until the claim is resolved, whichever comes first.

Despite this legal hurdle, generic drugmakers still frequently challenge patents and enter the market mainly because there is the further incentive that the *first* generic to obtain approval is granted a 180-day exclusivity period vis-à-vis all other generics. Once one firm begins to sell a generic substitute, no other generic firm is allowed to do so for at least 180 days. This is exactly what happened when Andrx applied for permission to market a generic substitute for *Cardizem CD* and Geneva Pharmaceuticals requested authorization to market a generic substitute for *Hytrin*. Both Aventis and Abbott sued, and the automatic thirty month delay began. Yet as that period drew to a close and with no resolution in sight, each incumbent was faced with the imminent entry of a rival. Presumably, each firm could have pursued predatory pricing to deter entry. Instead each went the route proposed by McGee. They bought out the potential competitor.

Aventis agreed to pay Andrx \$10 million per quarter in return for *not* selling the *Cardizem* substitute as well as an additional \$60 million per year from 1998 until the end of the ongoing patent trial. A similar agreement was reached between Abbott and Geneva. Under the law, signing such an agreement means that the generic firm loses its 180-day exclusivity. However, that exclusivity does not then pass to the next generic entrant. So, any later generic entrant must worry about competition from still more entrants.

The *Cardizem* and *Hytrin* agreements were both ultimately held to be illegal [*In re Cardizem CD Antitrust Litig., 332 F.3d 896, 908 6th Cir. 2003*]. However, court opinion soon turned. In several cases of generic entry, including those involving the major breast cancer drug *Tamoxifen* and the super antibiotic *Cipro*, the courts approved such "pay for delay" agreements arguing that such payments might actually encourage more generic entry. However, the Federal Trade Commission (FTC) has consistently opposed these deals from the start. Its internal 2010 study estimated that the net effect of such agreements is to suppress competition with an estimated annual cost to consumers of \$3.5 billion. A new change came in July of 2012, when the Third Circuit Court of Appeals sided with the FTC and overturned a lower court ruling that had approved an agreement between Merck's Schering-Plough division and the generic firm Upsher-Smith paying to delay entry of Upsher's generic treatment for hypokalemia. The case is now headed to the Supreme Court. If it upholds the appellate decision, the large pharmaceutical companies may need some painkillers.

Source: J. Guidera and R. T. King, Jr., "Abbott Labs, Novartis Unit near Pact with FTC over Agreement on Hytrin," *Wall Street Journal* 14 March 2000, p. B6; "Pay-for-Delay: How Drug Company Payoffs Cost Consumers Billions," www.ftc.gov; and E. Wyatt, "For Big Drug Companies, a Headache Looms," *New York Times*, July 27 2012, p. B1.

dominant firm. There is also a third reason. As noted above, unsuccessful rivals always have an incentive to claim that they are victims of predation rather than victims of their own inefficiencies. Hence, claims of predation that come from failed rivals must be taken with a grain of salt.

For example, consider the famous *Utah Pie*[9] case decided by the US Supreme Court in 1967. Utah Pie was a producer of frozen dessert pies operating out of Salt Lake City and selling to supermarkets in 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 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 then, largely repudiated. Yet the point remains. Company officials will inevitably wish to claim that the cause of their profit and market share decline is illegal activity by rivals who are "not playing fairly" rather than confess 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, over the last twenty-five years or so, a new view—sometimes called the post-Chicago School—has emerged. In this alternative view, while predation claims are rightly treated with caution, there is no *a priori* dismissal of such charges because it is recognized that predatory tactics are not a theoretical impossibility and real world predation should not be viewed as 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 (1982) and focuses on the information asymmetry between the new rival, in our case Newvel, and the dominant incumbent rival Microhard.

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 (1986).

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 important fundamental 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, the net profit both to the Bank and to Newvel are shown. Because 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 were \$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 knows 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 over both periods. Two one-period contracts will just run into the same problem

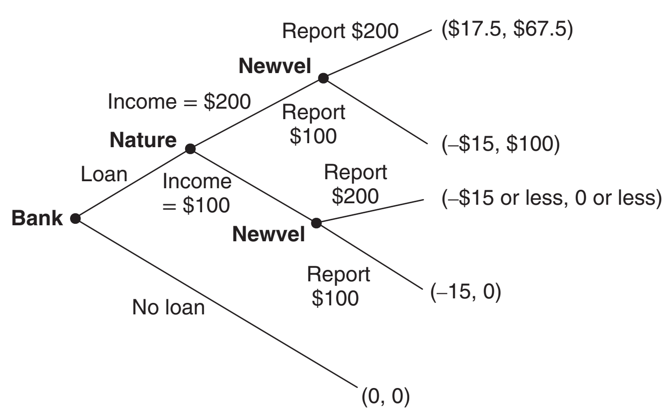

Figure 13.1 The bank and Newvel for just one period

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. Because 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 despite what happens by virtue of the 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 net profit from the two-period

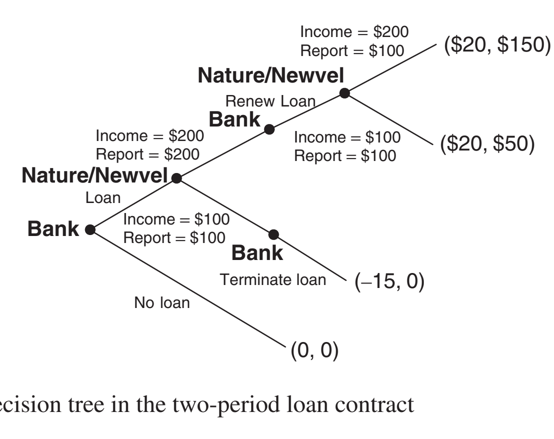

Figure 13.2 The decision tree in the two-period loan contract

contract is: $0.5[\$100 - \$115] + 0.5[(\$150 - \$115) + (\$100 - \$115)] = \$2.5$ 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. At the end of the first period, it either receives a net payment of [\$200 − \$150] or nothing, each with probability 0.5 so that the expected payment at the end of the first period is \$25 million. 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, for an expected second-period income of \$50 million. Because the *ex ante* probability of reaching the second period is just 0.5, the firm's *ex ante* expected profit for the second period is another \$25 million so that the overall expected profit over both periods 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 below cost, its profit is reduced by \$30 million. By cutting prices low Microhard can raise the probability that Newvel will fail from 50 to 70 percent. Because 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 $0.5 \times \$150$ million $+ 0.5 \times \$325$ million $= \$237.5$ to $0.3 \times \$150 + 0.7 \times \$325 = \$272.5$, 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. Nevertheless, the optimal contract is a two-period one that

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

cannot look at the second period alone. As a result, this contract must call for Newvel's premature death if it does not report a good outcome in period one in order to keep Newvel honest.[12]

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 percent 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. Each firm also knows that the other also understands all of this. 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 Microhard 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 again 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

[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.

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 because 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 able to compete less 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

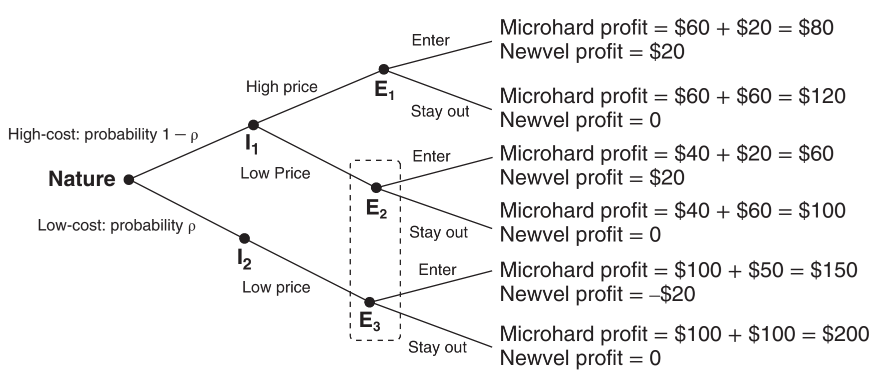

Figure 13.3 Extensive form of the sequential entry game with asymmetric information on cost

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 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 the entrant's decision to enter in the second period. 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 best 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 the first period. 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 then to earn a profit 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 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. Because 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: $-\$20\rho + \$20(1-\rho) = 20 - 40\rho$ (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 that 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 again is what we mean by predatory conduct.[13]

In sum, both the Bolton and Scharfstein (1990) and the Milgrom and Roberts (1982) models show how pricing below cost or 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 they can manipulate or exploit that information asymmetry in a way that eliminates rival firms.

Now recall McGee's (1958) claim that predatory pricing is dominated by the alternative strategy of eliminating rivals by buying them out. As we noted earlier, there are weaknesses in this argument, perhaps most notably the fact that buying out any rival is likely to encourage more and more rivals to enter just for the privilege of being bought out. Yet ignoring those issues for the moment, it does seem reasonable to ask if the profitability of predatory tactics in the informationally asymmetric settings just described is indeed less than the profitability of merging in these environments.

The simple answer is that it is difficult to say without more information. There are numerous private lawsuits filed by alleged victims of predatory tactics and few of these plaintiffs appear to have had the option of merging. This suggests that the issues raised earlier about the feasibility of McGee's "buy out your rival" strategy are real. Yet there is also a more complex answer, which is that the two tactics are not mutually exclusive. Indeed, predatory pricing and corporate acquisition may both be part of the same overall

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 pay-off 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 pay-offs are such that it will always fight in every market; and with probability $1 - p^0$ Microhard is believed to be "weak" (i.e., 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 will always enter no matter what Microhard does; and to be "weak" with probability $1 - q^0$, in which case the entrant's pay-offs 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 "fewer."

strategy. This is the idea in the take-over game analyzed by Saloner (1987) that is somewhat similar to the Bolton and Scharfstein (1990) model. In that game, the incumbent may cut prices low to reduce the profitability of the entrant precisely because by making the entrant less profitable, the incumbent can buy this rival at a lower cost.

Burns (1986) offers evidence that American Tobacco used the predatory pricing tactic exactly in this manner to acquire many of the forty-three rival firms that it ultimately bought. Specifically, Burns (1986) finds that after identifying the target rival it wished to eliminate, American Tobacco would then 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—25 percent lower by Burns' (1986) estimates.[14] Brevoort and Marvel (2004) report similar tactics by the National Cash Register (NCR) company, except that in this case, price reductions on specialized product lines were accompanied by harassing lawsuits charging the rival with violating NCR's patent rights. Brevoort and Marvel (2004) find one case that particularly stands out, namely, NCR's purchase of a rival named The Ideal Register Co. After repeated price cuts and legal challenges, Ideal eventually consented to being acquired by NCR for about $12,000 despite the fact that internal company documents suggested that NCR was willing to pay as much as $125,000 for Ideal.

13.3 CONTRACTS AS A BARRIER TO ENTRY

Our discussion of preemption in the previous chapter suggested that early building of plant capacity might be useful in persuading buyers to contract for purchases later. This suggests that part of the preemption story is related to the nature of contracts. Experience confirms this intuition. For example, while much of the Microsoft antitrust trial has focused on Microsoft's practice of bundling its *Internet Explorer* web browser in with its *Windows* operating system, that was not the only issue of concern. 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.

Indeed, concerns that contractual requirements may be used to exclude rivals have been an important issue in antitrust litigation for well over 100 years. The troubling contract provisions and the attendant antitrust concerns over this time span are perhaps best illustrated by the cases involving the United Shoe Machinery (USM) company. The first of these was decided in 1918, the next in 1922, and the most well known in 1953.

USM was created in 1899 as a result of the merger of seven separate shoe machine firms. In general, these firms produced machines related either to different types of shoes or to different parts of the shoe-making business, i.e., they were mostly complementary machines. Nevertheless, the new USM started with control of 60 to 70 percent of all North American shoe machine manufacturing. From the very beginning, USM followed a policy of not selling but only leasing its machines to shoe-making companies. It was the terms of these lease contracts that repeatedly landed the company in the courts.

[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.

To begin with, USM leases were long, lasing seventeen years. If the shoe company using the machine needed to add capacity, it had to lease another USM machine. Typically the shoe-maker needed different types of machines, and the contracts required that if the firm leased one type of USM machine, it had to use other USM machines for other kinds of work. Conversely, if a shoe manufacturer violated the terms of its contract for one type of machine, USM had the right to terminate the firm's leases for all of its USM machines. It may seem clear that some or all of these provisions were aimed at foreclosing the market to rival shoe-machine makers. Nevertheless, the Supreme Court initially sided with USM and permitted the lease only policy and the terms of the leases to remain. In reaching this judgment, the Court relied largely on a simple point. If these restrictions were harmful to shoemakers, why did they sign the contracts? This is an important question. If a shoe manufacturer understands that there is an alternative machine producer that will come on line soon, why should it sign a contract with USM that will prevent it from later contracting with this alternative supplier?

Prominent Chicago School scholars such as Bork (1978) and Posner (1976) have used the voluntary nature of restrictive contracts as a major reason to be skeptical that such contracts are a predatory device. In their view, any contract signed must give not just the supplier but also the buyer some benefit—say by way of increased service or repair. In turn, this implies that the deal ratified by the contract must be a step toward greater efficiency. These proponents of the Chicago School emphasize the efficiency grounds for observed contracts rather than the predatory motive. As we shall see, however, more recent theory has provided consistent arguments supporting the view that predation can occur in this rational world. We present two basic analyses showing 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, Rasmeyer, and Wiley (1991). We briefly present a numerical example illustrating each model in turn.

13.3.1 Long-Term Exclusive Contracts as Predatory Instruments

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 we will assume 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 its true cost as the buyer will be charged \$50 no matter the cost.

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 because a buyer values the product at \$100, the buyer 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 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 the 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 occur 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. Because 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.

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 fifty-two 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 2000. 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.

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 of the time it will be underbid by the new entrant. When it does sell at $100, the incumbent makes a profit of $50. Because this happens with probability 1/2, the monopoly seller's expected profit in the second period 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. Because 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:

$$3/4 \times (\$75 - \$50) + 1/4 \times \$50 = \$31.25 > \$25 \tag{13.2}$$

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 never to 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.

13.3.2 Naked Exclusion

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 total that it earns in operating profit from each customer will, in total, cover the firm's 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, the entrant will not find entry attractive.

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 of them will be able to buy the input at $70 if, and only if, each signs an exclusive contract promising not to buy from any other supplier. Why might this work?

Each buyer offered an exclusive contract with a purchase price of $70 now has to worry. 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 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 that 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).

13.3.3 Tying Contracts

We discussed bundling as an entry-deterring strategy in both Chapters 4 and 12. As tying is more or less a generalization of bundling, it should not be surprising that similar arguments apply to tying contracts as well. Of course, the Chicago School's "only one profit" approach eloquently presented by Posner (1976) and Bork (1978) among others, rejects the use of bundling or tying as part of a predatory strategy. In that view, centered on complementary products such as cameras and film, or food and lodging, what consumers really value is the combined good—e.g., a room and a meal. In that case, any rise in the price of, say, a meal will only lower the price that can be charged for a room. In this view, a monopoly hotel owner on a small resort island, for example, has little incentive to try to monopolize the local restaurant market.[15]

There are, however, at least three responses to the Chicago School analysis. First, while visiting tourists may be interested in both food and lodging, there are likely local residents who are interested only in restaurant meals. If this segment of the meals market is large, then we really have two independent goods and correspondingly, two independent markets. In this case, there is not "one monopoly profit" but effectively two—one for each market. As a result, tying can be profitable if it helps the hotel owner establish a monopoly in this second, largely unrelated market—say by denying an upstart restaurant enough consumers from those who value both goods such that the entrant cannot cover its average cost.

A second reason that the hotel owner (or the camera maker, etc.) may want to use tying or bundling to exclude rivals in a second market is that failure to do so may eventually lead to the loss of monopoly in the basic commodity. Thus, if the hotel owner does not eliminate rival restaurants on the island, one of these may eventually build a motel.

Finally, as we saw in Chapter 8, both tying and bundling are also techniques of price discrimination. While such price discrimination may eliminate a competitive film market (recall Microsoft and Netscape), it must nevertheless be acknowledged that if the price discrimination motivation is paramount, the incumbent firm will pursue it independent of the presence of any rival. Hence, this is not predation. Moreover, to the extent that this price discrimination expands the market, it tends to raise welfare.

In short, there are good practical and theoretical reasons to believe that bundling/tying are often part of an entry-deterring or exit-encouraging strategy. Yet there are equally good reasons to see these tactics as part of sophisticated price discrimination techniques. While the early Chicago "only one profit" analysis likely fails to hold, the welfare implications of bundling and tying remain complicated. They can be resolved only on a case-by-case basis built on careful analysis of each market setting.

13.4 PREDATION AND REPUTATION

There is one other point that we wish to make about the profitability of predation. This is that firms rarely operate in just one market or for just one period. Whatever competition it faces in one market today, a firm can usually count on potential rivals emerging in its other markets or even the same market in the future. In such cases, the gains from predatory activity may include the establishment of a reputation that also deters these potential rivals in other markets and times.

For example, consider again our limit pricing game between Microhard and Newvel but with one change. This is that when Microhard is a high-cost firm and sets the low-cost optimal price as a monopolist, its profits really suffer. In particular, its profits fall from \$60 million to just \$19 million, i.e., the cost of misrepresentation is now \$41 million.

If this were the only change, the incumbent would no longer find it worthwhile to try to fool the entrant that it is a low-cost firm. The cost now is too high. As a high-cost firm with a second period monopoly, it earns \$60 million, while as a high cost duopolist it earns \$20 million. Thus, by persuading the entrant to stay out, the firm preserves \$40 million of profit. Yet, as just noted, our new assumption implies that to deter entry by initially pricing as a low-cost firm even though it is a high-cost one, the incumbent now incurs a cost of $41 million. So, the gain would not appear worth the cost.

However, the foregoing analysis neglects the fact that later rival entrants or entrants in other markets in which the incumbent operates are also watching. They too will use the incumbent's behavior at this time in this market to infer its type and therefore its behavior in later periods and/or other markets. Thus, by acting as a low-cost firm the incumbent gains a reputation for aggressive pricing that may be enough to deter these other rivals. If this is the case, the gains from "acting tough" in the current market and period in question include the profit increases the incumbent enjoys from keeping its position in these other periods and markets.

Needless to say, the advantage gained by establishing a reputation as a tough competitor is independent of whether that reputation is earned as a result of low pricing, insisting on long-term contracts, tying purchases, or other means. All of the predatory tactics we have discussed have enhanced value to the extent that they deter rivals in markets beyond the ones in which they are applied.

The favorable effect of a reputation for toughness are clearly evident in the history of the National Cash Register (NCR) company in the late 19th and early 20th centuries, documented by Brevoort and Marvel (2004). The cash register was a major advance at this time. Not only was it able to store money like the common till, but it was also able both to display the precise charge to customers in large visible digits and, most importantly, keep a running record of all the day's transactions—keeping clerks honest and providing valuable information to managers.

John Henry Patterson quickly saw the cash register's value. He bought the patent rights from the machine's creator, James Ritty, and established NCR in 1884, complete with an expanded sales force to promote the product. Sales and profits grew rapidly and, of course, soon attracted rival cash register firms. Patterson's response was to create a special division called the Competition Department. The purpose of this division was simple: use promotions and other tactics—including threats of patent infringement lawsuits and sabotage of rival machines—to suppress these rivals. A particularly widely used strategy was to have an NCR agent visit a customer using a rival machine and surreptitiously insert a piece of metal or other object to make the machine malfunction. As the owner examined and attempted to repair the machine, the NCR representative would appear and offer to replace the machine with an NCR model typically referred to as a "knocker." NCR knockers were typically low-end NCR models often modified to look like those of other firms to match customers' specific tastes. NCR sold the knockers at well below cost, especially when considering the salary and expenses of paying the NCR representatives selling them. In this way, NCR was able to cut prices selectively against rivals in any region that they appeared, rather than cut prices across the board.[15]

The results of NCR's aggressive campaigns against rivals were clear. By 1900, the company had 90 percent or more of the cash register market. Newsletters at the time suggested that over 95 percent of the cash register companies formed in the prior decade had gone out of business. Equally important for our purposes is the fact that there were virtually no new entrants into the business for the next twenty years, and the entry that began to occur after 1920 was due to NCR's signing a consent decree in court to limit its aggressive behavior. In short, NCR appears to have consciously engaged in predatory tactics and established a reputation for doing so with the goal of suppressing competition.

15 See Whinston (1990) for a complete and illuminating discussion for these issues.