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STRATEGIC BUSINESS BEHAVIOR AND ANTITRUST

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Strategic Business Behavior and Antitrust*

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I. Introduction

During the seventies business consultants and academics became interested in "business strategy" as an instrument for improving profitability. The emphasis of this approach was generally on actions that a firm could take to improve its long run competitive position. At about the same time, there was a renewed interest by industrial organization economists and antitrust authorities in the possibility that monopoly power could be created or enhanced through predatory or limit pricing or through use of non-price instruments such as investments, patents, contracts, etc. Finally, the renaissance of game theory that also began in the seventies spawned a renewed interest in theories of oligopoly that explicitly incorporated dynamic and "strategic" elements.

One attempt to bring the business school and industrial organization approaches together was the FTC conference summarized in Salop (1981). At that conference, the leading proponent of the business school strategy perspective, Michael Porter, was brought together with influential proponents of the industrial organization perspective, such as Michael Spence and Steven Salop, in an attempt to develop a synthesis that could be applied in an antitrust context. Although the FTC volume was very useful in stimulating discussion, it did not provide a clear conceptualization of strategic behavior,

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* Forthcoming in *Economics and Antitrust Policy*, Robert J. Larner and James W. Meehan, Jr. (eds), Quorum Books.

or a framework for evaluating when strategic behavior would be anticompetitive.

Since the FTC conference, all three strands of literature on strategic behavior have mushroomed, and to a significant extent each has followed its own path. For example, Schmalensee's essay on the "new industrial organization" (Schmalensee (1982)) and the recent surveys of advances in oligopoly theory (Dixit (1982), Fudenberg and Tirole (1986), and Shapiro (1986)) pay little attention to the developing business school literature. As another example, a special issue of the Journal of Economic Theory (June, 1986) devoted exclusively to strategic behavior, bore no obvious relationship to either the business school or industrial organization literatures. Finally, Michael Porter's recent books on business strategy pass over the other literatures very lightly.

One purpose of this essay is to relate the antitrust implications of these literatures. We will focus primarily on the industrial organization literature, since that literature has the most to say about antitrust policy, although we will provide a conceptual framework that we believe provides some insight into all three literatures. Our aim has been to provide as technically simple a framework as is possible, consistent with the objective of distilling the antitrust implications of the more theoretical literature.

In section II we develop a conceptual framework for the analysis of strategic behavior. The section concludes with a definition of strategic behavior. Section III examines the classic models of strategy considered in the antitrust literature: predatory pricing and limit pricing. One topic given considerable attention in this section is the concept of *credibility*, as developed in the game theory literature. In Section IV the concept of

strategic precommitment is developed, beginning with Spence's capacity expansion entry deterrence model. Other types of strategic precommitment are also discussed. The section ends with a discussion of the literature on reputation and entry deterrence. Various types of strategic actions that may facilitate collusion are considered in section V. Finally, section VI attempts to summarize the antitrust implications of the recent literature on strategic behavior.

II. A Conceptual Framework for the Analysis of Strategic Behavior

We begin by motivating the issues that arise in the choice of a conceptual framework for the analysis of strategic behavior. Any definition of strategic behavior cannot hope to be all-inclusive of the many senses in which the term "strategy" has been used. Since the focus of this paper and volume is antitrust policy, we will limit our attention to business conduct that could have implications for competition policy.

The primary concern of antitrust is the direct exercise of market power, i.e., the possibility that a firm or group of firms may be able to reduce output below (or raise price above) the competitive level. The basic model of monopoly that identifies and quantifies the efficiency costs of exercised market power is now well known to both economists and antitrust practitioners.[2] Much of antitrust policy is concerned with simple horizontal conduct that restricts output and this conduct could not usually be termed strategic in any interesting sense. Whatever one takes strategic conduct to be, a price fixing conspiracy does not generally involve conduct that would merit categorization as strategic.[3] Similarly, strategic conduct beyond the transaction itself is not usually a matter of significant interest in the antitrust analysis of a horizontal merger.[4]

The types of conduct of concern to antitrust that are more appropriately classified as strategic are generally actions that work to create, enhance or protect market power, often by disadvantaging rivals. Predatory and limit pricing are examples that have received considerable attention. Another type of conduct that has historically been of concern in antitrust is "exclusionary" activity, one example being when a firm acquires control over an asset that is "essential" to its competitors' viability.[5]

We could limit our discussion of business strategies to conduct that injures rivals with the effect of creating or enhancing the market power of the perpetrator. This approach would, in principle, capture most types of strategic business behavior that have traditionally been the concern of the antitrust laws. One problem with this approach would be that it does not encompass all types of anticompetitive strategies, one example being those that benefit rivals by facilitating collusion. Would we not, for example, categorize as strategic sellers' adoption of provisions in sales contracts that facilitate collusion?[6]

However, even if we enlarged the scope of our inquiry to encompass some types of collusion-facilitating conduct, there is a more fundamental problem with attempting to limit the menu of actions to those that have anticompetitive effects: how do we determine when a particular strategy is anticompetitive? To better understand the nature of this problem, let us briefly describe the business school and antitrust economics literatures' approaches to business strategy and their relationship to developments in the literature on game theory.

A. The Business School Approach

The approach to strategy taken in the business school literature is typically based on a detailed consideration of a largely firm-specific historical development of a market. Important aspects of the internal organization of the firm often figure prominently in the analysis. The result is an institutionally rich, stylized model of a firm. What is missing in this approach, from an economic perspective, is a model that integrates the detailed exposition of a firm into an overall market equilibrium. At first glance, many of the strategies examined in the business strategy literature appear anticompetitive. However, it must not be forgotten that the effects of strategies are the result of an equilibrium involving the strategies of all the relevant actors in the market. The possibility of anticompetitive effects depends critically on the positions of the firm's actual or potential rivals. The institutional and structural environment faced by the firm places limits on the extent to which any type of conduct can be anticompetitive. After all, the essence of competition is to beat your rivals, and much business conduct that has the effect of injuring rivals is procompetitive (i.e., improves market performance).[7]

B. The Antitrust Economics Approach

Naturally, "strategic behavior" as the concept is used in the business school literature can, in some circumstances, have anticompetitive effects. This possibility is the focus of the antitrust economics literature. However, the assumptions of the models of strategic behavior in the antitrust economics literature usually guarantee that the strategist has or can obtain market power, and that efficiency-driven motivations or effects of strategies are absent. This approach is typical in economic modelling, which usually strives for simplicity in assumptions.[8]

Unfortunately, the analysis required to discern the competitive implications of various strategies is much more complex than that used to demonstrate the inefficiency of monopoly pricing. In the simple predatory pricing story, for example, consumers benefit in the short run and only lose in the long run if the predator succeeds in driving out the rival. The efficiency implications of other types of business strategy are even more difficult to derive. Does a large firm that augments its R&D expenditures to foreclose potential rivals impair efficiency because of reduced competition, or does it improve efficiency by hastening innovation? Does a firm that designs its products so that only a limited number of firms can produce compatible products injure rivals to the detriment of overall efficiency, or does such a policy efficiently police free riding? As a final example, do a set of trading rules agreed upon by competitors that, in principle, restrict competition (e.g., the New York Stock Exchange) reduce or improve economic welfare? Of course the antitrust laws generally recognize the ambiguity of the competitive effects of these types of conduct, by requiring a rule-of-reason analysis.

It would be useful to catalogue the types of conduct discussed in the business strategy and economics literatures according to the conditions under which the conduct is likely to be anticompetitive. But this would be a very major, if not impossible task; in any event, one that is beyond the scope of this modest survey. We will, however, provide some general discussion of the competitive implications of business strategy.

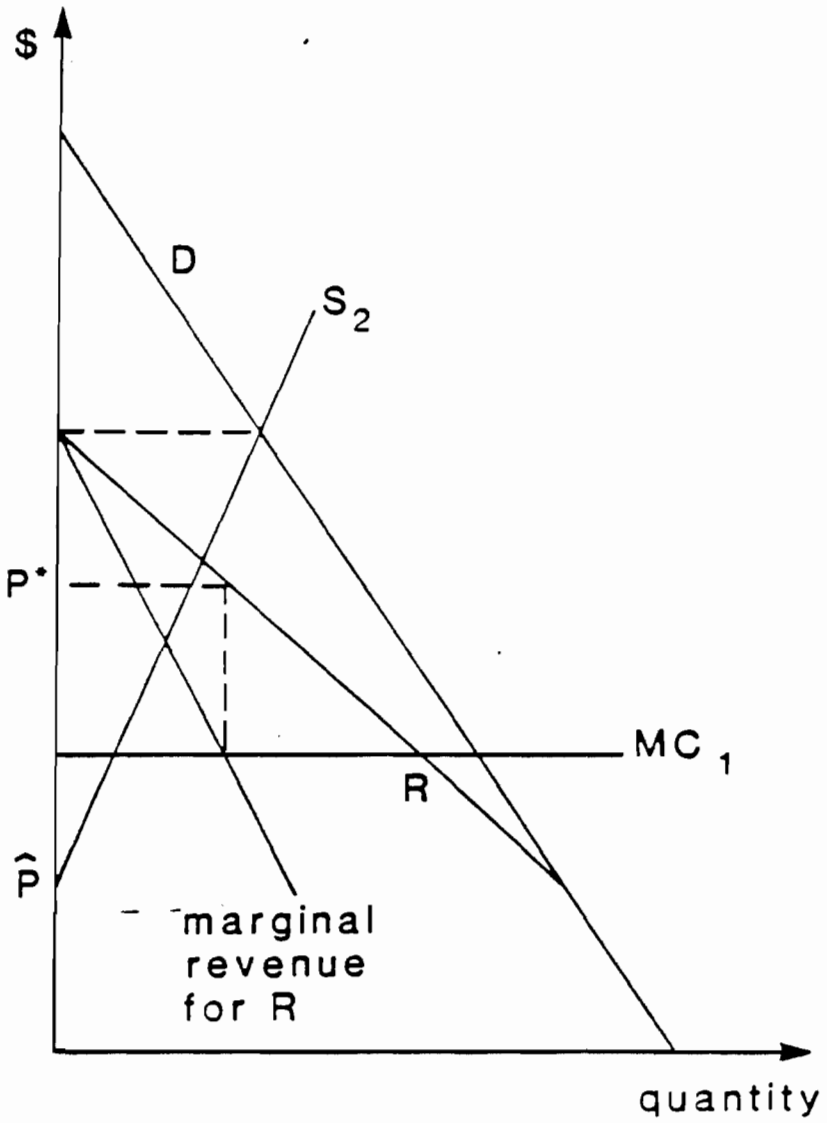
We will consider a broader category of strategies than those which are necessarily anticompetitive. The business strategy and antitrust economics literatures are primarily concerned with actions that individual firms can

take that expand or protect "their demand", generally at the expense of actual or potential rivals, or actions that lower their costs relative to their rivals. A smaller strand of literature is concerned with conduct that could facilitate collusion.

This distinction between practices that disadvantage rivals and those that facilitate collusion can be illustrated with the standard residual demand model in Figure 1. Here the market demand is D, the supply of the competitive fringe is S_2, and the horizontal difference between D and S_2 determines the residual demand, R, for the dominant-firm producer. The dominant firm, denoted G_1, will typically set a price, p^*, above its marginal cost, MC_1, as shown in Figure 1, but no strategically interesting conduct is present.[9] Strategic actions would be those designed to shift the residual demand curve upward, which would be accomplished by shifting D or S_2. For example, the dominant firm might be able to shift S_2 by "overbuying" a critical input used by the fringe in order to raise that input's price, or by obtaining a cost-increasing regulatory change.[10] Alternatively, residual demand could be shifted if market demand, D, could be shifted, for example by advertising or aggressive product promotion.[11] It is easily seen that strategic actions would be profitable if they result in a vertical shift in R that exceeds the vertical shift in the dominant firm's average cost.[12]

FIGURE 1

RESIDUAL DEMAND MODEL



Besides strategies that disadvantage rivals, producers might find it profitable to engage in forms of conduct that facilitate collusion. Suppose, for example, that there are several producers in G_1, with a supply curve MC_1, who somehow get themselves to act as if their supply curve were a higher supply curve that intersected R at the price p* in Figure 1. If such a strategy were not too costly, it would obviously be profitable. How would such a strategy work? Intuitively, since a competitor's supply is governed by his marginal costs, the strategy should change the producers' marginal costs. One method to accomplish this would be to sign contracts with suppliers of a critical input with prices that increase with the quantity purchased, but that preserved the nonstrategic *average* input price.[13]

There are many other types of strategic actions that can be analyzed with the residual demand model. For example, if learning by doing causes a firm's costs to shift down over time, the dominant firm may wish to expand its own market share by cutting price below p*.[14] A second example is predatory pricing; a price below $\underline{p}$ in Figure 1 would result in the exit of fringe firms. Both of these examples are dynamic in nature, and will be discussed more fully later after the necessary game-theoretic concepts are introduced.

C. The Game Theory Approach

Although residual demand analysis can be used to model a variety of interesting strategies, it is limited in two important respects: the simplistic modelling of the "victim" of the strategy, and the basically static nature of the analysis. Much of the economics literature has been concerned with dynamic, oligopolistic models of strategy. In his introduction to *Strategy, Predation, and Antitrust Analysis*, Salop (1981, pp.1-2) contrasts the dynamic

oligopoly emphasis of the "strategic approach" with traditional analysis that "... focused on oligopolistic interaction at a single moment of time among sellers who ignored the responses of rivals." The residual demand analysis that we have described thus far depends critically on the assumption that the firms in group 2 acted independently and competitively. If the "fringe" producers act as oligopolists or strategically in a more general sense, we could no longer represent their behavior by a competitive supply curve such as S_2. Game theory provides a method for analyzing such a situation.

In traditional static oligopoly models a firm's behavior is summarized by a *best response function* that specifies the optimal decision of the firm as a function of decisions made by rivals.[15] For example, suppose that firms E and I produce quantities denoted by q_E and q_I, respectively, and that price is determined by an industry demand function: $p = 10 - 2(q_E+q_I)$. Firm E, the "entrant," has a capacity of 1 if it enters, and firm I, the "incumbent," has a capacity of 5/2. If each firm has constant average cost of 4, the profits for various output combinations are as shown in Table IIA. In the language of game theory, the table shows the relationship between the players' strategies (choice of outputs) and their payoffs (profits).

Table IIA

Profits
with $p = 10-2(q_E+q_I)$ and $AC_i = 4$
(profit for firm I, profit for firm E)

	$q_E=0$	$q_E=1$
$q_I=1$	(4,0)	(2,2)
$q_I=1.5$	(4.5,0)	(1.5,.5)
$q_I=2$	(4,0)	(0,0)
$q_I=2.5$	(2.5,0)	(-2.5,-1)

The best response for firm I is 1.5 if $q_E=0$ and it is 1 if q_E is 1. The best response for firm E is 1 if q_I is less than 2 and 0 if q_I is greater than 2. As a matter of convention we assume that entry will not occur unless profits are strictly positive.[16] In Table IIA, profit levels for best responses are underlined, and it is apparent that the best responses for the two firms lead to an equilibrium in which each firm produces 1 unit. This is a *Cournot* equilibrium, or equivalently, a set of outputs that are consistent with these best response functions, *i.e.*, each firm's output is optimal given the outputs of the others, so no firm has an incentive to change its output unilaterally.[17]

Notice that each firm's best response in Table IIA tends to decrease as the other firm's output increases. If output quantities can be varied continuously, the best response functions for firms in a homogeneous product

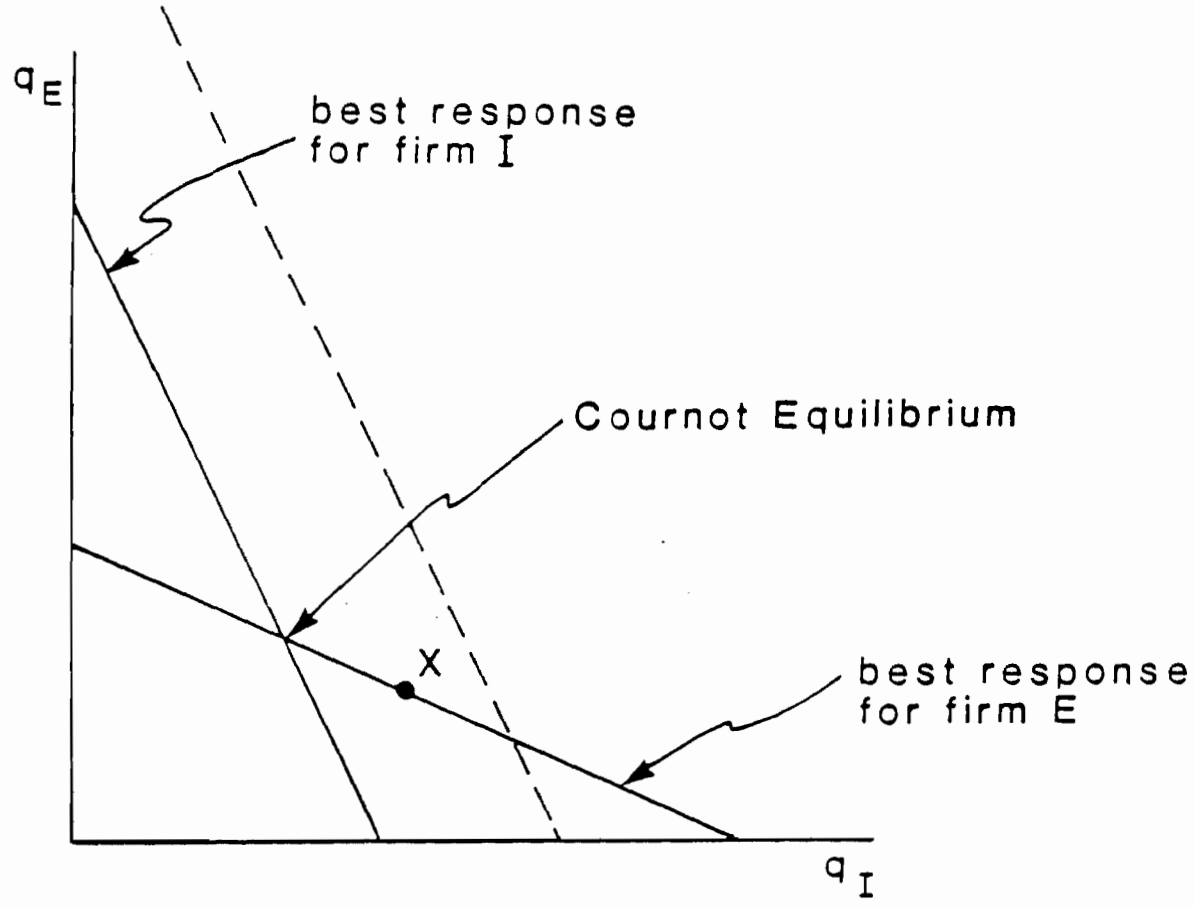
industry can be graphed as lines, and the Cournot equilibrium is depicted as the intersection of the duopolist's best response functions, as in Figure 2.

One of the earliest formal models of strategy is the Stackleberg duopoly model. In that model one duopolist is able to make a binding output choice, which the other reacts to. Thus, the leader essentially chooses his preferred point on the follower's best response function. This point would typically give the leader a higher market share; point X in Figure 2 could be such a point in which firm 1 is a leader. In Table IIA, the incumbent would lead with q_I=2, since we assume that the entrant will not enter unless profits are strictly positive. Thus the incumbent would earn a profit of 4 as a leader, as compared with a profit of 2 in the Cournot example. To become a Stackleberg leader, the firm would have to devise a strategic action that enables it to commit itself to an output first and then convey this information to the others.

It is easy to see how strategies of the type considered in our residual demand analysis can be modelled in a Cournot oligopoly model. A strategy that raises a rival Cournot oligopolist's costs would generally have the effect of shifting the rival's best response function in toward the origin, leading to higher profits for the other, "strategic," duopolist. Strategies that lower a firm's own costs shift its best response function out, expanding its share of the market.[18] Recent research has been concerned with how contracts between competitors or with buyers can facilitate responding profitably to interdependence, in essence by making the firms' best response functions explicitly take into account interdependence.

FIGURE 2

COURNOT MODEL



Although thus far we have considered only the Cournot model, it should be clear that the game-theoretic approach is easily generalized to other oligopoly models in which the strategic variables may be prices, advertising, etc. If there are strategies available to shift best response functions in these models, such strategies may be profitable, depending, of course, on the costs incurred in adopting such strategies. Examples in the economics literature abound, although the models are generally dynamic.

The easiest way to bring in dynamic considerations is to model firms' activities as a two-stage game, where some strategic action is taken "today" in order to produce a result "tomorrow." At their core, such two-stage models are simply elaborations of the static oligopoly games that we have just discussed. The analysis of the second stage typically involves an oligopoly model of some sort, such as Cournot. The actions taken in the first stage determine the nature of the best response functions that, in turn, determine the equilibrium decisions in the second stage. For example, an expansion in capacity may shift a firm's own best response function outward at high output levels, enabling it to deter entry (by guaranteeing low post-entry prices) and earn greater profits in future periods of increased demand. Alternatively, a firm may engage in cost-raising strategies that shift its rivals' best response functions.

D. A Definition of Strategic Behavior

The preceding discussion in this section suggests the following definition of strategic behavior: Strategic behavior involves actions that affect the best response functions of the "strategist" or of its rivals in a subsequent period. In game-theoretic terms, a strategic action affects the structure of the "subgame" that will be encountered in subsequent periods.

III. Predatory and Limit Pricing

A. The Classical Approach

The strategy given the most attention in the antitrust literature is predatory pricing. The idea of driving one's competitors out of business by underpricing them in order to gain a monopoly is very old, certainly antedating the provisions in the Sherman Act that deal with this sort of conduct. Limit pricing is analogous to predatory pricing. The only difference is that an entrant must bear the costs of entering, that have already been borne by incumbents. If none of the costs of entry are sunk, predatory pricing is exactly analogous to limit pricing.

Early notions of predation were based on the premise that the predator's power derived simply from its size relative to its victim. In essence, the model was of a bully who inflicted damage on his victim by price cuts. However, economists have long recognized that the predator needed some sort of cost advantage over its prey for price predation to be both successful and profitable.[19]

Naturally, if the predator has a sufficient advantage over its prey, predation will be both successful and profitable. However, in a situation in which the predator and prey have complete knowledge of demand and each other's costs, and the predator has a sufficient cost advantage that the net benefits of bankrupting the prey are positive, there is nothing in the predator's actions that is very interesting from a strategic perspective.[20] The predator's strategy simply involves a calculation of the relative profitability of predation and accommodation. Similarly, if the prey is fully cognizant of the facts that go into the predator's calculus, the only

"strategy" of interest to the fringe is the most profitable method and time to exit. Indeed, given such a scenario, it is unclear why the prey was ever in the market.[21]

Besides the absence of an interesting strategic issue, this simple model of predatory pricing provides little to discuss from a policy perspective. Under some elaborations of this story, the source of the predator's cost advantage could justify an argument that its eventual monopoly was "thrust upon" it, so that its "predatory pricing" incurred no antitrust liability. Alternatively, independent of the source of its cost advantage, if the size of the predator's cost advantage were sufficiently large that the predatory price exceeded the predator's average variable costs, its actions would incur no antitrust liability under the Areeda-Turner rule.

Rather than focus on whether the predator has any advantage over the prey, other than size, some discussions of predatory pricing have suggested that it may be possible to obtain a monopoly by a "threat" to outlast the other firm(s) in a price war. In essence, the theory behind the predator's threat is that the threat can convince the prey that the predator will continue the price war at whatever cost, until the prey exits. In considering whether such a threat would be viable, the discussion generally focused on whether the predator had sufficient financial resources (e.g., a "deeper pocket") to outlast the prey. Before we discuss the viability of such threats, it is useful to introduce a simple example that illustrates the strategic possibilities for the dominant firm with a size advantage. For expositional simplicity we will discuss the model in terms of limit pricing instead of predation, but we will show that the general results are applicable to predation.

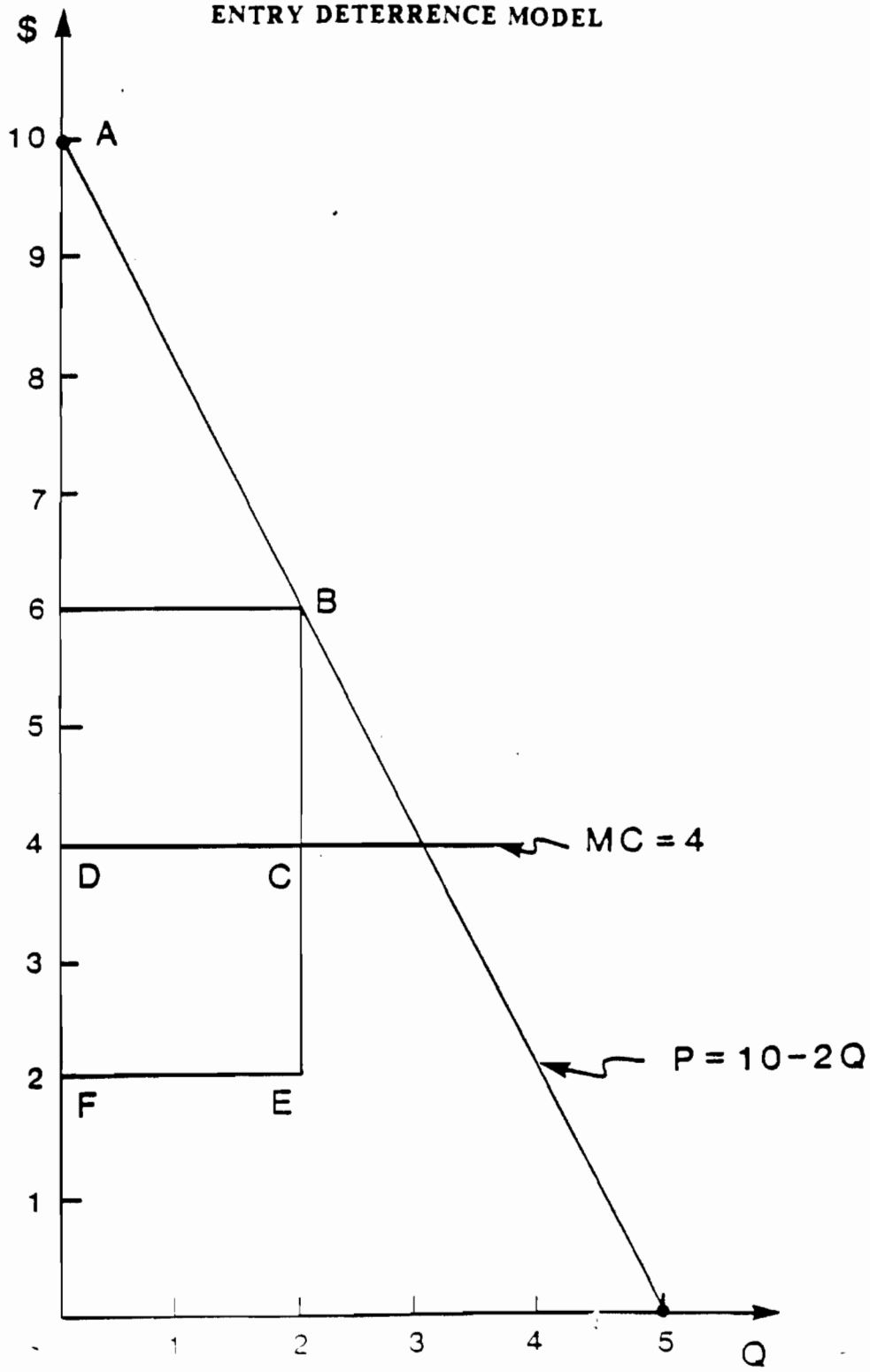
We begin with a variation of the example of the previous section. As before, demand is linear: $p = 10 - 2Q$, as shown in Figure 3. The outputs of the (potential) entrant and the incumbent are denoted by q_E and q_I, respectively. The incumbent is assumed here to have a sunk cost of $3/2 and a constant marginal cost of $4 per unit of output. We assume that the entrant can only have a capacity of one unit, so the entrant's marginal cost curve becomes vertical at $q_E = 1$. It is also assumed that an entrant would incur a fixed cost (per unit of time) of $1, and that the entrant's marginal costs are also $4. Since the entrant's capacity cannot exceed 1, the only advantage of the incumbent is one of maximum size.

As a matter of convention, we again assume that entry will not occur unless anticipated profits are strictly positive (rather than non-negative). In this example, a price of $5 would appear to deter entry (or induce exit of the entrant) because, with a marginal cost of $4, there is no feasible output for the entrant that would yield operating profits in excess of the fixed costs of $1. The incumbent would sell 5/2 units of output at the limit price, which is above the output of 3/2 that maximizes profit in the absence of entry (as can be seen by subtracting the fixed cost from the incumbent's profit numbers in the left column of Table IIA).

Notice that a policy of maintaining the price at $5 in the event of entry means that the incumbent accommodates the entrant by keeping industry output constant in spite of entry. In other words, the incumbent reduces its output by the increment added by the entrant. Modiglianni (1958) argued that it was not reasonable for the entrant to expect that the

FIGURE 3

ENTRY DETERRENCE MODEL



incumbent would reduce output in the event of entry; instead, the incumbent would be more likely to adopt a tough posture of maintaining its output at pre-entry levels, so that entry would raise industry output and lower price.[22] The assumption that the incumbent would maintain his pre-entry level of output is known as the *Sylos Postulate*. The analysis that follows from this postulate indicates that the incumbent firm will choose a pre-entry output level large enough that maintaining this level post-entry does not permit profitable entry. In our numerical example, an output of 3/2, resulting in a price of $7, will apparently deter entry because the entrant's post-entry output of one will reduce price to $5, a price that equals the entrant's fixed plus variable costs. Profits are denoted V_E and V_I.

Table IIIA

Sylos Postulate Entry Deterrence Example

$p = 10 - 2q_E - 2q_I$

marginal cost of entrant = $4

fixed cost of entrant = $1

capacity of entrant = 1

apparent limit price = $5 (with $q_I = 5/2$, $V_I = 1$)

apparent limit price under Sylos = $7 (with $q_I = 3/2$, $V_I = 3$)

B. Credibility and Price Strategies

What is critical to the success of either the simple limit pricing or Sylos-pricing policies is the entrant's forecast of the post-entry price, not the actual value of the pre-entry price. The connection made between

beliefs and the pre-entry price is that in simple limit pricing models the entrant is assumed to believe that the pre-entry price (or output, in the case of Sylos) will be the incumbent's post-entry price (or output). To examine the tenability of this assumption, let us make some more assumptions about the entrant. Assume that the entrant's fixed costs are sunk, i.e., that he must incur a cost of one per period, whether or not he produces, since the assets have no value outside this industry. Assume further that there are no shut-down or start-up costs for his plant.

Now consider what would happen if, for some reason, entry occurred at either the limit or Sylos price. At any price above marginal cost (=$4) the entrant would produce its capacity output of 1. A price below $4 would reduce the entrant's production to zero, but the entrant would not exit the industry, since, by assumption, all his costs are sunk. After entry, the incumbent would face a residual demand obtained by shifting the market demand curve in Figure 3 to the left by one unit for any price at-or-above $4.[23] It is straightforward to show that the best response of the incumbent to entry would be to select a price of $6 and produce an output of one (the profit- maximizing response, given his residual demand curve). One way to see this is to note that subtracting fixed costs from the relevant entries in Table IIA has no effect on the incumbent's best response function.

If the potential entrant had this knowledge, what should he make of the incumbent's threat to price at $5 post-entry? The threat to cut price to $5 by producing an output of 3/2 in response to entry is not *credible* since the incumbent's only rational response to entry would be to select a price of $6 (because a $2 price-cost margin on 1 unit is better than a $1 margin on 3/2 units). Notice that under the assumptions we have made in this

example, *the pre-entry price is irrelevant to the entrant's decision whether to enter.* Unless the entrant is convinced that the incumbent will act irrationally in the face of entry, entry is profitable, and cannot be deterred.

Credibility and the Concept of Subgame Perfect Equilibrium

The lesson of the preceding example is that threats are unlikely to work unless they are *credible*, where by credible we mean that the action taken by the firm at a specific time is in its own best interest *at that time*, given both previous and anticipated actions of its rivals. The rationality condition that requires that strategies be credible is called "subgame perfectness" in the game-theoretic literature.[24] To illustrate this concept further, consider a situation (formally, a game) in which the entrant decides whether or not to enter, and then output decisions are made based on the knowledge of whether or not entry has occurred. In game-theoretic terms a *strategy* for each firm will specify exactly what decision that firm will make in each possible contingency. Consider the strategies of the firms in our example:

Table IIIB

Strategies
(with a non-credible threat)

Incumbent's Strategy: if no entry, $q_I = 3/2$ (and $p = \$7$)

if entry occurs, $q_I = 3/2$ (and $p = \$5$)

Potential Entrant's Strategy: not to enter in the first stage,

$q_E = 0$ in the second stage.

For these strategies to constitute an *equilibrium*,[25] each strategy must represent a firm's best response to the other's strategy. In other words, no unilateral change in either firm's strategy will increase its own profit. The strategies listed above are clearly an equilibrium in this sense; the entrant should not enter if the incumbent is going to maintain output in the event of entry, and the incumbent should produce an output of 3/2 if entry does not occur. (There is also another equilibrium which will be described below).

Subgame perfectness requires a stronger condition for equilibrium. It requires that each action specified in each firm's strategy represents the best response of that firm to *any* action that is known to have been taken by its rivals, i.e., that strategies are credible. For the strategies in Table IIIB, the action specified by the incumbent's strategy in the event of entry ($q_I = 3/2$) is not credible, because this action is not the incumbent's best response if the potential entrant actually does enter. (Recall that q_I is the best response to entry).

The only subgame-perfect equilibrium for this example is one in which there is entry and both firms produce outputs of one in the second stage; this level of output is the profit-maximizing response for each firm to the

output of one by the other firm. Recall that the incumbent's fixed cost is $3/2, and it operates with excess capacity in this equilibrium. Then, it follows from the relevant areas in figure 3 that the entrant's and incumbent's profits are, respectively, $V_E = 1$, $V_I = 1/2$. Welfare, measured as the sum of consumers' and producers' surplus, is 11/2, which is calculated by subtracting the sum of the fixed costs (1 + 3/2) from the area ABCD in Figure 3 (area ABCD = 8). Letting W denote aggregate net welfare, we can summarize this analysis:

Table IIIC

Subgame Perfect Equilibrium

Entrant's Strategy: enter in first stage

$q_E = 1$

Incumbent's Strategy: if no entry, $q_I = 3/2$ (and $p = \$7$)

if entry occurs, $q_I = 1$ (and $p = \$6$)

Equilibrium Outcome: $q_E = q_I = 1$

$p = \$6$, $W = 11/2$, $V_E = 1$, $V_I = 1/2$.

The analysis of this example illustrates the general result that price itself cannot be used as a weapon to deter entry of a firm if the incumbent's best response in the face of entry is to accommodate. This will always be the case if the potential entrant is as efficient as the incumbent, unless, of course, natural monopoly problems require that there be only one firm in the market. Similarly, a predatory pricing strategy will not be a credible strategy for forcing the exit of an equally efficient firm. However,

the discussion of "reputation" models in Section V will show that a price-cutting response to entry can deter future entry if the entrant is uncertain about the incumbent's costs.

To sum up, predatory or limit pricing strategies as threats are not likely to be credible unless there are some significant asymmetries between the incumbent and the entrant. Strategies that result in successful predation or limited entry are more likely to involve non-price instruments. We begin our discussion of such instruments in the next section.

IV. Credible Strategies that Deter Entry

A. Strategic Investment

Antitrust experts have been concerned with capacity expansion at least since Judge Learned Hand's famous dictum in *Alcoa*: "Nothing compelled it [Alcoa] to keep doubling and redoubling capacity before others entered the field."[26] In his seminal analysis of strategic behavior, Spence (1977) presented a formal analysis of a strategic investment in capacity that would alter an incumbent's costs in a manner that deterred entry.[27] An investment of this kind fits our definition of a strategic action because, by taking an action that alters its own costs, the firm alters its own *ex post* incentives in a manner that benefits itself. To see how this would work, consider the following modification of our earlier example.

Suppose now that the incumbent can make an *irreversible* investment that costs $2 per unit of capacity and that results in a marginal cost of $2.[28] This new investment has a higher fixed cost and a lower marginal cost than the existing capacity. We will show that there is an equilibrium in which the incumbent invests in 2 units of new capacity and thereby successfully deters entry. Since investments are irreversible, the incumbent

retains the fixed cost of the old, unused capital, and so, the incumbent's fixed cost following the strategic investment would be $1 1/2 (per unit of time).[29]

The model now has three stages. In the first stage the incumbent makes a decision on an irreversible investment; in the second stage the entrant observes whether or not the investment is made and decides whether or not to enter; then, outputs are selected by firms in the market in the final stage. To derive the equilibrium of this model, first consider what would happen if both investment and entry occurred. Recall that the entrant will produce at his capacity of 1 unit if price exceeds his marginal cost of $4. Using this information, it is straightforward to show that the incumbents' opportunities are:

Table IVA

Incumbent's Post-Investment Position in the Event of Entry

price	$6	$5	$4
quantity	1	3/2	2
variable cost	2	3	4
fixed (sunk) cost	1 1/2	1 1/2	1 1/2
incumbent's profit	-$3/2	-$1	-$3/2

Thus, once the investment is made, the incumbent has an incentive to respond to entry by maintaining output at 3/2 and letting price fall to $5. The incumbent's profit is negative at this output, but profit would be even lower at all other outputs, since the investment is irreversible.[30]

The effect of strategic investment in this example is to change the incumbent's best response function, and the result is that the incumbent's incentives are altered in a manner that makes it credible to charge the entry-deterring price even if entry occurs. The only equilibrium that satisfies the subgame-perfect criterion now involves investment, no entry, and an output of 2 (which is the monopoly output for the incumbent with a marginal cost of $2). The resulting price will be $6 and the incumbent's profit will be $5/2, and so the strategic investment permits the incumbent to deter entry and raise profit above the level that would result in the subgame-perfect equilibrium without the investment.[31]

Irreversible investment makes an entry-deterring strategy credible because it alters the incumbent's best response in the face of entry. However, notice that we assumed in our example that there is a cost-effective way of reducing marginal costs to 2. Naturally, the viability of such strategies depends on their costs. Besides the cost-effectiveness issue, this sort of strategic investment assumes the ability to preempt, i.e., that the incumbent can take an action prior to the entrant, since if entry occurred prior to the incumbent's strategic investment, that investment would no longer be profitable.[32] Although the incumbent would seem to have a natural "first-mover" advantage, he may also have some disadvantages. The entrant, in principle, has the advantage of more flexibility, being able to decide everything from scratch. This can make strategic investments risky for the incumbent if technology or other market conditions change. We will discuss these issues further below when we summarize the antitrust implications of strategic behavior.

The welfare implications of strategic investment in this section's example are quite interesting. It is easily shown that the strategic equilibrium results in aggregate net welfare of 13/2 (per unit of time).[33] This level of welfare is *greater* than the level of welfare of 11/2 in the subgame-perfect equilibrium with no strategic investment, which is given in Table III C. To see why welfare has improved, notice that industry output (2 units) and price ($6) are the same in each equilibrium (leaving consumer surplus unchanged), but producer surplus has increased from $3/2 to $5/2. Producer surplus is higher in the strategic equilibrium because the investment enables the incumbent to be more efficient than the entrant, and this gain more than offsets the cost of the increased capacity.[34] Of course, the welfare effect depended on the costs of the strategic investment. If, for example, the $4 incremental costs of the strategic investment were instead assumed to be between $5 and $6, the investment would still profitably deter entry, but welfare would fall because producer surplus would fall below 3/2.

B. Strategic Underinvestment

The typical preemptive capacity expansion model predicts precommitment to low variable costs through overinvestment as a method of entry deterrence. The intuition is clear: under this assumption a strategy that reduced one of the firm's marginal costs would shift his best response function out, resulting in a decrease in his competitor's output in equilibrium, and this could increase the strategist's profits if the costs of reducing marginal costs were sufficiently low.

However, this intuition is not always valid; the profitable strategy in some situations results in the equivalent of *under*investment. Needless to

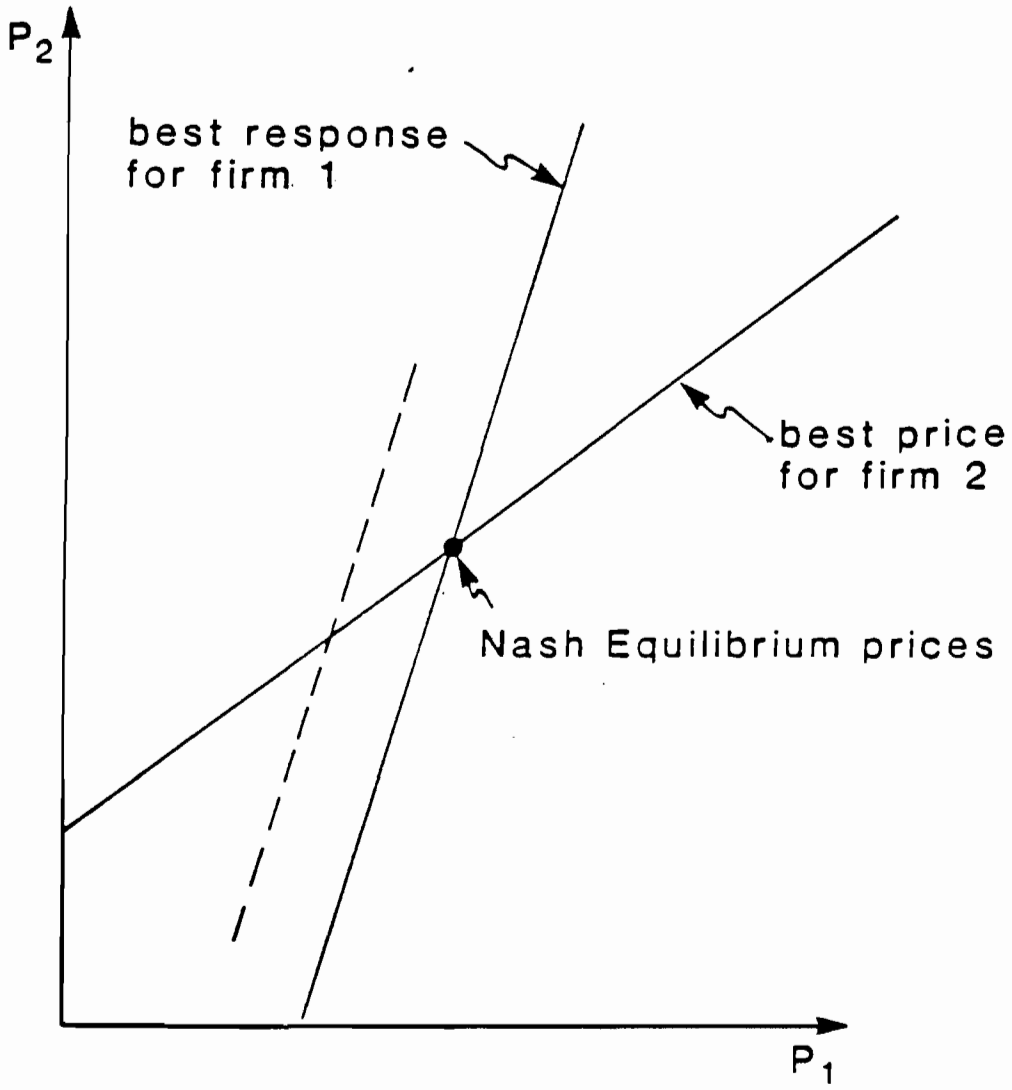
say, this complicates the policy application of strategic models, an issue we will return to below. Suppose, for example, that instead of a Cournot duopoly, the duopolists are price setters with differentiated products. We assume here that the price setters take the price of their competitor as given. The best response functions of the duopolists can now be drawn in a graph where the prices of the two producers are measured on the axes, as in Figure 4. Notice that price- setting duopolists (assuming the products are substitutes) have upward sloping best response functions, i.e., the optimal price of one duopolist is an increasing function of the price charged by the other.

Consider now our earlier analysis of strategic investment: an investment for one firm that lowers its marginal cost, shifts out its best response function, causing the rival's output to shrink, in a Cournot duopoly. In a price-setting duopoly, however, lowering one's own marginal costs results in lower best response prices for that firm (as shown by the dashed line for firm 1 in Figure 4), leading one's rival to lower his price in equilibrium (and therefore, increase his output). The result is an equilibrium with greater output for both firms. Thus, investment that, for example, simply reallocates some variable costs to fixed costs, may hurt the price-setting duopolist, since the result is greater output by both him and his rival.

Similarly, although actions that raise the rival's costs can be powerful strategies (if cost-effective), sometimes raising your costs relative to your rivals is a profitable strategy, since it may commit you to a high-price strategy that they will follow. These effects are analyzed in more detail in Fudenberg and Tirole (1984).

FIGURE 4

BERTRAND MODEL



There are other reasons why a profitable strategy may involve underinvestment. Consider, for example, R&D as a strategic instrument. An incumbent with large sunk costs may have less of an incentive to innovate, *ceteris paribus*, than an entrant with no sunk costs, and therefore he may have an incentive to accommodate an innovating entrant.[35] In order to credibly deter entry through R&D expenditures then, it may be profitable for the incumbent to underinvest, since that strategy credibly maximizes the incumbent's incentives to respond aggressively to the threat of an R&D race.

C. Strategic Effects of Long Term Contracts: Meet-or-Release and Most-Favored-Customer Contracts

Long-term contracts, like sunk investments, under some conditions can deter entry. As an example, suppose that the incumbent has signed a contract in which buyers agree not to divert purchases from the incumbent to an entrant as long as the incumbent matches a lower price offered by the entrant. Such clauses are known as "meet-or-release" provisions. In addition, we assume that the contract contains "most-favored-customer" provisions that preclude preferential discounts, i.e., a discount offer given to one buyer must be given to all. The competitive effects of such contractual provisions has received considerable attention recently. Salop (1985), for example, noted that meet-or-release provisions may provide the incumbent with a credible contractual method of maintaining output in the face of entry. In *Ethyl*, the FTC argued that most-favored-customer clauses deterred aggressive discounting.[36]

We will illustrate the effects of these contractual provisions in the context of the Sylos postulate entry deterrence example of Table IIIA. Recall that the incumbent with a marginal cost of 4 can deter entry with

the "Sylos price" of 7 and the corresponding output of 3/2, provided that this output is protected by meet-or-release clauses.

But when the long-term contracts expire, the entrant may be able to compete on an equal footing, so contracts with meet-or-release clauses may not deter entry permanently. This possibility can be illustrated in the context of the example summarized in Table IIIA. For simplicity, we alter the example by allowing only one size plant, that with a capacity of 3/2 and a fixed cost of 3/2. Since fixed cost equals capacity and marginal cost equals 4 for each firm, the long run competitive price is 5. The issues to be analyzed are whether entry can be deterred and whether price can be maintained above the competitive level.[37]

Suppose that the incumbent has announced in advance that its list price will be 6, which is between the Sylos and competitive levels. If the potential entrant decides to enter he will not announce a higher list price, since then he would get no business. We assume that the entrant matches the list price of 6 but retains the option of offering a subsequent list price reduction, which we will call a discount. The entrant in this example has three choices: not enter and earn a profit of 0, enter with a list price of 6 and not discount, and enter with a list price of 6 and offer a discount price of 5 (a price below 5 would never be profitable). If entry occurs, we assume that each firm contracts to sell one unit, which is half of the market demand at the common list price of 6. Then each firm decides whether or not to discount before knowing the other's discount decision. Thus a discount in this example is a unilateral, across-the-board reduction in list price, which also must be offered to existing buyers with most-favored-customer clauses. The discount decisions are simultaneous, although because

of meet-or-release clauses in sales contracts, each firm has the contractual right to retain its own sales if it subsequently matches the other's discount.

In order to decide what to do, the potential entrant must consider what happens if entry occurs. If entry is observed, there are four outcomes that can occur since each firm then decides whether or not to discount from the common list price. If neither discounts, each sells one unit at a price of 6 and incurs a variable cost of 4 and a fixed cost of 3/2, so profits are 1/2 each, as shown in the upper left-hand box of Table IVB. If both firms discount to 5 and the additional market demand of 1/2 unit is divided equally between them, their profits will be -1/4 each. If one firm discounts and the other does not, the discounter obtains all of the additional market demand (1/2 unit), but the other firm is able to retain all of its contract sales (1 unit, at the price it must meet, 5), which permits it to cover some of its fixed cost. Since the discounter has to offer the discount price of 5 on both the previously contracted sales of 1 unit and the new sales of 1/2 unit, the discounter earns a profit of 0. The firm that did not initiate the discount earns a profit of -1/2 because it operates with excess capacity.

Table IVB

Entry Subgame

(entrant's profit, incumbent's profit)

		incumbent's decisions:	
		not discount	*discount*
entrant's decisions:	*not discount*	(1/2, 1/2)	(-1/2, 0)
	discount	(0, -1/2)	(-1/4, -1/4)

Table IVB illustrates the way in which contracts with meet-or-release and most-favored-customer clauses may result in supra-competitive list prices that are stable with respect to unilateral across-the-board discounts;[38] if one firm thinks that the other will not discount, then it is in his own interest not to discount. In other words, unilateral discounts from a list price of 6 will be unprofitable in the entry subgame in Table IB. And if neither firm discounts, profits are positive, so one subgame-perfect equilibrium outcome is entry with no discounting.[39]

D. Refinement of Subgame-Perfectness

In the last several years game theorists have realized that the notion of subgame-perfectness needs to be refined because it often admits "too many" equilibria, some of which are not sensible. For example, note that simultaneous discounting is also an equilibrium in Table IVB, since if a firm thinks that its rival will discount, then its best response is to discount. Thus there are two outcomes in the subgame of Table IVB that are equilibria in the sense that a unilateral deviation by either firm is unprofitable. The

discounting equilibrium in the entry subgame results in negative profits, so one subgame-perfect equilibrium for the game as a whole is for the potential entrant to stay out and for the incumbent to discount in the event of entry.[40] (Remember that a strategy specifies what a player will do in each contingency, so the incumbent's strategy specifies what he will do in the face of entry, *even though entry does not occur in equilibrium*).

How can we choose between the two, quite different equilibrium outcomes? This question is related to the issue of what beliefs in the post-entry game are reasonable. The subgame-perfect equilibrium with discounting and no entry is not "sensible" in that the only reason to enter the market would be to earn positive profits, which is not possible if the entrant discounts. Thus it would be reasonable for the incumbent, having observed entry, to infer that the entrant will not offer a discount in this example.

In essence, the entrant is able to make the following "speech" to the incumbent: "We both know that, by entering, I gave up the option to earn a zero (economic) profit with certainty, and I would not have done this unless I expected to do better in competition with you, so you should infer that I will not discount, and therefore you should not discount." It is important to note that the analysis of the entry subgame here depends on an event, entry, that occurred *previously*.[41]

E. Other Models of Strategic Entry Deterrence[42]

The simple model of strategic investment discussed above exhibits the essential feature of one type of strategic-entry-deterrence model -- the incumbent makes irreversible commitments that affect *his* costs sufficiently that the post entry price would be unprofitable for the entrant. In terms of the analysis of Section II, this type of model involves the incumbent making

an irreversible commitment that changes his post-entry best response function. In a one-incumbent model that action results in the market being a natural monopoly. In a model with more than one incumbent, strategic precommitments by the incumbents may result in the exit of some incumbents and entry deterrence against potential entrants, thereby enhancing or protecting profits in an oligopoly equilibrium.

We will now briefly summarize some of the other main strategic instruments of entry deterrence that have been considered in the literature. The central feature of these strategies are that they are designed to increase the strategist's profitability at the expense of his (actual or potential) rivals. These other strategies include:

1. *Learning by Doing.* In this type of model current costs are a decreasing function of past cumulative output. The incumbent increases production to get further down the learning curve, lowering his marginal costs and the post-entry price.

2. *R&D Investment and Preemptive Patenting.* Here, the incumbent races to beat potential entrants to technologies with which they could enter and compete by developing and patenting them first. Some of the R&D models are similar to the learning-by-doing models in that the incumbent speeds up R&D to lower his costs. In the preemptive-patenting models the incumbent may not lower his own costs (e.g., in the case of "sleeping patents") but he raises the costs of entry.

3. *Product Selection.* The incumbent may "fill up" product space through product or brand proliferation, or locational preemption, leaving no viable niche for an entrant. Another possibility is to create a "fighting brand" to raise the marketing costs of a new entrant.

4. *Advertising.* If there are economies of scale in advertising, the incumbent might engage in "excessive" advertising if this can raise the unit costs of an entrant more than his own unit costs.

5. *Cost-Increasing Input Purchases.* One method by which an incumbent can convert variable into fixed costs is by contracting for inputs in a way that converts input costs into fixed costs. Requirements or "take-or-pay" contracts have this effect. The result is to lower marginal costs by converting some variable costs into fixed costs. Another strategy involves overpurchasing inputs to increase their price to the entrant. For example, if the incumbent is partially vertically integrated, raising the "market" price of his produced input raises the entrant's marginal costs more than the incumbent' average costs. Such a strategy might be accomplished either by continuously overbuying inputs in the market, or foreclosing access to inputs by buying up their suppliers. Entrants' costs can also be raised by regulations that "grandfather" incumbents or by preempting otherwise cost-efficient choices of entrants.

This list is not exhaustive, but it does summarize the most prominently considered strategic instruments that we have not already discussed in more detail. Although the instruments differ substantially, they all have the same effect: they change either the incumbent's or entrants' best response function (or both). As discussed in Section II, strategies that shift the strategist's or his rivals' best response functions can be profitable even if they do not result in predation or entry deterrence, and so any of the strategies we have enumerated could be profitable strategies even if they

don't deter all entry or cause rivals to exit. Finally, however, as discussed above, without more structure and institutional detail, the nature of the profitable precommitment is generally ambiguous; a profitable strategy may involve the equivalent of either over- or under-investment.

F. Incomplete Information and Reputation

All of the strategic actions discussed above involve non-price instruments that alter the structure of the subsequent subgames (i.e., the strategic actions changed at least some of the best-responses of the participants in the game). Strategies based on price alone did not deter entry because these strategies did not alter the structure of the subsequent subgames. In this section we will show that it may be possible to deter entry without using a non-price instrument by "fighting" attempted entry, if the entrant is uncertain about the incumbent's costs.

The discussion will be based on the following example. Suppose that there are just two kinds of incumbents. "Weak incumbents" are not willing to fight an entrant by holding their output at pre-entry levels if entry occurs. But "strong incumbents," like the one who made the strategic investment in our earlier example, have marginal costs sufficiently low to make such a fighting response credible. If the entrant does not know with certainty which type of incumbent he is facing,[43] then in a multi-period setting a weak incumbent may fight any entrant in early periods in order to establish a "reputation" of being tough and to thereby deter subsequent entry. Models with such reputation effects were first analyzed in Kreps and Wilson (1982) and in Milgrom and Roberts (1982).

The effects of reputation can be illustrated in the context of our ongoing numerical example of strategic entry deterrence. Suppose now that

the entrant can enter with a fixed cost of 3/2 per period that is not a sunk cost.[44] Suppose, further, that the entrant knows that there are only two types of incumbents, and a weak incumbent has a fixed cost of 3/2 and a marginal cost of 4, while a strong incumbent has fixed cost of 11/2 and a marginal cost of 2.[45] The entrant's beliefs about the strength of the incumbent are summarized by the probability that the entrant is strong, denoted X. The incumbent, of course, knows with certainty whether he is strong or weak.

Again, using the demand function $p = 10 - 2q_I - 2q_E$, we can compute firms' single-period profits for aggressive ($q_I = 3/2$) and for accommodating ($q_I = 1$) responses to entry. The firms' profits for the relevant output combinations are given in Table VA.

Table VA

Outcome	Profits of entrant (FC=3/2, MC=4)	Profits of "weak" incumbent (FC=3/2, MC=4)	Profits of "strong" incumbent (FC=11/2,MC=2)
no entry (monopoly q_I)	0	3 (q_I=3/2)	5/2 (q_I=2)
entry accommodated (q_E=1, q_I=1)	1/2	1/2	-3/2
entry contested (q_E=1, q_I=3/2)	-1/2	0	-1

Consistent with our earlier discussion of this example, Table VA shows that a weak incumbent will prefer to accommodate entry, but a strong

incumbent will not. It is straightforward to show that a potential entrant will not enter in a one-period game (or in the final period of a longer game) if the probability that the incumbent is strong is greater than 1/2.

Now consider a two-period model in which the entrant holds the belief that the incumbent is strong with a probability X that is greater than 1/2. We will take this probability to represent the entrant's beliefs at the beginning of period 1. The entrant could consider entering in period 1 in an effort to determine the incumbent's type. If the incumbent accommodates entry, this response would obviously reveal the incumbent to be weak, and thereby induce entry again in the final period, since a weak incumbent will always accommodate in the last period. Following Kreps and Wilson, assume that an entrant who observes the fighting response ($q_1 = 3/2$), will not revise his prior beliefs of the probability (X) that the incumbent is strong.[46] Therefore, a fighting response to entry in the first period will also deter entry in the second period because the entrant believes that the incumbent is more likely to be strong, and hence that the profit of -1/2 is more likely than the profit of 1/2.

Even a weak incumbent in this example will wish to fight entry in the first period because his profits of 0 in the first period would rise to the monopoly profit of 3 in the final period, which yields a greater total profit than the profit of 1/2 in each period that results from accommodating entry. (Recall that accommodation in the first period will also induce entry in the second.) Thus, there is an equilibrium in which both types of incumbents contest entry in the first period, and the entrant does not enter in either period. The conclusion is that the entrant's uncertainty about the incumbent's cost type can result in an equilibrium in which the incumbent

would fight entry in an early stage in order to build a reputation that deters entry in a later stage.[47]

The implications of models such as this one are unclear. These models typically have many possible "equilibria," including both entry and deterrence, and the structures of the models sometimes provide little insight into what equilibrium will be attained. The problem here is partly a technical one, involving what is the appropriate definition of equilibrium. However, perhaps the most interesting development in modern oligopoly theory is the growing consensus that institutional details and especially, industry history, are critical determinants of what sort of equilibrium an industry will reach.[48] Thus, although oligopoly theory is becoming increasingly technical, it is moving in the direction of the business school literature in its emphasis on institutional and historical detail. Until it has moved much farther, the literature on reputation and uncertainty provides little that is applicable to policy issues.

V. Collusion-Facilitating Practices

Up until now, the focus of our discussion has been on strategies that injure rivals such as predation and entry deterrence. Strategies that benefit rivals by facilitating collusion are also possible. Such strategies fall into two categories. First, firms can commit to high prices by changing the mixture of their costs in a way that raises marginal costs. Of course such a strategy will generally have to be effected in concert (explicitly or tacitly) to be successful. (In addition, a high-marginal-cost strategy leaves the firms more vulnerable to entry). The second type of collusion-facilitating strategy involves commitments that result in more "interdependent" best response

functions. A strategy that commits a firm to follow a competitor's price cuts changes its and its competitors' best response functions. As shown above, the use of meet-or-release and most-favored-customer provisions in long term contracts may have this effect.[49] An example that has long been thought to be a method of facilitating collusion is adoption of basing-point pricing.[50] Basing point pricing changes the firms' best response functions for prices at particular locations. Another example that has concerned antitrust authorities is "price-signalling" through advance announcement of price changes in the media. Finally, some recent research has examined the effect of interfirm exchange agreements on tacit coordination.[51]

Antitrust economists are interested in identifying and analyzing facilitating practices for two reasons. First, there is the possibility of challenging the use of practices under Section 1 as a restraint of trade. Second, in merger cases the use of facilitating practices is considered a "plus factor" that makes it more likely that the government will challenge a merger under the 1984 DOJ Merger Guidelines.[52]

Of the researchers concerned with business strategy, game theorists have given the most attention to strategies that could facilitate collusion. One recent example is Green and Porter (1984), who develop a "trigger-pricing" model of enforcing a collusive agreement. This type of model has firms building into their best response functions "punishment strategies" that are triggered by prices below the collusive level. In their duopoly model, Green and Porter's firms select output quantities and price is determined by the quantities selected and by a random demand shock. It is assumed that the firms cannot observe either the shock or their competitor's quantity directly, so they use the observed price to infer something about their

competitor's quantity. Firms maximize the expected value of profits over an infinite horizon.

There is a range of equilibria in the Green and Porter model, involving quantities each period that are, on average, below the Cournot equilibrium quantities, yielding a price that is, on average, above the price that results in a Cournot equilibrium in a single-period or stage of this infinitely repeated game. These equilibria are supported by punishments of the following form. If either firm observes that the price has fallen below some "trigger-price" level, then it increases its output to the Cournot equilibrium level for the single-stage of the game for a fixed number of periods. The length of the punishment must be long enough to deter either firm from deviating from the low equilibrium outputs, i.e., the single-period gain from such a deviation must be swamped by the effects of lower earnings during the punishment period. In this way collusive prices can result from purely noncooperative behavior in a dynamic game, although the maximum price level that can be sustained depends on firms' discount rates and other factors. The antitrust implications of this type of model are derived from the *equilibrium* relationship between the maximum price level that can be sustained with such strategies and the variables, such as the number of firms, that might be affected by antitrust policy. Also, any effort to write punishment strategies directly into sales contracts could have a strong anticompetitive effect, although this would be a red flag to the antitrust enforcement agencies.

Friedman (1971) and others have analyzed similar equilibria in infinite period "super games" in which firms choose prices, not quantities.[53] In general, there are many supra-competitive price levels that can be supported

in equilibrium. At an equilibrium, each firm is deterred from cutting price unilaterally because the one-period gain is swamped by the lower earnings during the "punishment period". Obviously, the quicker a deviation is detected in these models, the lower the gain from deviation, and the higher the price that can be supported in equilibrium. Thus any industry practice or institution that forces quick revelation of discounts should receive careful antitrust scrutiny. Also, as Stigler (1964) noted, selective discounts are harder to detect. Thus any practice that results in uniform pricing tends to make a unilateral price cut less attractive in an equilibrium in which punishments follow detection. Another antitrust implication of these models is that any practice that enables a firm to commit itself to cutting price for a fixed minimum period of time may thereby enable it to "announce" exactly the kind of punishment strategy that supports "collusive" price outcomes in a supergame. It is ironic to note that Baumol (1979) proposed institutionalizing such a punishment strategy by adopting an antitrust policy which would require a firm that cuts price in response to entry to keep price down for a specified period of time (e.g., 6 months). Although such a policy would punish the firm making a predatory price cut, it might also facilitate entry deterrence in equilibrium because the predator is not permitted to revert quantity to an accommodating posture.[54]

Although game theorists have developed a number of new models of oligopoly, very little advance has been made thus far in identifying collusion-facilitating strategies that could be prosecuted under the antitrust laws. Should these modern oligopoly theories be developed sufficiently to provide empirical implications, they may shed light on the circumstances under which a merger in a concentrated industry is likely to be

anticompetitive.[55] However, it would appear that we may still be a long way from any significant contributions of this type.

VI. Business Strategy and Antitrust

We have now completed our survey of the strategic literature. What remains is to evaluate the policy implications of this literature. To begin, it is worth restating Michael Spence's oral remarks at the 1980 FTC conference on business strategy: "All business behavior is strategic." Real world competition involves direct rivalry between competitors, and rivalry cannot exist without recognition of interdependence, and without winners and losers (among the competitors). The fundamental problem for antitrust is to determine when rivalry reduces aggregate net efficiency.[56]

In the industrial organization literature it was once argued that discerning anticompetitive conduct was fairly easy. It is now difficult to find such an optimistic outlook, as Kenneth Elzinga's contribution to this volume indicates.[57] Economists have demonstrated that a variety of strategies can result in predation, entry deterrence, or oligopoly pricing. The same strategies, however, can also lead to the exit of inefficient producers, efficient expansion of capacity, efficient speeding of R&D, etc. As a general theoretical matter, the competitive effects of business strategies are ambiguous. This is also an obvious empirical conclusion, since we can find variants of most types of strategies being used by firms without market power in largely competitive industries. Next, we will summarize the major problems that arise in any attempt to derive useful policy conclusions from the business strategy literature.

A. First Mover Advantage vs. the Risks of Precommitment

The models of predation and strategic entry deterrence generally assume, at least implicitly, that the incumbent is able to act before the entrant. In reality, this assumption may presume more advantage than the incumbent often has. Sometimes, the entrant (or competitor) may be able to preempt any action of the incumbent, thereby insuring the incumbent's best response is to accommodate entry. In our illustration of preemption by capacity expansion, for example, if the entrant is able to make an irreversible investment first, the equilibrium will involve entry. Most of the models in the literature build in an implicit first mover advantage for the incumbent and so do not allow the possibility of a preemptive strategy for the entrant.

In most cases the models of business strategy do not feature the inherent risks of precommitment in the analysis. By definition, precommitment to some extent "ties your hands" with respect to what actions you will take in certain contingencies. As we have seen, such self-imposed restrictions can have benefits. However, such restrictions also leave a firm at risk, if its expectations about the future state of an industry and one's competitors are not borne out. For example, a strategy of investing in excess capacity to deter domestic entry into widget production will turn out to be a bad strategy if movements in exchange rates or the efficiency of foreign competitors opens up the domestic market to foreign competition. Such a strategy will also turn out to be undesirable if gadgets, a good substitute for widgets, are invented, resulting in a significant decline in the demand for widgets. Similarly, raising industry costs through regulation may benefit some competitors in short run, but may have undesirable long run

consequences. Finally, making precommitments to facilitate collusion are likely to increase the likelihood of future entry. The business strategy models usually make static assumptions about future market conditions, so that the literature on "anticompetitive strategies" probably overestimates the profitability of strategic precommitment.

B. The Qualitative Relationship Between Strategy and its Consequences

As discussed above, the recent literature on business strategies shows that the *qualitative* relationship between strategic instruments and their competitive effects can be ambiguous, with the ambiguity depending critically on the form that competition takes in the market of interest. *Under-*investment (or its equivalent) may, in some cases, be the profitable entry-deterring strategy, if the market is characterized by differentiated products and price-setting oligopolists. The ambiguity of the qualitative relationship between strategies and their consequences obviously complicates the problem of deriving policy implications.

C. Welfare Analysis

To begin our discussion of the welfare implications of business strategy, recall that the strategic investment example of section IV A showed that strategic behavior that deters entry does not necessarily reduce market efficiency,[58] even in an incumbent-monopoly model that does not allow any efficiency-augmenting effects of the strategy.[59] Although the example is simple, the conclusion is valid in more sophisticated models of business strategy. Therefore, assuming that antitrust is concerned with economic efficiency,[60] it should be clear that policing business strategy by antitrust regulation is inherently complicated. One of the primary reasons for this complexity is that strategies often provide a gross, if not net, benefit to

customers. For example, building more capacity benefits customers by assuring future supply. Similarly, speeding up R&D is likely to speed up innovations of benefit to customers. Finally, meet-or-release and most-favored-customer clauses in sales contracts are provisions that customers would value, *ceteris paribus*. In a nutshell, the problem is how to use observed industry data to determine in a specific case whether the strategist is simply better at responding to his customers current and future needs, or instead, is engaging in welfare-reducing strategic entry deterrence. The models in the literature generally do not confront this calculus because they typically rule out any gross benefits by implicitly assuming them away.

D. "Second Best" Problems

Another reason for the ambiguity of welfare conclusions arises directly from what is termed the problem of the "second best."[61] Simply put, for our purposes the main result of the theory of the second best is that an increase in market power for a firm that already has some market power does not necessarily reduce welfare.[62] Therefore, if the strategist has market power absent the strategic activity, the theory of the second best shows that as a theoretical matter, it is very difficult to establish that aggregate (or even consumer) welfare is necessarily reduced by the strategic activity. The simple example of entry deterrence by capacity expansion discussed above illustrates the principle. In that example the strategist preserves his monopoly position as a result of the strategy that forestalls entry, but welfare is nonetheless enhanced.

VII. The Application of Strategic Theory to Antitrust Analysis: the Example of *DuPont*

In this section we will discuss the application of strategic theory to antitrust. For purposes of illustration we will base most of our discussion on the FTC's case charging DuPont with monopolizing the titanium dioxide (TiO_2) market.[63] In many ways this was the most straightforward of the strategic monopolization cases brought by the government in the 1970's. The strategic theory was a relatively simple version of the strategic capacity expansion theory that we discussed above. First, we will briefly summarize the facts.

Beginning in the 1960's, DuPont pioneered a technology for the production of TiO_2 that was different from that of its competitors. For a while, this technology placed DuPont in about the same cost position as its competitors. However, because of changes in relative input costs and environmental regulations, DuPont had a significant cost advantage over its competitors by the late 1960's. At about the same time DuPont and the industry were projecting that there would be a significant growth in demand for TiO_2 in the 1970's. As a result, DuPont set out on an aggressive capacity expansion program. It also refused requests from its competitors to license its technology. From 1972 to 1976 DuPont's share of sales in the (domestic) TiO_2 market grew from 30% to 42%. Its share of capacity grew even faster, since the anticipated demand growth was not realized because of the slowdown of the American economy.

In 1978 the FTC issued a complaint charging that DuPont had been engaged in an attempt to monopolize the titanium dioxide (TiO_2) market for at least the preceding six years.[64] The FTC's basic argument was that

DuPont had engaged in capacity expansion in order to deter investment by its existing competitors in the TiO_2 market, and that the effect of this action was that DuPont would be able to raise prices without threat of capacity expansion by its rivals.

As discussed above, the basis of such a strategic entry deterrence theory is that the creation of excess capacity by the incumbent makes the threat of low post-entry prices credible, thereby forestalling entry. If the strategy is successful, the incumbent is sheltered from the threat of entry, and can act as a monopolist or dominant firm.

One significant problem with this line of argument is that, as in any predatory theory that involves significant costs for the predator, recoupment must be shown to be plausible. Recoupment becomes less plausible, other things equal, the longer and more costly the predatory period. At the time the FTC suit was brought, DuPont had already been engaged in a capacity expansion program for six years, the result of which was that prices had fallen throughout the period. Thus, establishing that DuPont would be likely to be able to recoup its short run losses would not be an easy task.

Although the FTC's theory was strategic capacity expansion, it did not deal satisfactorily with the credibility problem.[65] Rather, the FTC made a standard predatory pricing argument -- i.e., that because of its excess capacity DuPont would necessarily discipline its rivals if they attempted to expand capacity. But, as we have seen, for a capacity expansion strategy to be credible, it must be the case that expansion of capacity by the competitors would be likely to lead to prices below their long run average costs. Assuming, as argued by the FTC, that DuPont was a dominant firm,[66] then the central issue in assessing the credibility of DuPont's strategy is

whether accommodation or price competition would be the most profitable strategy for DuPont to adopt if a competitor had increased its capacity.

Although the model of strategic investment in section IV A above pertained to the case of a potential new entrant, it can be reinterpreted as a case of potential capacity expansion by an existing competitor. This is because the demand function in the example could be taken to represent residual demand, *i.e.*, market demand adjusted for the supply behavior of fringe competitors. With that interpretation the example shows that a cost-reducing investment by the dominant firm may deter capacity expansion by the fringe competitors. And even if capacity expansion is deterred, as we saw above, the welfare effects depend on the degree of the cost and capacity advantage enjoyed by the dominant firm, which are empirical issues that would have to be resolved in any strategic-capacity-expansion monopolization case.

It is probably obvious to the reader that establishing that capacity expansion by DuPont's rivals would be likely to lead to prices below their long run average costs would not be a trivial matter. Arguments would have to be based on the structure of the market, and in particular, on relative costs and capacity conditions. Obviously, a necessary condition for low prices to result if DuPont's competitors expanded their capacities is that the size of increments in capacity be sufficiently large relative to the overall market that they would have a significant depressing effect on price. In a market with static demand and in which increments of capacity must be of significant size relative to the market, such a theory is plausible. It is less plausible in a market in which there will be growth in demand and in which increments in capacity might come from "stretching" existing capacity instead

of from new plants. These are issues that would have had to be addressed if the FTC had recognized the credibility problem in its predation theory.

Even if the FTC had recognized and dealt with the credibility problem, *Dupont* would have been a very difficult case. As discussed above, the modern strategic models typically make implicit or explicit assumptions that may be critical to the analysis. Perhaps the most difficult issue in *DuPont* is that the FTC conceded that DuPont had a significant proprietary cost advantage over its competitors. If DuPont is firm I in the Cournot example in Figure 3 above, the "fortuitous" cost reduction would shift DuPont's best-response function to the right, as indicated by the dashed line.[67] This shift would raise DuPont's market share and lower price.[68] Thus DuPont would be expected to be the major capacity-expander in such a situation, regardless of the degree of market power that it had. This raises the very difficult issue of how much expansion by DuPont would have been procompetitive? The strategic literature provides no guidance here.

The fact that DuPont's exploitation of its cost advantage by capacity expansion resulted in lower prices and a higher market share for DuPont for a significant period of time was difficult for the FTC administrative law judge (ALJ) to reconcile with a predation argument. In his opinion (issued in 1980), the ALJ stated:

> "I am not convinced that DuPont was required to take actions different than those it did take. DuPont's cost advantage was the result of business foresight, intelligent planning, dedicated technological application to a most difficult production problem,

the taking of economic risk, and its competitors' choice [to stay with an alternative technology]." (p. 693).

"I do not believe that DuPont was required to price its TiO_2 products high enough to insure its less efficient competitors sufficient revenue to finance expansion." (p. 693).

"The lowest cost producers's choice to expand capacity in a situation of short supply, is sound business judgement that is economically justified." (p. 694).[69]

Although some version of the facts in *DuPont* could support a theoretically valid predatory capacity expansion theory, the litigation in *DuPont* made clear that it is very difficult to distinguish competitive from predatory behavior -- particularly in a situation in which the predator's actions involve taking advantage of a cost advantage derived from its own efforts. The FTC attempted to finesse this issue by arguing that, although DuPont had pioneered an alternative technology that had resulted in significantly lower costs, DuPont should not be able to exploit its superiority to the disadvantage of its competitors because the lower costs derived largely from "fortuitous" changes in input costs and regulation. Needless to say, this approach, if upheld, could have very far reaching implications for successful innovative firms. Under the FTC's theory, a large innovative firm that gained a significant advantage over its rivals because of fortuitous circumstances, could not consciously exploit its advantage too much at the expense of its rivals.[70] Indeed, the FTC's theory was perhaps broad enough to reach non-fortuitous circumstances -- such as innovations specifically undertaken to gain advantage over rivals by producing a better product.

The FTC staff's proposed remedy in *DuPont* would have required that DuPont license its superior technology to its competitors on terms favorable to the competitors. The ALJ rejected such a remedy, although on somewhat narrow grounds:

> "DuPont was not required to license its ilmenite technology to its competitors (or potential entrants, if any). ... There is not showing on this record that competitors could not develop that technology, if they had chosen to take that course of action. The fact that these competitors found themselves five to ten years behind DuPont in 1972 did not obligate DuPont to give up its technological advantage." (p. 694).

The language of the ALJ's decision could be read as conceding that if a dominant firm had an advantage that could not be duplicated by its competitors, it might be required to offer licenses to its competitors. This theory however has not thus far been upheld in the courts.

In summary *DuPont* illustrates much of the difficulty inherent in bringing a monopolization case under strategic theories. Strategic capacity expansion to preempt actual or potential rivals is a fairly simple theory. Nonetheless, establishing an anticompetitive effect will generally be very difficult, particularly if, as in *DuPont*, the capacity expander has a cost advantage over his rivals, and the apparent interim impact of capacity expansion is lower prices.

DuPont was probably the simplest strategic monopolization case. The FTC's case against the breakfast cereals companies and the Justice

Department's case against *IBM* were much more complex. The basic lesson, however, from the strategic monopolization cases appears at this point to be that economics may not be able to sufficiently distinguish between procompetitive and anticompetitive strategic conduct for the courts to conclude that such conduct violates the antitrust laws. The richness of evidence presented in a monopolization case cannot generally be easily fit into a strategic model. And if the suspect strategic actions relate to basic competitive advantages of the respondents (e.g., pioneering a lower cost technology, making a better breakfast cereal, etc.), it will necessarily be difficult for economics to conclude that those actions are anticompetitive. Thus, although the strategic literature offers many useful insights to antitrust analysis, the literature still seems a long way from being able to provide tests that are useful to the courts.

VIII. Summary of Antitrust Analysis of Business Strategy

In economic terms, the antitrust analysis required to evaluate the legality of business strategy is analogous to rule-of-reason analysis of vertical and horizontal restraints. However, the prevailing view in antitrust economics indicates that vertical restraints should probably be legal in most cases, and that horizontal restraints that significantly restrict competition are suspect, at this point theory gives us almost no guidance on presumptions about the strategies considered in the antitrust economics literature. In addition, these strategies usually have a more prospective character than does conduct more typically dealt with in a rule-of-reason analysis.

The traditional approach to diagnosing anticompetitive conduct in antitrust has been to determine whether the firm engaging in the conduct

has or can attain market power. That focus, of course, provides a useful initial screen for conducting the analysis of the competitive consequences of particular conduct.[71] Unfortunately, the market power "test" provides only an initial screen, since the strategic literature indicates that many types of conduct can be procompetitive, even when the firm has market power.[72] This is for the two reasons discussed above: gross customer benefits accompany most strategies, and passing the market power test puts us in the very complicated world of the "second best."

Demonstrating that the activities of a naked cartel are anticompetitive is fairly straightforward.[73] A much more sophisticated and empirically-based analysis is required to determine that a firm's aggressive expansion of capacity is an example of inefficient entry deterrence,[74] or that a firm's attempt to minimize compatibility with competitors' products is inefficient predation,[75] or that brand proliferation is an entry-deterring strategy that harms consumers,[76] or that the common adoption of contractual provisions in an industry facilitates collusion with no out-weighing efficiency.[77] The prominent strategic antitrust cases of the seventies make clear the difficulties that courts, regulatory bodies, and even economists have in proving that a particular set of strategies has an anticompetitive effect, even in the context of a particular case with vast empirical and institutional detail.[78]

In conclusion, although the business strategy literature has increased our understanding of the ways in which firms actually compete, discerning the circumstances in which consumers do not gain from such forms of competition remains a very formidable task. If the business strategy literature is to make a useful contribution to antitrust policy, this deficiency

will have to be remedied.

FOOTNOTES

1. University of Virginia and the Federal Trade Commission, respectively. The views expressed here are those of the authors, not necessarily those of the Federal Trade Commission. This research was supported, in part, by the National Science Foundation under grant SES - 8720105. The authors are grateful to Richard Higgins, Kenneth Elzinga, James Langenfeld, Robert Porter, and Roger Sherman for helpful comments.

2. See Scherer (1980) and Posner (1976).

3. However, some types of conduct, which we will call strategic, facilitate collusion. We will discuss such conduct below.

4. Department of Justice Merger Guidelines (1984). Occasionally, some form of conduct that could be dignified by being termed strategic may be an issue in a horizontal merger investigation. Later, we will discuss some examples.

5. See Krattenmaker and Salop (1986).

6. See Holt and Scheffman (1987) for an analysis of such contracts.

7. The textbook economic models of competition largely fail to address such rivalry. These models typically treat demand and costs as exogenous and describe competition as arising from simple profit maximization in a context in which there is no apparent need or role for strategic behavior. Firms in these models simply deliver their output to the "market", having chosen the output level that maximizes profits. Most "real world" firms are faced with the constant task of finding a market for their output (often by stealing their rivals' customers), or finding a way of obtaining a cost advantage relative to their rivals (sometimes by engaging in actions that raise the relative costs of their rivals), so that much of business behavior is inherently strategic.

8. Economic modelling also tends to concentrate on anticompetitive explanations of business conduct. "[I]f an economist finds something--a business practice of one sort or another--that he does not understand, he looks for a monopoly explanation." (Coase 1972).

9. If G_1 were a group of firms operating as a cartel, it would take RR as its demand curve, acting as a monopolist with respect to that demand curve, charging a price above p^*, so that the elasticity of the residual demand curve RR would be a critical parameter in assessing the extent of market power possessed by the first group. See Landes and Posner (1981), Baker and Bresnahan (1985), and Scheffman and Spiller (1987).

10. For more discussion see Salop and Scheffman (1983).

11. For example, the strategic business literature is concerned with such issues as "product positioning" which envisages a market with differentiated products. Most of the interesting strategic aspects of such promotion cannot be captured in our simple model of a homogeneous good market, and so for the time being we will not consider further actions that would shift market demand.

12. For the details of this analysis see Salop and Scheffman (1983).

13. Of course this story leaves unresolved why the suppliers of the input would find it in their interest to have such contracts, since the effect would be to reduce their sales. It would be possible, in principle for them to be compensated by the strategic group.

14. The semiconductor industry is one commonly cited example.

15. Best response functions are sometimes called "reaction functions," but the word "reaction" is misleading because all decisions are simultaneous in a static model.

16. Alternatively, we could have made E's fixed costs of entry slightly larger, so E's profit in the situation $q_I=2$, $q_E=1$ is negative (and all other entries for E for the case $q_E=1$ would be slightly smaller.

17. In essence, each firm assumes that the demand facing it is the market demand minus a fixed supply by its rivals. More specifically, each firm's reaction function gives its profit maximizing output decision for each level of output of the rival. The firm is assumed to postulate that its output decisions do not alter the output decisions of its rival, as is the case when outputs are selected simultaneously. Thus, for any given output level of the rival, say q, the firm perceives that the demand it is facing is the market demand minus q. Notice that the simultaneity inherent in this approach differs from the residual demand analysis in which the dominant firm knows what the fringe will do for any action of the dominant firm, which would be the case if the dominant firm announces its price before fringe firms choose their outputs.

18. As we will see below, the relationship between changes in costs and shifts in the reaction functions depends critically on the particular oligopoly model.

19. For one thing, the relative size of the predator works against him in that any given reduction in price imposes more costs on him than it does on the prey, although the predator, if successful, will reap the monopoly gain.

20. By net benefits here we mean that the profits of a bankruptcy strategy exceed the profits of strategy of accommodation.

21. A more interesting story can be told in a dynamic context, where, for example the static picture we have depicted arose from exploitation of learning curve effects. We will return to dynamics presently.

22. "...as long as we are dealing with homogeneous oligopoly, it is hard to find a well-defined sensible alternative." (Modiglianni 1958, p.230).

23. This would be the post-entry residual demand curve facing the incumbent.

24. This concept was introduced by Selten (1965). A nontechnical discussion of this and related concepts can be found in Meyerson (1986).

25. Formally speaking, a *Nash* equilibrium.

26. 148 F. 2d 416 (2nd Cir. 1945).

27. In Spence's first model, the investment only affects the firm's capacity. Our analysis most closely matches Spence's second model in which investment affects both capacity and marginal cost. One difference is that there is only one incumbent firm in our analysis; Spence considered the case in which there were several incumbent firms that colluded perfectly prior to entry but behaved noncooperatively in their post-entry price choices (i.e. entry changed the equilibrium concept).

28. It is critical to the analysis that the investment is irreversible. Otherwise the best response in the face of entry would be to reverse the investment, making the investment not credible.

29. This is $4 for the strategic investment plus $3/2 for the existing sunk investment.

30. If the incumbent had only installed 1 unit of new capacity, then the cost and profit rows of Table IVA show that the incumbent's best post-entry quantity is 1, so a threat to let the post-entry price fall to $5 would not be credible for this smaller level of investment. Conversely, the incumbent would not acquire more than 2 units of new capacity, since 2 is the monopoly profit-maximizing output in the absence of entry.

31. Another method of achieving the no-entry equilibrium described in our example would be to pre-pay for variable inputs, reducing their variable cost by $2 per unit of output. Finally, post-entry output of 3/2 could be made credible if the incumbent could enter into long term contracts with buyers that commit the him to sell (and buyers to accept) 3/2 units of output. We will discuss these and other methods of precommitment further below.

32. This assumes that the entrant has sunk costs of entry.

33. Welfare after the investment is difference between the area ABEF in Figure 3 and the incumbent's post-investment fixed cost of 11/2.

34. The result does not depend on output remaining unchanged due to strategic investment. The example can be changed so that output falls but the gain in producer surplus exceeds the loss in consumer surplus that arises from the decline in output.

35. For further discussion of the possibility of strategic underinvestment see Fudenberg and Tirole (1984) on the "fat-cat effect" and the "lean and hungry look."

36. See Holt and Scheffman (1985) for a discussion of the case and a complete version of the following analysis.

37. These issues are analyzed in more generality in Salop (1985) and Holt and Scheffman (1986).

38. Of course, in this example, no potential efficiency-enhancing properties of meet-or-release or most-favored-customer provisions in sales contracts were considered.

39. The analysis of Holt and Scheffman (1986), applied to this example, implies the unprofitability of any (possibly small) discount from any (possibly noninteger) common list price below 6 in this example.

40. There is also a third equilibrium in the entry subgame that involves randomization, but it can be shown that the entrant's expected profits are also negative in this "mixed strategy" equilibrium.

41. This type of reasoning has been called "forward induction" by Kohlberg and Mertens (1986); it is different from the usual "backward induction" method of first analyzing the final stage (here the entry subgame) and then analyzing the first-stage decision. Cho and Kreps (1986) have used this type of reasoning to eliminate "bad" equilibria in signaling models; and Kohlberg and Mertens have proposed an formal equilibrium solution concept that would rule out the no-entry equilibrium in our example. There have been several previous attempts to develop a satisfactory equilibrium concept that prunes equilibria that are not sensible, among these are the notions of a sequential equilibrium, a perfect equilibrium, and a proper equilibrium. These concepts have been widely discussed and used by theorists, but none of these would rule out the no-entry equilibrium in our example. By their own admission, the work of Cho and Kreps and of Kohlberg and Mertens is incomplete, but we anticipate that the developing theory of equilibrium for noncooperative games will have important implications for the analysis of strategic behavior in industry. Brandts and Holt (1987) report results of laboratory experiments that are supportive of the Cho and Kreps analysis.

42. Although are discussion here will focus on strategic-entry-deterrence, there are analogous models of predation.

43. That is, he does not know the incumbent's costs.

44. The presence of significant sunk costs for the entrant would make it more difficult for the incumbent to drive the entrant out of the market).

45. In this model the incumbent's technology is predetermined by a random event. The strong incumbent cannot liquidate the additional investment and a weak incumbent cannot alter its type by making a strategic investment.

46. Kreps and Wilson calculate a "sequential equilibrium" in which the beliefs are endogenous, and as they note, there may be many such equilibria, some of which are more reasonable than others.

47. Kreps and Wilson (1982) work with multi-period examples in which there are equilibria in which the firms randomize over possible decisions. In such equilibria, there is a positive probability that entry actually occurs, so reputation building is observed along the equilibrium path. There would be an equilibrium in randomized strategies in our example if the probability of a strong incumbent were smaller than 1/2.

48. See Kreps and Spence (1985), Fudenberg and Tirole (1986), and Shapiro (1986).

49. For a full discussion see Holt and Scheffman (1987).

50. However, see Haddock (1982).

51. See Holt and Scheffman (1986).

52. A plus factor is a structural or behavioral characteristic in a market that increases the likelihood of collusion in that market.

53. See Kreps and Spence (1985), Fudenberg and Tirole (1986), and Shapiro (1986) for critiques of the supergame approach to collusion.

54. Isaac and Smith (1985) report the result of a series of laboratory experiments in which the imposition of the Baumol rule resulted in higher prices and lower market efficiency.

55. An analysis of the implications of modern oligopoly theory for merger analysis has essentially not yet been conducted. We are currently developing such an analysis.

56. And when this rivalry violates the antitrust laws.

57. One thing, however, the recent strategic literature does make clear is that traditional theories of predatory pricing are untenable. Predation is more likely to be the result of non-price strategies such as "raising rivals' costs."

58. For a discussion of models in which limiting entry can lead to increases in welfare see von Weizsacker (1980).

59. For example, the example does not allow the possibility and effects of increased assurance of supply.

60. Or even with only consumer welfare (see Lande (1982)).

61. See Scherer (1980).

62. In its original form, the theory of the second best showed that in an economy with competitive and imperfectly competitive sectors, restoring competition to one of the imperfectly competitive sectors could result in the economy's net welfare being reduced. The result here is even stronger, in that it states that increases of market power within an individual market may improve welfare in that market, independent of competitive conditions in other sectors of the economy. For the typical model in the strategic-entry-deterrence literature featuring a dominant firm, the technical result is that the relevant comparative statics results in dominant firm models are generally ambiguous. See Salop and Scheffman (1987) for examples. For examples of second best problems in oligopoly models see von Weiczacker (1980).

63. Titanium dioxide is a white chemical pigment employed primarily by the manufacturers of paints, paper, synthetic fibers, plastics, ink and synthetic rubber to make them white or opaque.

64. *In the matter of E.I. DuPont*, docket no. 9108, complaint filed April 10, 1978.

65. Of course, the necessity of credibility was not fully developed in the economic literature at that time.

66. This was a somewhat dubious proposition given DuPont's share in the TiO_2 market.

67. For the case of price competition, the cost reduction shifts the firm's best-response function to the left, as shown in Figure 4 above. The resulting price reductions would cause the quantity sold to expand, as was the case in Figure 3 when the best-response function shifted to the right.

68. In particular, total quantity will rise and price will fall if the best-response function of firm E has a slope of greater than -1.

69. The FTC upheld the ALJ's decision on appeal by the FTC Staff.

70. The Commission's economic expert, Professor W.G. Shepherd testified that "Dupont should have done whatever it wanted to do, subject to the proviso that it not choose a strategy whose effect was to transform the TiO_2 industry into a virtual monopoly." (CX 218 pp. 65-66). Shepherd's explicit complaint was that Dupont had kept prices too low and had refused to license its technology.

71. Although, it is sometimes important to discern where the market power exists. For example, it can be profitable for firms without market power in the market they sell in to raise their rivals' costs. (See Salop and Scheffman (1987) and Salop, Scheffman and Schwartz (1984)). The market power in that example is the power to affect the costs of their rivals.

72. Recall that in our example of entry deterrence by capacity expansion, entry deterrence was efficient, even though it resulted in the incumbent having a monopoly.

73. Although, as with everything, it may not be as easy as was once thought. See, for example, Bittlingmayer (1982).

74. See *FTC v. Dupont.*

75. See *U.S v. IBM.*

76. See *FTC v. Kellogs, et. al.*

77. See *FTC v. Ethyl, et. al.*

78. See, for example, Fisher, McGowan and Greenwood (1983).

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