PREDATOR-PREY MODELS

SEE *Predatory Pricing.*

PREDATORY PRICING

Predatory pricing is primarily a strategy of price reduction that intends to eliminate a rival firm and thus increase market power. More generally, the goal of predatory pricing may be to discipline or otherwise inhibit a competitor. Also, while price is typically the instrument used for this purpose, other actions may be taken, such as bundling, refusing to supply, or other practices that effectively raise the rival's cost of doing business. Predatory pricing is therefore just one form of predation—though arguably the most commonly practiced and studied.

Predatory pricing is a controversial issue in scholarly and legal circles alike. On one hand, price cuts can be used as a means to exclude rival firms and increase future market power. On the other, price cuts are the bread and butter of market competition. Thus it is very difficult to distinguish genuine competitive pricing from predatory (and thus anticompetitive) pricing; and even if predatory pricing has negative long run effects, in the short run it has the same positive effects of aggressive competitive pricing.

LEGAL PERSPECTIVES

Allegations of predatory behavior are as old as oligopoly competition. Starting in the nineteenth century, examples include ocean shipping, sugar, tobacco, oil, and others. For example, some historians argue that, in the late 1900s the Southern Bell Telephone Company effectively eliminated competition through a strategy of pricing below cost in response to entry.

Reviewing the evidence in one of the most prominent cases, *Standard Oil Company of New Jersey v. United States* 221 U.S. 1 (1911), economist John McGee argued that there is little support for the allegations of predatory behavior. More importantly, he argued that the concept of predatory pricing itself lacks logical consistency. Of the several reasons pointed out by McGee, one deserves special attention. McGee maintained that, in addition to the prey, the predator too suffers from predatory pricing. If the prey resists predation and remains active, then the predator eventually will give up its efforts. Anticipating this outcome, the prey is indeed better off resisting predatory efforts. Anticipating this outcome, in turn, the alleged predator is better off refraining from its predatory strategy. Even if the alleged prey were short of cash, it could always borrow from a bank with the (correct) prom-

ise that its losses are only temporary. One can hardly underestimate the influence of McGee's work, both in economics scholarship and in legal practice.

Early-twenty-first-century legal rulings in the United States illustrate a skeptical approach to the concept of predatory pricing. This is particularly apparent in two important decisions by the U.S. Supreme Court: *Matsushita Electric Industrial Co., Ltd. v. Zenith Radio Corp.,* 475 U.S. 574 (1986) and *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.,* 509 U.S. 209 (1993). Adopting the theories of McGee and his followers, the Court embraced the view that predatory pricing schemes are rarely attempted; and that, if attempted, their success is rare.

In contrast to the United States, the European Union's (EU) approach to predatory pricing (based on Article 82 of the European Community Treaty) is rather aggressive. For example, in 2003 France Telecom SA was fined for "offering its services at a loss" in the high-speed internet access market.

Broadly speaking, the U.S. and EU approaches to testing for predatory behavior are similar: They look for evidence that there is (a) a sacrifice of short-term profits; and (b) a reasonable expectation that such losses are compensated by long-term gains from greater market power. The main difference between the United States and Europe is the strength of the second requirement, which is weaker in Europe. (There is also some divergence with respect to part (a). Typically, evidence of short-term losses is gathered by comparing price to some measure of cost. The question is then what measure of cost makes the most theoretical and practical sense.)

ECONOMIC PERSPECTIVE

For a long time, McGee's analysis provided the only coherent economic theory of predatory pricing. But unlike legal practice, economic thinking has departed significantly from McGee's theory. The research suggests that there are several reasons why predatory pricing is a plausible strategy. One reason is asymmetry of information between predator and prey. By repeatedly fighting rivals with low prices, a predator increases its reputation for toughness; and thus encourages exit and discourages future entry. Alternatively, if the prey is uncertain about the predator's costs, then the latter's low prices signal that the predator's costs are low too, and so are the prey's long term prospects.

A related source of information asymmetry is between the prey and capital markets. One of the key points in McGee's case against predation is that, if the alleged prey were short of cash, banks should be willing to step in with a loan under the (correct) promise that the prey's losses are only temporary. But due to imperfect monitoring of the borrower's actions banks are forced to

offer contracts where future financing is contingent on repayment of current loans. In this context, the predator may have an incentive to price below cost: While the predator loses money, so does the prey; and to the extent that lower current profitability decreases the probability of loan repayment, the predator has something to gain in the long run—the possibility that the prey, unable to secure financing, will be forced out of the market.

Finally, a third class of equilibrium models of predatory pricing is based on dynamic effects through the firms' profit functions (either through demand or through costs). Consider the case of two competitors moving down the learning curve. If the lagging firm loses the current sale, it might find itself so far behind the race that exit is the best option. Anticipating such behavior, the leader has an incentive to price aggressively, possibly below cost, thus increasing the chances of monopolizing the market. Unlike the previous theories, this one does not rely on asymmetric information between firms or between firms and capital markets. Moreover, while the learning curve provides a natural link between current sales and future profits, there are several other examples: switching costs, installed base or network effects, and so forth.

In summary, although U.S. legal doctrine is rather skeptical with respect to predatory pricing, economic theory has provided a wealth of coherent explanations of why predation is plausible.

SEE ALSO *Antitrust Regulation; Competition; Competition, Imperfect; Competition, Marxist; Game Theory; Information, Asymmetric; Monopoly; Price Setting and Price Taking; Regulation*

BIBLIOGRAPHY

Bolton, Patrick, and David S. Scharfstein. 1990. A Theory of Predation Based on Agency Problems in Financial Contracting. *American Economic Review* 80 (1): 93–106.

Cabral, Luís M. B., and Michael H. Riordan. 1994. The Learning Curve, Market Dominance and Predatory Pricing. *Econometrica* 62 (5): 1115–1140.

Kreps, David M., and Robert Wilson. 1982. Reputation and Imperfect Information. *Journal of Economic Theory* 27: 253–279.

McGee, John S. 1958. Predatory Price Cutting: the Standard Oil (N.J.) Case. *Journal of Law and Economics* 1 (October): 137–169.

Milgrom, Paul R., and John Roberts. 1982a. Predation, Reputation and Entry Deterrence. *Journal of Economic Theory* 27: 280–312.

Milgrom, Paul R., and John Roberts. 1982b. Limit Pricing and Entry under Incomplete Information: An Equilibrium Analysis. *Econometrica* 50 (2): 443–460.

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PREDICTION

Prediction can be defined as "to declare in advance: foretell on the basis of observation, experience, or scientific reason" (Webster's 7th New Collegiate Dictionary). Predictions can be short-term, long-term, qualitative, quantitative, negative, positive, optimistic, or pessimistic. They can be based on hunches, guesses, folklore, astrology, palm reading, extrapolations from data, or scientific laws and theories or alleged laws of historical change. The term *prediction* overlaps with *prophecy* but has somewhat different connotations.

Not until the seventeenth and eighteenth centuries did prediction take on its modern connotations. Pierre-Simon Laplace (1749–1827), arguably its first major theorist, presented a systematic answer to the major theoretical and practical problem prediction raises: Why are we so successful in some areas of research (e.g., astronomy, physics, and chemistry) but conspicuously less successful in others, particularly human behavior? The most frequently given answers are that some phenomena are intrinsically unpredictable, or we are not using correct scientific methods, or the complexity of the phenomena rule it out, or it is due to limits of human ignorance, fallibility, and superstition. The twentieth century saw significant developments in the theory and practice of prediction, with simultaneous significant advances in predictive accuracy and a greater awareness of the limits of such accuracy.

EMPIRICAL AND PRAGMATIC SIGNIFICANCE

There are four major theories concerning the possibility of predictive success in the areas where, so far, they have been rather limited. The first is *Laplacian determinism*, named for Laplace, who asserted that an intelligence endowed with omniscience (who therefore would know the current position and velocity of all particles, as well as the laws that control their behavior) could predict every future event.

The second view, *the covering law model*, is based on the two principles involved in the Laplacian view. As developed by Karl Popper (1934), it requires that an adequate explanation be deduced from universal laws and initial conditions (a generalization of Laplace's positions and velocity). The more general and more precise the prediction, the better it is. This is because it is more testable, which in Popper's view means "falsifiable."

The third position, *probabilistic prediction,* is more modest but still in accordance with Laplace's view that our ignorance and fallibility forces us to rely on probability, not certainty, in our predictive endeavors. We can predict a 60 percent chance of rain this weekend, but not with the virtual certainty of astronomical predictions (e.g., that Venus will be in transit in 2112) or those based on