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# An Economic Definition in Predatory Product Innovation

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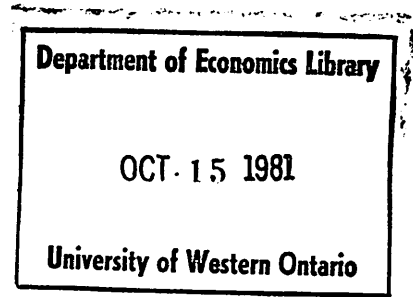
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**AN ECONOMIC DEFINITION OF PREDATORY  
PRODUCT INNOVATION**

Janusz A. Ordover  
and  
Robert D. Willig

October 1981



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**An Economic Definition of Predatory**

**Product Innovation**

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October 1980

revised January 1981

**AN ECONOMIC DEFINITION OF PREDATORY  
PRODUCT INNOVATION\***

by

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**I: Introduction**

Many forms of business behavior have been attacked as predatory since the enactment of the Sherman Act in 1890.<sup>1</sup> However, we think it can be fairly concluded that neither the courts<sup>2</sup> nor legal and economic scholars<sup>3</sup> have been able to develop a general standard of predatory behavior with which to test diverse industrial practices for possible anticompetitive effects or intent. In Section II of this paper, we present an economically sound and judicially workable general definition of predatory behavior, and briefly explicate its various elements.<sup>4</sup> We argue that predation should be defined as a response to a rival that sacrifices part of the profit that could be earned, under competitive circumstances, were the rival to remain viable, in order to induce exit and gain consequent additional monopoly profit.

In Section III we indicate how the much-discussed cost-based tests for predatory pricing can be deduced from this general standard. This permits us to clarify these tests and to expand their scope to apply to realistic instances of multi-product firms.

With this material as necessary introduction, we turn, in Section IV, to the main focus of this paper - the development from our general standard of

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specific tests to distinguish between predatory and pro-competitive product innovations.

We find that anti-trust scrutiny of product innovations is not a priori unwarranted. Surprisingly, we find that even genuine innovations, that is new products that in some regards are superior to existing ones in the eyes of both engineers and consumers, can in fact be anticompetitive. Such predatory innovations do not provide benefits to consumers that are worth the cost, and are motivated by the additional monopoly profits that are made possible solely by the exit they induce.

We analyze two types of exit inducing tactics that entail introductions of new products and that may or may not be anti-competitive. The first tactic is the introduction of a new product that is a substitute for the products of the rival firm and that endangers its viability by diverting its sales. While this tactic in itself has not been scrutinized in anti-trust litigation, it has been a part of more complex tactics that have been the subject of an important and rapidly growing line of cases. These tactics are employed in the context of systems rivalry. They entail introductions of new systems of components that are incompatible with components manufactured by rivals, together with the constriction of the supply of components that are complementary to those of rivals. This complex tactic endangers rivals' viability by inducing consumers to bypass their use of rivals' products.

In Sections V and VI we develop workable tests for ascertaining whether or not such tactics involve predatory product innovation. These tests reflect two novel considerations that have not been incorporated in any existing tests for predatory behavior. First, as detailed in Section V, our standard leads us to the scrutiny of the R&D investment in the innovation. Second, as detailed in Section VI, our standard implies that in the context of systems rivalry the predatory act may be the upward repricing or withdrawal of the pre-existing components complementary to the rivals' products.

we provide an overview of these matters in Section IV. In Section VI, we show that the workable tests derived from our general standard can protect competition and deter anti-competitive product innovation without distorting incentives for pro-competitive innovation and without unduly taxing scarce judicial resources.

Finally, in appendices, we discuss the application of our standard to the scrutiny for predation of product preannouncements and cross-market entry.

#### II: General Standard of Predatory Behavior

Our proposed general standard of predation is founded on a natural and basic interpretation of the phrase "intent to monopolize" that is central to the antitrust statutes under which business behavior is examined. A predatory practice is an action undertaken with the intent to increase monopoly power by means of inducing the exit of a rival. Here, by intent we mean that the essential purpose of the practice was the additional monopoly power that would result from the rival's exit. It would be clear that monopolization were the purpose of the practice if the practice would have been unprofitable without the exit it actually caused, but profitable with it. Obviously, even if a practice caused a rival's exit, it would not be predatory if it would have been profitable without any additional monopoly power resulting from the exit. Thus, in our interpretation, there is intent to monopolize if the practice can only be rationalized by means of the additional monopoly power it generates. From this interpretation of intent, it then follows that predatory behavior can be defined as a response to a rival that sacrifices part of the profit that could be earned, under competitive circumstances, were the rival to remain viable, in order to induce exit and gain consequent additional monopoly profit.

A market must have several structural characteristics for a practice

that induces a rival's exit to generate additional monopoly power and thus conceivably violate our general standard of predatory behavior. First of all, a market must be horizontally concentrated. In an unconcentrated market, there is sufficient competitive discipline from the remaining rivals to eliminate monopoly power, irrespective of the exit of one of them.

Second, a market must be protected by a form of entry barriers that we term entry hurdles. These exist whenever the prospective entrant is cost disadvantaged vis-a-vis the incumbent solely because the incumbent is already functioning as an ongoing concern, while the entrant has not yet committed the requisite resources. The cost difference between the entrant and the incumbent vanishes once the prospective entrant overcomes the entry hurdle and enters the industry. In general, entry hurdles arise when investments are not fully reversible.<sup>5</sup> The necessity to sink, and thus to put totally at risk, the irreversible portion of the requisite investment in effect faces the prospective entrant with a cost disadvantage relative to the incumbent. Because potential entrants, but not actual entrants, are disadvantaged by entry hurdles, the incumbent may have an incentive to push the entrant over the entry hurdle and to thereby gain incremental monopoly power. Conversely, where there are no entry hurdles, there can be no incentives for predation because prospective entrants constrain the market power of the incumbent as effectively as do actual entrants.

Lastly, for a tactically induced exit to augment extant monopoly power, a market must be characterized by the presence of reentry barriers. A re-entry barrier is defined as the additional cost which must be incurred by a firm which has exited in order to restart its operations. If all physical and human capital that has been retooled or dispersed upon the firm's exit can be costlessly reassembled, then no reentry barrier exists. Absent re-entry barriers, a firm confronted with possibly anticompetitive behavior of

its rival can shut-down its operations and then costlessly reenter the market as soon as the alleged predator attempts to recoup profits which he sacrificed during the predatory campaign. Thus, where reentry barriers are truly inconsequential, recoupment of sacrificed profits would not be possible because the dominant firm's rivals would always remain viable. Consequently, there can be no motive for predation absent reentry barriers.<sup>6</sup>

To summarize, in a market which is horizontally unconcentrated, or in which entry hurdles and reentry barriers are not significant, a dominant incumbent firm cannot hope to earn any additional monopoly profits from the induced exit of a rival. In such a market, actual and potential competitors effectively constrain the market power of an incumbent firm whether or not the rival whose exit is at issue remains viable.

Here, then, there can be no motive for predatory behavior. Consequently, behavior need not be scrutinized for predation and should be presumed pro-competitive if the market in which it occurs is unconcentrated, or has no entry hurdles, or has no reentry barriers. Thus, ascertaining whether the relevant market has these characteristics is a structural test that should be performed prior to the application of any test, like ours, to allegedly predatory behavior.<sup>7</sup>

In markets in which all of the structural preconditions listed above do not obtain, a firm may rationally engage in anticompetitive behavior with the intent of inducing exit of a rival, in order to gain additional monopoly profits. The hallmark of such anticompetitive, predatory behavior is that it entails a sacrifice of a part of the profit that could be earned, under competitive circumstances, were the rival to remain viable.

The possibility of gaining additional monopoly profits provides the necessary element of motive for engaging in anticompetitive behavior. On the other hand, the mere fact of a rival's exit, as a result of the alleged

predator's action, even in markets in which exit does lessen competition, does not constitute the proof that predation actually took place. Indeed, exit-inducing actions cannot be considered predatory if they are a part of competitive interactions. Because of cost or other disadvantages, not every entrant or existing rival will be assured positive output and profits in a sufficiently competitive market place. Such inefficient rivals could be induced to exit by actions which the incumbent would find profitable without his taking account of their effects on the rival's viability and on any consequent additional monopoly profits. Such actions are innocent of predation under our standard.

Under our standard, predatory sacrifice of profit is assessed under the premise of the continued viability of the rival. This possibly counterfactual premise means that the rival remains ready to produce, should he so choose, without incurring new start-up costs, whether or not he has actually ceased production. Thus, the continued viability premise is equivalent to the premise of the absence of reentry barriers. Then, a firm's action entails predatory sacrifice of profit if there is some alternative action which would yield greater profit if there were no reentry barriers. The fact that such an action were chosen by a firm indicates that it was motivated by the thereby induced exit of its rival.

These concepts are illustrated by Tables 1 and 2, which display the present discounted values of the profits of the incumbent under various scenarios. The actual action of the incumbent induces the exit of his rival, while the alternative action does not. The numbers displayed in Table 1 indicate that the incumbent has incentive to choose the exit-inducing "actual action", because it yields him a profit of 110, while the alternative yields only 105. However, here, this choice is predatory because under the counterfactual premise of the continued viability of the rival, the actual action entails a

INCUMBENT

	ACTUAL ACTION	ALTERNATIVE ACTION
V		
I		
A		
R	100	105
B		
L		
I		
E		
V		
E		
A	110	
X		
I		
L		
T		
S		

TABLE 1

profit sacrifice of 5; i.e. the difference between 105 and 100.

In contrast, the choice by the incumbent of the "actual action" in the scenario of Table 2 is not predatory even though it does induce exit. The incumbent does have incentive to make this choice, because it yields him a profit of 110 instead of the profit of 95 that he would earn from the alternative action. However, the actual action entails no predatory sacrifice of profit because it yields higher profit even under the premise of the continued viability of the rival.<sup>9</sup>

It should be emphasized that our definition of predatory profit sacrifice is not that short run profit be sacrificed for future monopoly gain. For example, the actual action of Table 1 might earn current period profits of 10, while the alternative action might earn only 5.<sup>7</sup> Then, despite the fact that the actual action maximizes short run profit, it is nonetheless predatory because it does not maximize overall profit given the rival's viability. An effect of this kind need not arise in the context of predatory

petitive fashion. From this vantage point, a cartel-like response would not benefit the incumbent because the rival's competitive reaction to it would undermine its profitability. Thus our standard does not penalize the incumbent for competitive responses, even if they damage the rival. The standard does not protect a rival who can only prosper under non-competitive circumstances. The standard, therefore, is designed to protect competition by protecting competitive rivals from predation.

The practical relevance of our proposed standard would be problematic if its application necessitated estimation of data like those presented in our numerical examples. Fortunately, we are able to identify certain conditions that are readily testable and that logically imply predatory sacrifice of profit. Thus, while our definition of predation is not in itself a workable test, it provides a unifying, general, and open-ended standard from which specific and workable tests can be logically derived. Novel tests for predatory product innovation are so derived in Sections IV, V, and VI. In the next section we sketch how cost-based tests for predatory price cutting can also be derived from the general standard, and how useful new variants naturally emerge as well.<sup>10</sup>

### III: Application of the General Standard to Predatory Price Cutting

The purpose of this section is two-fold. First, we demonstrate that in the simplest context of an incumbent firm that produces a single product (or service), the application of our general standard yields the familiar Areeda-Turner cost-based price tests. Second, with the view towards the discussion of predatory product innovations in Section V, we develop the relevant price tests for a multi-product (multi-service) incumbent firm.

Consider, as a stereotype, the example of an incumbent dominant firm which, in response to entry, drops its price and thereby endangers the viability of the entrant. The application of our standard requires that the

### INCUMBENT

#### ACTUAL ACTION      ALTERNATIVE ACTION

V		
I		
A		
R	100	95
B		
I		
L		
E		
V		
E		
X		
A	110	
I		
T		
S		

TABLE 2

price cutting. However, it may well occur where the action to be tested for predatory intent involves investments (e.g. in plant capacity or R&D). For example, a predator may respond to entry by shifting from a relatively expensive R&D program aimed at significant quality improvement to a cheaper one aimed at an exclusionary redesign (as detailed in Sections IV and VI).

In such a case, the predatory investment decision may raise short term profit, raise expected long run profit (because of additional monopoly power), but lower long run profit under the premise that the new rival remain viable.

Our standard stipulates that the sacrifice of profit be assessed "under competitive circumstances." As such, sacrifice cannot be inferred merely because the incumbent avoided a cartel-like response that may have yielded both him and his rival greater profits. Instead, for the assessment of sacrifice, the profitability to the incumbent of his actual and alternative responses are to be gauged on the presumption that the rival reacts to them in a com-

structure of the relevant market be examined for concentration, entry hurdles, and reentry barriers, before the price cut is appropriately scrutinized for possibly anti-competitive effects. If the market does exhibit all these structural features, and if the price cut demonstrably raises the probability of the entrant's exit to a dangerous level, then our standard directs attention to the question of whether the incumbent's response entails predatory sacrifice of profit. This response is comprised of decisions pertaining to the firm's price, output flow, and perhaps such other elements as capital investment and marketing activities. A finding of predation would be supported if it can be established that a different response would earn greater profit for the incumbent under the premise of the continued viability of the rival.

In the context of this stereotypical example, the premise of the continued viability of the rival rules out consideration of future monopoly profits made possible by the entrant's exit. Even if the response of the incumbent causes the rival to shut down production, if the rival's viability were unpaired (as would be the case absent reentry barriers), the fact that he would rationally expand output if prices were to sufficiently rise renders his shutdown irrelevant to his constraint on the incumbent's market power. The fact that the incumbent's response did induce the rival's exit may have actually provided the profit rationale for the chosen prices, output, etc. However, under the continued-viability premise, the rival's irreversible exit is treated as if it were only a reversible shutdown. As such, the fact that the response did induce the rival's exit would have no influence on the expected future profits of the incumbent, under the premise of the continued viability of the rival.

Consequently, the examination of whether the incumbent's response entails predatory sacrifice may only require testing whether an alternative

response, less threatening to the entrant's viability, would have yielded a higher level of current profit under competitive circumstances. This conclusion rests on the supposition that the response at issue has no impact on the incumbent's future profits, apart from effects on the degree of competition offered by the rival. This supposition rules out intertemporal demand effects, like those that motivate promotional pricing, and any impacts on future profitability of current period output and investment elements of the response. Although such effects may sometimes be important, and although our standard can readily account for them, here, for simplicity, we disregard them.<sup>11</sup> Thus, we assume here that under the continued-viability premise, the response to the rival affects only the current profits of the incumbent.

In this simplified setting, the actual response of the incumbent exhibits predatory sacrifice if there exists an alternative price and output response that would raise the incumbent's current profits under competitive circumstances and that would lower the probability of the rival's exit. The relevant such alternative response to be examined entails a quantity flow that is smaller than that actually chosen by the incumbent, say by  $\delta$ , together with the corresponding higher price. Which higher level of price would actually result, under competitive circumstances, from an output cutback of  $\delta$  depends on the precise properties of market demand as well as on the details of the rivals' structures of production costs. Fortunately, however, a cost-based test for predatory profit sacrifice can be derived without assessment of that higher level of price, as long as one proceeds under the natural presumption that an output reduction would not result in a lowered market price.

Then, <sup>12</sup> the incumbent's cutback of  $\delta$  in sales would reduce his revenues by less than his original price multiplied by  $\delta$ ;  $\delta \cdot p$ . If the price were unaffected, the revenue reduction would, of course, equal this figure.



and, if the price were to rise, this reduction would be partially offset by the additional revenue earned on each remaining unit of output.

Consequently, this alternative response, designed to be less damaging to the rival, would also increase the incumbent's profits under the viability premise, if it yielded a saving in production cost that exceeds the reduction in revenues. As such, predatory sacrifice of profit can be inferred if the cost saving from reducing output by  $\delta$  is larger than  $\delta \cdot p$ , which, as just explained, is a conservative estimate of the revenue reduction. Thus, there is evidence of predatory sacrifice if the incumbent's actual price is less than the average savings in costs that could be achieved by cutting back output, where the average is taken over the size of the cutback, for any such hypothetical contraction.<sup>13</sup>

There are several different sized cutbacks that specialize this general test to particularly useful cost-based price floors. First, for consideration of the alternative response that entails elimination of the incumbent's entire output, the test for predatory sacrifice is whether the price is below the average avoidable cost of the product line in question. Second, for consideration of small output cutbacks, the test is whether the price is below the marginal (avoidable) cost.<sup>14</sup>

Thus, familiar cost-based tests for predatory pricing can be logically derived from our proposed general standard. Surprisingly, we find that both average cost and marginal cost define correct price floors. There is evidence of predatory sacrifice if the price is found to be below either one of them. In particular, if the price is below marginal cost, a slightly smaller output level would have raised the incumbent's profits, under the premise of the continued viability of the rival. Similarly, if the price is below average cost, elimination of the incumbent's output flow would have raised his profits under the same premise. Since either of these

alternatives would have less endangered the rival's viability, both define correct tests of predatory sacrifice under our standard.<sup>15</sup>

Another valuable result of deriving cost-based tests from the standard is that the appropriate cost concepts are thereby clarified. In all cases, it is the cost saving from an output contraction that is to be compared with the associated revenue reduction. Hence, for example, capital costs should be included if they could have been thus saved. Also, advertising and other marketing costs should certainly be included in the average cost test to the extent they could have been entirely avoided if the incumbent were to cease production.<sup>16</sup>

The tests for predatory pricing derived from the general standard protect and enhance competition without simultaneously interfering with its workings. By their very construction, the tests cannot indicate any normal competitive response to be predatory, whether or not that response induces a rival to exit. This follows from the fact that competitive responses entail no sacrifice of profit under the premise of the continued viability of the rival. On the other hand, the tests do constrain behaviors that induce exit and that are not part of the normal competitive process.

Further, it can be theoretically demonstrated that application of our proposed standard would protect from tactical exit inducement any rival who would actively produce in the socially optimal allocation of production among extant firms. Conversely, it can be shown, the standard would permit the inducement of exit of a firm that is insufficiently efficient to actively produce in that socially optimal arrangement.<sup>17</sup>

For example, suppose that both the incumbent and the rival have constant marginal and average costs. If the costs of the incumbent are lower than those of the rival, then the latter would not actively produce in the socially optimal allocation of production between them. In this case, the

incumbent can induce the rival's exit by lowering his price to a level just below the rival's cost. No alternative price, less damaging to the rival, would earn the incumbent greater current profit under competitive circumstances. This follows because a higher price could be undercut by the rival, thus yielding the incumbent no sales. Yet, the price just below the rival's cost does earn the incumbent some profit, since his cost is lower still. Thus, this response entails no profit sacrifice, and therefore induces exit without violation of our standard of predation.

If, instead, the costs of the incumbent exceed those of the rival, then the latter would actively produce in the socially optimal arrangement. In this case, according to our general result, any exit inducing response by the incumbent must entail predatory sacrifice. Here, this is true because a price below the rival's cost must cause the incumbent a negative profit that is less than he would earn with any one of these alternative responses that are less damaging to the rival: a small cutback in output; eliminating production; or raising his price to the level of his cost and accepting any sales that may result. Of course, if it succeeds in driving out the rival, and in thereby making possible later additional monopoly profits, the low price of the incumbent may be his most profitable response. Nonetheless, as just explained, that low price is not the most profitable response under the premise of the continued viability of the entrant. That is why such a tactic could be found to be predatory under our proposed standard.

III B: Price Floors for Multiproduct Firms

In this section we sketch the development of a test for predatory price-cutting that pertains to multiproduct firms. This test is a necessary component of the test developed below for predatory product introductions. In addition, it shows how cost-based price floors should be correctly adjusted for demand interrelationships to test for predatory price-cutting under

our standard.<sup>18</sup>

We consider, for simplicity, the same scenario analyzed above with one additional complication: the product whose price and output level are at issue is cross-elastic with another product offered by the incumbent. That is, we seek a floor on a price whose level affects the quantity demanded of another product sold by the incumbent. As before, the test for predatory sacrifice investigates whether a contraction, of size  $\delta$ , in the output level,  $q^*$ , of the good in question would increase the current profit of the incumbent under competitive circumstances.

In this case, as above, we presume that the output contraction would not cause the price,  $P$ , to fall, so that  $P \cdot \delta$  is a conservative estimate of the loss in revenue from the sales of the product. However, in this multiproduct case, the effects on the incumbent's profit are not necessarily limited to this revenue loss and to the savings in cost from the output contraction. Instead, there may be an additional net effect on current profits due to the change in the level of sales of the cross-elastic product,  $\Delta y$ , that is induced by the output contraction and by the corresponding rise in the price. This additional effect on profit is equal to the change in revenue,  $w \Delta y$ , where  $w$  is the price of the cross-elastic good, net of the change in production cost caused by the induced output change.

Thus, there is evidence of predation if the conservative estimate of the loss of direct revenues from the output contraction,  $P \cdot \delta$ , is less than the sum of the direct cost saving from the contraction and the net effect on profit caused by the induced change in the sales of the cross-elastic product. Equivalently, the test for predatory sacrifice is whether the price at issue is below the cost saving from the cutback, averaged over the size of the cutback, plus an adjustment for the cross-elastic effects. This adjustment is the ratio of the induced output change,  $\Delta y$ , to the cutback,  $\delta$ , multiplied by the margin between the price,  $w$ , and the average cost change associ-

ated with the cross-elastic good.<sup>19</sup>

Hence, we have derived from our standard an adjustment to the cost-based price floors that takes into account interrelationships among the demands for the incumbent's products. To analyze the effects of the adjustment on the price floors, we assume that the price of the cross-elastic good is not less than its average incremental cost. This is likely to be the case because it is not this price whose level is being tested for predation. And, in general, absent predatory intent, it would not pay the incumbent to maintain that price below average incremental cost.

Then, the adjustment would raise the cost-based price floor if the cross-elastic product were a substitute for the good in question in the eyes of consumers. Here, the test for predatory price-cutting is made more stringent because price cuts have the additional negative effect on the incumbent's current profit of diverting profitable sales from its other product. Conversely, demand complementarities make the test less stringent because, in this case, price cuts have the additional positive effect on the incumbent's current profits of stimulating profitable sales of its other product. In both cases, the size of the adjustment to the cost-based price floor is greater the larger is the mark-up on the cross-elastic good, and the more sensitive are its sales to the price and output of the good at issue. No adjustment is called for if there are no significant cross-elastic effects, or if there is no significant mark-up over average incremental costs on the cross-elastic good.

III C: Concluding Remarks

In this section of the paper, we have derived tests for predatory price-cutting from our proposed general standard. For the scrutiny of a price that affects the demand of no other product of the incumbent, the tests are cost-based price floors, in the spirit of the Areeda-Turner test.

However, we have shown that both marginal and average costs define correct floors, and we have provided a framework for analyzing what cost elements are properly reflected in the floors. Finally, we have derived the adjustment to the cost-based floors that properly reflects interrelationships among the demands for the various offerings of a multiproduct firm.

In the remainder of the paper, we utilize this same analytic approach to derive from our general standard tests for predatory product innovations.

IV: Predatory Product Innovations - An Overview

Predatory pricing, discussed in the preceding section, is only one of the many strategies that a firm may use to induce exit of a competitor. As we shall see below, cutting prices on the existing product lines to below some relevant floor is not always the most effective strategy for forcing a competitor back over an entry hurdle or a reentry barrier. In this section, we argue that an introduction of a new product can be anticompetitive and predatory. Of course, the introduction of a new product can also be pro-competitive, as well as directly beneficial to those consumers who prefer the new product to the already existing ones.

Our main task here is to provide some specific tests which would permit one to distinguish between predatory and non-predatory product innovations. According to our general economic standard of predation, an introduction of a new product is predatory if it is a response to a rival that sacrifices part of the profit that could be earned, under competitive circumstances, were the entrant to remain viable, in order to induce exit and gain consequent additional monopoly profits.

Before this standard can be applied to the problem at hand, one must recognize that, unlike a simple price cut, an introduction of a new product is a composite strategy. It involves, at least, the following fundamental decisions: (a) the choice of the product design; (b) the choice of the

timing of the announcement of the new product; (c) the choice of the price for the new product; (d) the choice of associated adjustments in the prices of the existing products; and (e) the choice of the size and of the content of the research and development and promotional budgets. It is plain that each of these choices can have an impact on the viability of competitors and, therefore, on the strength of competition following the introduction of a new product. Thus, in order to test for the predatoriness of an introduction of a new product, it is necessary to scrutinize these decisions not only singly but also jointly, as components of an overall strategy.

Professors Areeda and Turner shy away from this approach and argue against an extensive antitrust scrutiny of investments in new products, or product lines. In the Areeda-Turner test, for a new product to be judged non-predatory it is only necessary that its price satisfy the de minimis condition of exceeding or equalling the short-run marginal cost (or, if marginal costs cannot be computed, the short-run average variable cost). We think that, for at least two reasons, this position is incorrect. First, even in the absence of antitrust sanctions, manipulation of the product set can frequently be more effective than price cutting as an anticompetitive tactic. Consequently, there is a strong policy reason not to exclude strategies for the introduction of new products from antitrust scrutiny, unless reasonable tests for predatoriness cannot be feasible implemented.

Second, short-run marginal cost and short-run variable cost do not command themselves as the correct cost-based price floors for new products. If the presence of a viable competitor only restricts the innovating firms to charging a price that is no lower than the short-run marginal cost, then the initial expenditures on research and development need not be recouped. Such a finding might indicate that the new product would increment the firm's profits only by inducing the exit of otherwise viable competitor(s). If this is

indeed the case, social benefits from the new product are questionable.

Our analysis considers two types of tactics that entail product introductions and that may be either pro-competitive or predatory. The first tactic is the introduction of a new product that is a substitute for the products of the rival firm and that endangers its viability by diverting its sales. The second tactic is employed in the context of systems rivalry. It consists of constriction in the supply of components that are vital to consumers' use of the rival's products, coupled with the introduction of systems components that enable consumers to bypass their use of the rival's products. Each of these tactics may have at least three distinct types of effects. First, they both may result in an increased variety or an increased quality of products available to consumers. Second, they both may serve as vehicles for pro-competitive entry of new firms or for a pro-competitive expansion of the number of rivalrous product offerings. Third, however, the principal effects of these same tactics may, in other circumstances, be to undermine competition, for example through the elimination of rivals whose viability is essential for competition. The aim of our analysis is to demarcate some of the circumstances in which each of these two kinds of tactics is pro- or anti-competitive. In particular, we analyze the structural features of the markets that are necessary for a finding under our standard that a defendant's actions had a predatory motive. In addition, we provide workable tests, applicable in the two scenarios, for ascertaining whether the defendant's actions entailed predatory sacrifice of profits.

In Section V, we consider an introduction of a new product which is a substitute for the existing product(s) of a competitor. We argue that product introductions of this type can be essentially viewed as a two-stage price adjustment: First, a decrease in the price of the new product to the level of the price actually set, from a level sufficiently high to choke off

any possible demand for it. Second, whatever adjustments were effected in prices of the existing products from their pre-introduction levels. (Here, withdrawal of a pre-existing product is viewed as an increase in its price to a level that chokes off all demand for it.) Given this framework, an introduction of a new substitute can be tested for its possible predatoriness using the already summarized tests for the scrutiny of pricing behavior of multiproduct firms. As detailed below, the treatment of research and development expenses is the novel element of these tests when they are applied in the context of product innovation.

In Section VI, we analyze introductions of new systems. A system is a collection (package) of complementary products which are combined by a manufacturer, or a consumer, to yield a final product. Tennis rackets and tennis balls; cameras and film; central processing units and plug compatible peripherals are all examples of systems. The presence of complementarity relationships among products requires that the various components of the system be compatible with one another.<sup>20</sup> This being the case, the viability of a firm which produces only some of the components that comprise the system depends critically on the prices and on the availability of the remaining components. A dominant firm may exploit this interdependence in the final goods market by pricing up, or even withdrawing from production, the components complementary to the products of its competitors, while introducing a new system which is incompatible with its competitor's components. This policy of introducing a new system and simultaneously subjecting competitors to a vertical price squeeze may be a more effective tactic for inducing exit than would be a simple predatory price cut on the existing products. Yet, like a price cut, this policy may simply be an innocent and socially desirable aspect of competitive interactions.

In Section VI, we provide the extensive analysis that is necessary to

explicate some of the possible motives for tactical exit inducement in the context of systems rivalry. We show that the alternative tactic of vertical price squeezes does not necessarily enable a firm with monopoly power over some system components to extract all rents available in the final market.<sup>21</sup> In particular, this tactic could be less effective than inducing the exit of a rival when the extant monopoly power of the dominant firm is limited by another inferior source of supply.

There are structural preconditions on the various facets of the systems market that are necessary (but not sufficient) for the existence of motives for tactical exit inducement. There must, of course, be monopoly power over some of the components sold by the defendant, as well as hurdles to entry into the final systems market. There must be hurdles to entry into the production of some of the system's components -- which ones depend on the nature of the ineffectiveness of the vertical price squeeze. And the tactically induced exit must substantially weaken competition in the systems market.

We show that the defendant firm sacrifices some of the profit that it could earn were its rival to remain viable if it refuses to sell a component of the old system that is needed by the rival, rather than offer it at a compensatory price. By definition, this is the lowest price at which sales of a pre-existing component would not lower the innovator's profit, given the viability of the rival. Loosely speaking, the compensatory price (a) covers the cost of supplying the old component and (b) yields the same incremental profit as would the cross-elastic sales of new and other components, under the premise that the terms of those sales are constrained by the viability of the rival in the systems market. We show that, in some simple situations, the above definition of the compensatory price implies that after the innovation is introduced, the manufacturer must offer the same or lower markup on the old component as he charges on the parallel component of the new system, in preference to discon-

tinuing the old component. More generally, a price above the compensatory level entails predatory profit sacrifice if there is a lower price which both benefits the rival and raises the innovator's profit under the premise of the continued viability of the rival. It is important to emphasize that the viability of a rival must be assessed in terms of his ability to compete in the final systems market, and not in terms of his ability to offer components that are compatible with the new line of the innovator. We think that the latter conception of viability, while being more pro-rival than the one we have adopted, could result in a socially undesirable chilling of the innovative process.

It is crucial to note that compensatory prices need not induce any demand for the component or for the old system of which it is a part, if consumers view the new system as sufficiently superior to the old one. This would be the case if the exit of the rival were economically efficient, were the result of legitimate competitive interaction, and were not caused by predation. The thrust of our approach is that such a judgment is correctly rendered by the market reaction to a properly compensatory structure of prices, rather than by the market reaction to a structure of prices that predatorily disadvantages the rival's offering.

A manufacturer who is prepared to offer old components at compensatory prices may, nevertheless, be predating. To support an allegation of profit sacrifice, a plaintiff may demonstrate that the innovation was not intended to earn a positive incremental profit, given the continued viability of the rival, but was instead motivated by the additional profits that the rival's exit would make possible. The calculation of the incremental profit must be based on (a) complete costs, which include economically allocable expenditures on research and development; and (b) full incremental revenue, which includes the net revenue foregone on the possible sales of the existing components or systems.

We show, in the context of a simple market scenario characterized by the availability of an inferior source of supply, that the application of these tests for compensatory pricing and for the RSD motive would enhance social welfare. The tests permit socially desirable innovations, whatever their effects on market structure. And they simultaneously restrain socially wasteful innovations whose only motivation were the additional monopoly profits enabled by their anti-competitive effects.

There exists yet another test for predatory sacrifice that can be usefully appended to those described above in some special circumstances. This test would scrutinize whether there existed an alternative design of the product which would have yielded a higher incremental profit than the design actually chosen, on the assumption of the continued viability of the rival. Note that the tests proposed above compare an innovation to the status quo: i.e., to the situation with no new product. The test suggested now would compare the innovation actually marketed to some alternative product design. Generally, such an investigation could only be based on cost and demand data too speculative for legal standing. However, in some instances, there may be an evident alternative design that is at once less exclusionary of rivals, less costly to produce, and equally desirable to consumers.<sup>22</sup> The decision by a defendant against such a design would entail a predatory sacrifice of profit.

We close the paper with appendices that discuss product preannouncements and retaliatory cross-market entry, respectively. This form of entry occurs when, in response to entry in its own (geographical) market, the firm introduces its own product, or attempts to expand its sales, in the (geographical) market of the entrant. Although this type of conduct differs in many details from the introduction of a product innovation, it can be viewed as an introduction of a new product, especially if the firm cross-enters a territory in

which it did not compete before. In this instance, research and development expenditures may be non-existent, or minimal, but promotional expenditures may be substantial, and are analogous to the expenditures on research and development that characterize product innovations.

What is peculiar about predatory cross-market entry is that its aim is to induce a rival's exit not from the market which has been cross-entered, but rather from the market that was first entered. One could take a position that cross-market entry is prima facie predatory: if cross-entry is (innocently) profitable after rival's own entry, it is incumbent upon the cross-entering firm to prove that it was not profitable prior to the initial entry.

We take the opposite position and suggest that cross-market entry be presumptively legal. It is plausible to argue that entry may be easier when a rival is engaged in his own expansion in other markets, and thus leaves some room for profitable operation in his own market. By placing the burden of proof on the plaintiff, our position is generally more pro-competitive than is the stated alternative view. However, under our standard, a plaintiff would be permitted to argue that cross-market entry had the intent of monopolizing or attempting to monopolize the defendant's original market.

In the appendix on product preannouncements, we argue that the scrutiny of innovations under our standard largely obviates the need for additional scrutiny of timing of the announcement for its possible anticompetitive effects.

IV A: A Stylized Example

Before proceeding to a more detailed discussion, we illustrate some of the key concepts of our standard by means of a stylized example of rivalry through product innovation. Consider a market for systems that are comprised of proverbial widgets and widget accessories. Widgets Incorporated (henceforth, WINC) is the dominant manufacturer of widgets. Widget accessories are offered by WINC, as well as by its rival, WAC. At some point in time, WINC

introduces a new line of widgets and compatible accessories. Because the accessories produced by WAC are incompatible with the new line, the viability of WAC is threatened by the innovation.

Beginning with this sketch, let us summarize some additional features of the scenario that would immunize WINC from a finding of predation under our standard. First, there could be no predation if the exit of WAC would fail to increase the monopoly power of WINC. This would be the case if there were available sufficiently close substitutes for widget systems to render the systems market competitive; if other firms could offer accessories that are compatible with WINC's new line or with the widgets of other viable suppliers; or if, despite current concentration, the systems market, or the production of widgets, or the offering of new line compatibles were unprotected by entry barriers.

Second, there could be no predation if WAC did not face a reentry barrier into the systems market. This would be the case if WAC could retool to produce accessories compatible with the new line without substantial disadvantage vis-a-vis the parallel production by WINC. While the need to sink costs and other hurdles would constitute such disadvantages, they must be balanced against whatever outlays WINC had to incur to develop and introduce its new accessories.

Finally, even if the above-mentioned structural features of the markets permitted a finding of predation, WINC could be nonetheless legally invulnerable under our standard if its behavior exhibited no sacrifice of profit. In the hypothesized scenario, this would necessarily entail WINC continuing to offer WAC-compatible widgets at no higher than a compensatory price, in preference to discontinuing sales of these pre-existing components. The compensatory price for a widget would yield WINC the same incremental profit as it would earn from the cross-elastic sales of new-line components. This

properties, but also on the scope of the available substitute products, and on their prices. Thus, if the innovator, by his anticompetitive behavior, restricts the scope of the available substitutes or raises their prices, then market acceptance of the new system is not a correct index of social benefits from innovation. Rather, the proper test of economic superiority of the new offering in part rests on its market acceptance when the old line remains available at compensatory prices.

Second, whether or not the new product is economically superior to the old one cannot be deduced merely from market acceptance of the new product, even if the pre-existing components are sold to rivals at compensatory prices. What must be examined is whether the initial decision to invest in R&D can be justified, given the continued viability of rivals, or equivalently, given compensatory pricing of pre-existing components.

Thus, to continue our hypothetical, suppose that WINC has expended a large sum to develop its new line of widgets and accessories. Moreover, suppose that the new line is only slightly superior to the old in the eyes of consumers, incurs equal unit variable costs of production, but excludes WAC's line of accessories by means of an inimitable interlock configuration. The price that can be charged for the new widgets is only slightly higher, because of their slight quality improvement, than that formerly charged for the old widgets. On the advice of counsel, WINC continues to offer original widgets at a compensatory price. Here, because the unit variable costs of the two models are equal, the compensatory price of the old model is equal to the price of the new one. Then, as a consequence of the slight quality differential, all consumers abandon the old line for the new one. This loss of demand for WAC's old widget accessories causes WAC to go out of business because it cannot redesign its components to be compatible with the interlocks of WINC's new line of widgets. And WAC's exit yields WINC additional monopoly profits that are protected by sufficiently high entry barriers.

is the sale of components in the new line that would be displaced by a sale of an original widget. Thus, if the sale of one original widget would displace the sale of one new widget, the compensatory price for an old widget would yield a markup over its current production cost equal to the markup earned on new ones.

By offering original, WAC-compatible, widgets at such a compensatory price, WINC avoids incurring a sacrifice of profit under the presumption of the continuing viability of its rival WAC. Nonetheless, the availability of compatible components does not assure the continuing viability of WAC. There may be no, or very little, market demand for systems comprised of original widgets and accessories when the new line is available, even if the original widgets are priced in a compensatory manner. Of course, this is especially likely if the new line of widgets is regarded by consumers as being sufficiently superior to the original one.

Thus, it is not continuing sales of the old model widgets that is to be required of WINC, but rather the offer to supply them (for a reasonable duration) at a compensatory price. This requirement could not, by the very nature of a compensatory price, diminish the innovator's profit contingent on the viability of its rival. Instead, it could only forestall whatever additional monopoly profits could be earned by the tactical exit inducement of the rival.

The important conclusion to be drawn from this example is that compensatory prices need not be so low as to induce some demand for the component. If consumers view the new system as sufficiently superior to the old one, economic efficiency would dictate that it should supercede the old system. This remark is subject, however, to two important caveats. First, whether or not the new product or system is economically superior to the old one cannot be deduced merely from market acceptance of the new product. Market acceptance of a new product depends not only on its price and technological



In this scenario, WINC could be found guilty of predatory product innovation under our standard. First, the product introduction induced the exit of WAC by diverting its sales to the incompatible new line. Second, the hypothesized facts indicate that the development costs of the new widget line could not be recovered from the added profits afforded by the slight quality improvement, as long as WAC remains viable. Hence, the decision to expend these development costs clearly entailed a predatory sacrifice of profit. Finally, WINC stood to gain additional monopoly profits from the induced exit of WAC, and these evidence the rational, if illegal, motive for the predatory sacrifice.

The predatory sacrifice in this example would be pellucid if substantial R&D expenses could be attributed to the development of the interlock configuration itself, and if this feature yielded no benefits to consumers. Consequently, the decision to develop the interlock could only be attributed to its exclusionary effects on WAC. Then, a finding of predatory sacrifice would be inescapable, regardless of whatever consumer benefits were derived from the remainder of the R&D expenses.

#### V: Introduction of New Substitute Products

We now turn to a more detailed discussion of the diverse types of competition through product innovation. We begin with a fairly simple case -- an introduction of substitutes -- which allows us to isolate some of the basic features of this type of competition. We should mention, however, that unlike systems competition studied below, introduction of substitutes has not been a subject of extensive antitrust scrutiny as possibly predatory conduct. Nonetheless, the tests of predatory product innovation developed here are necessary to the development below of tests of predation that are relevant to the more complex scenarios that have been actively subject to such scrutiny.

The prototypical instance of a possibly predatory introduction of a substitute product is as follows: The dominant manufacturer of widgets in a

concentrated industry introduces a new and superior model. The price of the new model is set sufficiently low to induce a large share of buyers to switch from previous models, among which there was some interfirm competition.

Because of the loss in sales and net revenues, some rival manufacturer(s) abandons the production of widgets, and disperses his productive assets. After exit occurs, the innovating firm readjusts prices and earns additional monopoly profits that are protected by entry hurdles and re-entry barriers.

These facts allow us to draw two conclusions. First, the innovator and his rival were participating in the same market because (a) the quality and the level of the price of the new model affected adversely the profitability and thus the viability of the rival and (b) the exit of the rival beneficially affected the profitability of the innovating firm. Second, because of the existence of entry hurdles, actual competitors are more effective than are potential competitors in controlling the monopoly power of the innovating firm.

The simplest way to approach the question of whether or not the new product is a predatory innovation is by a cost-based test analogous to those developed (Section III B, supra) to test price cuts by multiproduct firms for predation. Here, as in the multiproduct case, the usual cost-based tests for predatory pricing must be modified by demand-side adjustments. In particular, the lowering of one price will have a negative effect on the sales of substitute products offered by the price-cutting firm. The corresponding losses in incremental profits must be added to the incremental cost of the product whose price was reduced.

An introduction of a new product can be viewed as a reduction in the price of an existing product from a price level sufficiently high to choke off all effective demand. In this context, the test compares the market price and quantity of the new product with the comparison scenario in which the new product is not available and the firm's profits accrue from the sale of only the already existing products. This comparison must take into

account any diversion to the new product of sales from the pre-existing products of the innovator.

Hence, under our standard, the introduction of a new substitute product is vulnerable to a finding of predation if the revenues from its sales fail to exceed the incremental costs of its production, plus the reduction in net revenues caused by the diversions in sales from the pre-existing products of the innovator. In such a case, there is prima facie evidence that the product introduction entails a sacrifice of profit under the premise of the continued viability of the innovator's rivals.

In this context, as in all others, a showing of profit sacrifice is not in itself sufficient for a finding of predation. In addition, it must be demonstrated that the likelihood of the rival's exit is substantially raised by the product introduction. It must also be demonstrated that the additional monopoly profit that would accrue to the innovator after the exit of the rival would have made the introduction of the new product profitable for the innovator. This last element of the test for predatory product introduction ensures that the alleged facts utilized by the plaintiff to show profit sacrifice are consistent with the existence of a motive for a predatory tactic.

It must be emphasized that both the character and the details of this test depend to a large extent on the significance of the relevant post-entry research and development costs. If these costs are small relative to the other incremental costs of the produced quantities of the new product, then the test for predatory price reductions by a multiproduct firm is directly applicable. (Note that pre-entry R&D costs cannot be logically included in the calculation of predatory price floors. This is discussed more fully below.) However, if post-entry R&D expenditures are significant, then it is the decision to undertake the R&D investment that, along with the innovator's pricing strategy, must be tested for predatoriness.

In this case, the concept of the test is an examination of the intent underlying the investment decision. This would entail scrutiny of the levels of profits with and without the viability of the entrant, and inclusive of the post-entry R&D costs, that were anticipated (ex ante) at the time the investment was made. But such anticipations are not directly observable from market data. Consequently, recourse must be made to either evidence on the investment planning process or to necessarily imprecise inferences from current market data. Inferences of this kind may be admissible components in a plaintiff's argument, and they can entail simply substituting market data for expectations. From this viewpoint, it is clear that an admissible line of defense for the defendant could entail a showing that his ex ante anticipations were not those alleged by the plaintiff nor those inferred from market data. Such a showing could not be adduced from purely speculative evidence in view of the Court's dictum that intent can be deduced from conduct.

In particular, the defendant may be able to justifiably claim that his inability to recover the full incremental cost of the newly introduced product, including the post-entry R&D costs, was due to an exaggerated estimate of consumers' demand for it. One element in such a showing could be a proof that the defendant attempted to recoup the initial outlay on R&D. An initially high, compensatory, price that was followed by price reductions needed to bolster sales may be indicative of such an attempt, when supported by the appropriate marketing studies. All this may be, however, academic: if the new product is truly unwanted it is not likely to cause the exit of a rival who produces a substitute product. It is not likely, therefore, that a charge of predatory innovation will be brought in such an instance. Of course, even an unsuccessful product may be required to pass cost-based price tests from which all elements of post entry R&D costs have been removed. The mere fact that the product does not succeed does not necessarily immunize the

innovating firm from a possible charge of predatory conduct.

The preceding discussion indicates that whether or not the new product passes the test of non-predatory pricing depends significantly on the extent to which R&D costs are included in the cost-based price floor. The proper allocation of these costs depends on when the allegedly predatory innovation was undertaken. If the new product is available before entry occurs and is taken "off-the-shelf" after entry occurs, the R&D costs are properly viewed as sunk and the correct test for predatory pricing is the same as for a multi-product firm.

This treatment of the R&D costs may give an innovator incentives to accumulate new product designs in anticipation of entry, and to then wait with their introduction until entry occurs. It is difficult to conjecture how strong would be these incentives. Certainly, carrying product designs in anticipation of uncertain entry is costly. It is also conceivable that firms may introduce too many products too soon in order to create an artificial entry barrier. (See the complaint In re Kellogg.)<sup>23</sup> Thus we conclude that the incentives for over-accumulation of product designs need not be overly strong.

To make them even weaker, the plaintiff can be permitted to utilize as evidence of predatory product introduction the fact that the defendant did not bring the off-the-shelf innovation to market prior to entry. The plaintiff can argue that it was the exit inducing aspect of the product introduction that made it profitable for the defendant post-entry, even though the introduction was evidently unprofitable pre-entry. As such, the product introduction would entail the sacrifice of profit under the premise of the continued viability of the entrant.

Despite the strength of this argument, we hesitate to treat off-the-shelf product introductions in response to entry as being prima facie indica-

tive of predation. Intrinsic complications that would generally attend this line of argument would focus on the other alterations in the profitability of the product introduction that are caused by the alteration in market structure. For instance, the defendant could argue that the introduction was more profitable post-entry than it would have been pre-entry because of the reduction in the diversion of demand from his own substitute products. On the other hand, the plaintiff could argue that, pre-entry, the new product would have had greater sales than it would have in the more competitive post-entry market. While these arguments must rest on speculative evidence, disregarding them out of hand might have a chilling effect on the socially desirable process of product competition.

It is not the implication of our analysis, however, that the new products should be exempt from thorough antitrust scrutiny. Because technological progress is desirable and should not be stifled by antitrust laws, it may be tempting to follow the view, expressed in ILC, Peripherals Leasing Corp. v.

International Business Machines, 458 F. Supp. 423, 439 (N.D. Cal. 1978), that if engineering data suggest that the new product is superior to the product it replaced, the antitrust inquiry should end. Yet, it is plain that not all new products conduce to higher social welfare.<sup>24</sup> Under our standard, the relevant question is whether the anticipated incremental profit of the new product was positive, given the continued viability of the rival. As we have seen, the incremental profit measure is properly calculated net of the losses resulting from diversions of sales from the innovator's pre-existing products, as well as net of all post-entry R&D costs.<sup>25</sup> Where these costs are small because the newly introduced product had been developed previously, the plaintiff may attempt to adduce anticompetitive conduct from the fact that the off-the-shelf design was brought to market only in response to entry.

Thus, it is the treatment of the R&D process and its costs that distin-

dictated by our general standard, it is necessary for a finding of predatory intent to show both motive and sacrifice of profit. To show motive, it is required to first establish that the market is concentrated and exhibits entry hurdles and reentry barriers. In addition, more presumptive elements of motive concern the profit rationale for exit inducing tactics vis-a-vis the alternative stragem of a vertical price squeeze.

A distinguishing feature of the test for sacrifice of profit is that it proceeds in two novel stages. The first stage, which is particular to systems rivalry, involves an examination of the post-innovation prices of the components that are complementary to the products offered by rivals in the systems market. We argue that for the innovator's behavior to be free of profit sacrifice, he must stand ready to provide his rivals with the needed components at compensatory prices, rather than discontinue them. Loosely speaking, the prices of old components or the terms of long-term supply contracts (where they are economically necessary) are compensatory if they (a) cover the cost of supplying the old component and (b) yield the same incremental profit as would the cross-elastic sales of new and other components, contingent on the rival's viability in the systems market. Compensatory prices of old components should not be permitted to reflect the additional monopoly profits that would accrue to the innovator if he were to first induce the exit of a competitive manufacturer of complementary components.

The second stage of the test for sacrifice of profit in the systems context examines the rationality of the R&D investment in the new product under the maintained assumption that the innovator is willing to sell old components at compensatory prices. Thus, the second stage employs the predation tests developed in Section V wherein we applied our standard to introductions of substitute products.

The plan of the rest of this section is as follows. In subsection VI B,

guides the application of our standard to introductions of substitute products from its application to price cuts on homogeneous products. In the next section it is shown that additional and novel issues arise in the application of our standard to systems rivalry and the introduction of complementary products.

VI A: Systems Rivalry

Most of the important recent cases in the area of predatory product innovations were concerned with the allegedly anticompetitive impact of innovations in the context of systems rivalry.<sup>25</sup> Typically, the defendant was a firm that had been offering systems components (e.g., computer mainframes or film) compatible with components produced by its rival (e.g., computer peripherals or film processing), as well as components competitive with its rival's. The defendant then introduced an entire new system comprised of components incompatible with those of its rival. In such a case, the rival's ability to compete in the final systems market could depend on the availability of compatible complementary components. Then, the rival can be doubly disadvantaged by the introduction of a new system. First, if the new system is superior to the old system, demand for the latter will tend to decline even if the price of the old system remains unchanged. Second, the innovator can increase the price of the old system by either raising the prices of the old components that are compatible with rivals' complements or by withdrawing the old components altogether. Despite its disadvantages to rivals, a firm's introduction of such a new system may be socially advantageous inasmuch as it improves the product choices available to consumers and it enhances interfirm competition.

It is the purpose of this section to provide workable tests for ascertaining whether or not an introduction of a new system, coupled with price adjustments on components of the old system, has been anticompetitive. As

A system can frequently be assembled from complementary components produced by different manufacturers. For this to be possible, various components must be compatible with each other. When components of various manufacturers are interchangeable without much loss in their efficiency, competition in the final market, i.e., the system market, is enhanced. Conversely, incompatibilities may reduce competition. Consequently, creation of incompatibilities may conceivably increment the monopoly profits of a firm which has monopoly power over one or more of the components.

Figure 1 summarizes diagrammatically the basic elements of systems rivalry. Each system consists of two complementary components which we denote with numbers. Manufacturers are labeled with letters. Thus A1 stands for the first component manufactured by firm A, while B2 stands for the second component manufactured by firm B. In the diagram, components are denoted by boxes. A line joining two boxes indicates that the two components are compatible. An absence of a line indicates an incompatibility. Thus, in Figure 1, A1 and B2 are compatible, but C1 and A2 are not.

In Figure 1, the final systems market, denoted by a circle, is characterized by substantial intersystem rivalry: consumers can select from three distinct systems, all of which may be perfect substitutes for each other.

Let us now modify the diagram in order to reflect a possibly less competitive systems market. As indicated in Figure 2, firm A has monopoly over the first component. It is also an integrated firm: it produces both components one and two. Firm B specializes in the production of the second component, which is compatible with A1. It is plain that in the market scenario depicted in Figure 2, firm A has substantial market power, and that the ability of firm B to compete in the systems market may be substantially lessened by the absence of the alternative source of supply of the needed component, viz. of firm C, as in Figure 1.

We provide a detailed discussion of systems rivalry. We describe the diverse tactics that may conceivably be used by a firm with monopoly power over one or more components to induce the exit of a rival manufacturer of complementary products. We briefly outline the conceivable profit motives for such exit-inducing tactics. We show that such tactics may raise the profits of a dominant firm when a vertical price squeeze would not yield the maximum attainable monopoly profit, even in the presence of monopoly power over one of the components. This discussion is elaborated in subsection VI C.

Subsection VI D contains the main findings of this section. We show how compensatory prices can be calculated from the data. We argue that in some simple situations, compensatory pricing requires that all components vital to a rival's viability be priced with markups equal to those of their parallel counterparts in the new system, if the alternative is to instead discontinue their availability. We show that, in the context of a simple model, our tests would find predatory all socially undesirable innovations that were motivated by tactical exit inducement. And our tests would find all socially desirable innovations to be innocent of predation, regardless of their possible effects on market structure. Finally, in subsection VI E we discuss the burden of proof entailed by our suggested test for predatory product innovation.

IV B: Basic Concepts in Systems Rivalry

We define a system as a collection (package) of complementary products which are combined by a manufacturer, or a consumer, to yield a final product. Since the components of the system are complementary products, an increase in the price of one of them reduces the demand for the remaining components. For example, an increase in camera prices tends to reduce the demand for film; an increase in prices of computer central processing units tends to reduce the demand for the associated peripheral equipment, etc.

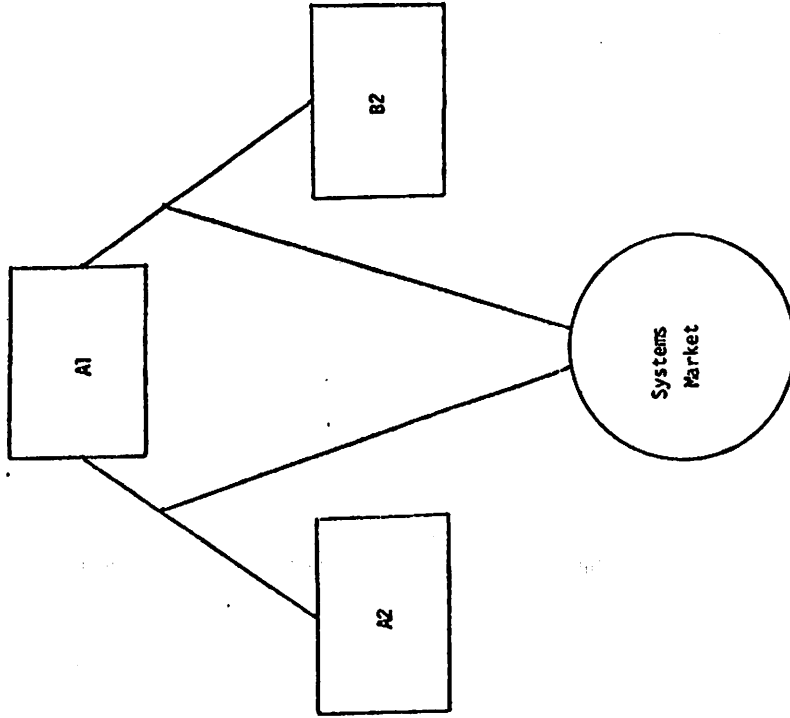


Figure 2

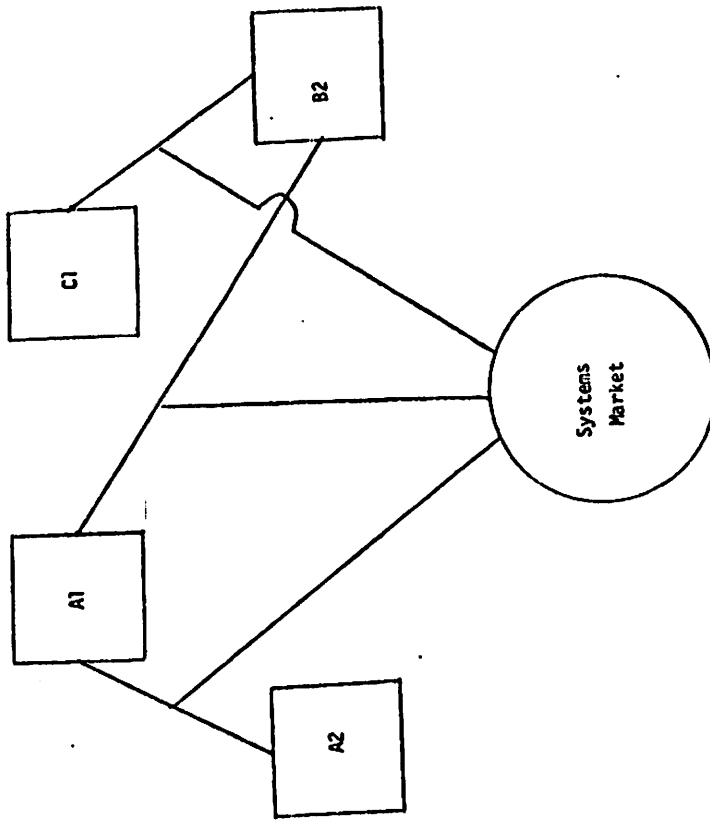


Figure 1

Given the market situation depicted in Figure 2, several business decisions available to firm A may disadvantage firm B as its rival, whatever the underlying motive, and irrespective of their effect on competition. First, firm A can refuse to deal with firm B by withholding the complementary component from the open market and selling it exclusively as a part of a system. Plainly, if B has an alternative source of supply, as he does in the scenario diagrammed in Figure 1, the refusal to deal by firm A may have only insubstantial impact on the ability of firm B to compete with A. That impact will be less significant if (a) the component C1 is a good substitute for A1, in the eyes of the final consumers; (b) component B2 can easily be made compatible with the components of either of the two manufacturers; (c) manufacturer C does not increase his prices following the refusal to deal by firm A. Absent, however, such an alternative source of supply as manufacturer C1 a refusal by A to deal with B leaves firm A as the sole supplier of systems, at least temporarily.

Refusal to deal can be viewed as a form of price discrimination, which is another business strategy that may, incidentally or otherwise, disadvantage a competitor. A price discriminating firm sets two prices: a high one on components sold to a rival, or to the rival's customers, and a lower price to those customers who do not purchase components manufactured by the rival. The limiting form of this strategem arises when the higher price chokes off all effective demands. Such a price may have the same effect on the rival as a pure refusal to deal: it may conceivably leave the firm which has monopoly power over one of the components as the sole supplier of systems. That is, it may permit the firm with monopoly power over one component to extend that power to the systems market.

Refusal to deal and price discrimination, in a scenario of this kind, may be pro-competitive sound business practices regardless of their effects

This would be the case, for example, if they were necessary to maintain the quality reputation of the system, the product differentiation of the system, or the assured supply of requisite system components. Yet, in some instances, the two strategies described above might transparently lack business reasons to justify their implementation other than monopolization or attempt to monopolize. In such instances, the monopolist may seek other, less obviously anticompetitive strategies which would permit him to extend his monopoly power over one of the components into a monopoly position in the systems market. It is our major contention that introduction of new systems may be employed as a camouflaged anticompetitive strategy precisely because introduction of new products or systems is usually regarded as being pro-competitive and as enhancing consumers' welfare.<sup>26</sup>

Of course, introductions of new products and systems should be viewed as presumptively socially beneficial. Still, one should not be blind to the conceivable anticompetitive effects of and intent behind them.

An introduction of a new system could harm rivals' sales and disadvantage them as competitors for at least two reasons. First, if the new system is superior to the already available systems, demand for the old systems will decline. This decline will be the greater, the better is the new system and the lower its price as compared to the price of the old systems. Second, following the introduction of a new system, the innovator may increase the prices of the old components or even discontinue their production. The discontinuance of the old components will be particularly damaging to rival's profits (a) the more incompatible are his components with the new components (b) the more costly it is to introduce a new line of components which is compatible with the innovator's new components; (c) the more costly or inferior are the needed compatible substitute components that are available.

These harms to rivals may well be incidental effects of socially benefi-

cial and pro-competitive product innovation. However, harms to rivals may, in some instances, be the primary motivation for what we label predatory product innovation. The task here is to provide workable tests for identifying such anti-competitive behavior.

When the innovating dominant firm continues to make available the old components at compensatory prices, the introduction of a new system can be scrutinized as possibly anticompetitive conduct using the tests developed in Section V. A novel set of issues arises, however, if subsequent to the introduction of a new system, the defendant raises the prices of the already existing components to above the compensatory levels. In this instance, the allegedly anticompetitive conduct does not involve a price cut, but rather a price increase. Consequently, a standard comparison of prices to costs does not reveal the underlying intent.

The standard of predatory behavior developed in Section II, supra, yields a set of tests which can be implemented in the context of systems competition. The implication of our standard is that for a system innovation and an attendant price revision to be, in combination, predatory conduct, three necessary conditions must be met. First, the conduct must substantially increase the probability that a rival will exit. Second, the timing, the method, and post-introduction pricing policies must involve a sacrifice of profits when compared to those that could have been earned if the innovator had pursued a different strategy and had the rival remained viable. Third, there must be a motive for inducing or attempting to induce the exit of a rival manufacturer of complementary products.

Before turning to a detailed exposition of the motive and sacrifice prongs of the predation test, we address the issue of how to define viability in the context of systems rivalry. The relevant market for the definition of the rival's viability is the final systems market. In order to compete in

that market, the rival must not have irreversibly exited. In addition, there must remain available, either directly to the rival or indirectly to his customers the compatible components requisite for a complete system. When such components can be obtained from the defendant or some other, albeit inferior, supplier, the rival's viability in the systems market is tantamount to continued availability of his productive assets. However, even if the productive assets of the rival were to remain available (e.g., no re-entry barriers) the rival would not be viable in the systems market if the requisite compatible components were unavailable. This could only occur if all of the following conditions were to obtain: (a) the defendant refuses to sell the components at compensatory prices; (b) there are no existing alternative suppliers of compatible parallel components; (c) there are entry barriers that prevent a new entrant from supplying the requisite components; (d) the rival has no substantial advantage over prospective entrants in the production of components compatible with the new system. Note, then, that even if the rival is denied the availability of the old complementary components, he nonetheless would remain viable in the systems market if he were able to promptly and cheaply alter his components to compatibility with the new system.

It may be tempting then to simply define viability in terms of the rival's ability to offer components that are compatible with the new system. Unfortunately, this pro-rival conception of viability suffers from irresolvable difficulties. The most important is that, in a free market economy, the prospect of temporary quasi-monopoly profits is necessary to stimulate the innovative process. In other words, the innovating firm must be assured some "imitation lag" to be able to recoup its initial outlay on R&D. If the imitation lag were to shrink to zero, rivals could generally undersell the innovator and still make a positive incremental profit, inasmuch as their expenditures on imitative R&D would generally be lower than



those of the original innovator. To take this into account, the court would have to determine (a) the socially optimal duration of the imitation lag for each new system and (b) whether or not the innovating firm has unduly lengthened the imitation lag. We cannot think of workable procedures which would make such findings free of substantial errors. Fearing those errors, the prospective innovators might reduce their investments in R&D and the innovation process would be stifled. It is preferable, therefore, to define viability narrowly, i.e., as the availability of the assets of the rival for his continued competitive role in the systems market.

The question still remains why the viability of a rival manufacturer of a complement should limit the profits of a firm which has some monopoly power over one of the components of the system. Shouldn't such a firm be able to extract all the monopoly profit by executing a vertical price squeeze on the rival who purchases from it the requisite complements? The answers to this question are critical for the understanding of the possible profit rationales and motives for tactical exit inducement in the systems' context. They will also prove essential for the construction of tests of predatory sacrifice of profits. The next section discusses the mechanics of vertical price squeezes and delineates a prevalent market circumstance in which this tactic is less effective than exit inducement in extending to the systems market monopoly power over one of the components.

VI C: The Economics of Vertical Price Squeezes

We now turn to a more detailed discussion of vertical price squeezes in order to better grasp what are, and what are not motives for inducing the exit of a rival who produces competing complementary components. The discussion will also facilitate the understanding of the notion of complementary price which underlies our conception of profit sacrifice.

In order to focus the analysis of this section, we first examine a

market scenario in which a firm with market power has no motive to engage in anticompetitive exit-inducing behavior vis-a-vis its rival. In such a situation, which is depicted in Figure 3, the dominant firm can extract all the monopoly profit that is available in the systems market by subjecting the rival to a carefully designed vertical price squeeze. Because of the possibility of perfect vertical price squeezes, some analysts hold the view that a firm with market power over one component will in general lack incentives to lever its market power in one market into a monopoly in the other market. As we shall see below, this view is not generally correct.

A perfect price squeeze situation is illustrated in Figure 3, which is Figure 2 augmented by the display of the production costs in the appropriate boxes. Thus, the unit incremental cost of the monopolized first component is constant and equal to c. The unit incremental cost of the second component is the same for either firm and is equal to a. All consumers are identical and are assumed to have a maximum willingness to pay, or reservation price, of b for either system. In other words, if the system price were b or less, each consumer would buy one system. If, however, the price exceeded b, consumers would refuse to buy systems.

We shall show that in this scenario the viability of the rival, firm B, need not diminish the profits of firm A, the monopolist over component one.<sup>27</sup> To demonstrate this, we first consider the profits that could be earned by A in the absence of B, and then analyze the profits that could be earned by A with a perfect price squeeze executed on a viable B.

Absent B, firm A could maximize its profit by simply selling systems to consumers at the highest possible price: their willingness to pay of b. Since each system would cost A c+a to produce, each sale would yield a profit margin of b-(c+a). And A's total maximal profit would be that margin on the volume of sales provided by the entire systems market.

If, instead, firm B were as efficient as A and competitive, its viability would constrain the equilibrium price of type two components to be a, its unit cost. Nonetheless, firm A could extend to the systems market its monopoly over type one components by charging a price of b for entire systems, a price of b-a in the open market for type one components, and a price of a in the open market for type two components. Then, each sale of a system of any kind in the entire systems market yields a profit to A of  $b-(c+a)$ , as was the case above. A direct sale of a whole system by A has  $b-(c+a)$  as the price-cost margin. A system comprised of components A1 and B2 yields A a profit of  $(b-a)-c$ , through its sale of component A1 at the price of  $(b-a)$  and with the cost of c. Finally, a system assembled by consumers that is comprised of components A1 and A2 yields firm A a profit of  $(b-a)-c$  on its sale of A1 and no profit on its sale of A2 at cost. Thus, with such pricing, firm A does not lose profits if consumers choose systems that include the rival's component rather than systems wholly comprised of A's own products. And, A is able to extract the maximal profits available in the entire systems market.<sup>28</sup>

The crucial implication of our analysis is that in the hypothetical market of Figure 3, the monopolist has no motive to induce the exit of an equally efficient rival. The monopolist earns an incremental profit of  $b - (c+a)$  on a system sale and the same profit on a sale of a single component of type one. The component price of  $b-a$  is therefore fully compensatory: by charging the rival this price, the monopolist can transfer to himself all the monopoly profit that can be earned in the systems market. Consequently, in this hypothetical example, we find that the monopolist has no motive to induce the exit of the rival because there are no additional monopoly profits which could be earned subsequent to the rival's exit. In other words, there are no incentives for leveraging the monopoly power over one of the components into monopoly power in the market for the other component.

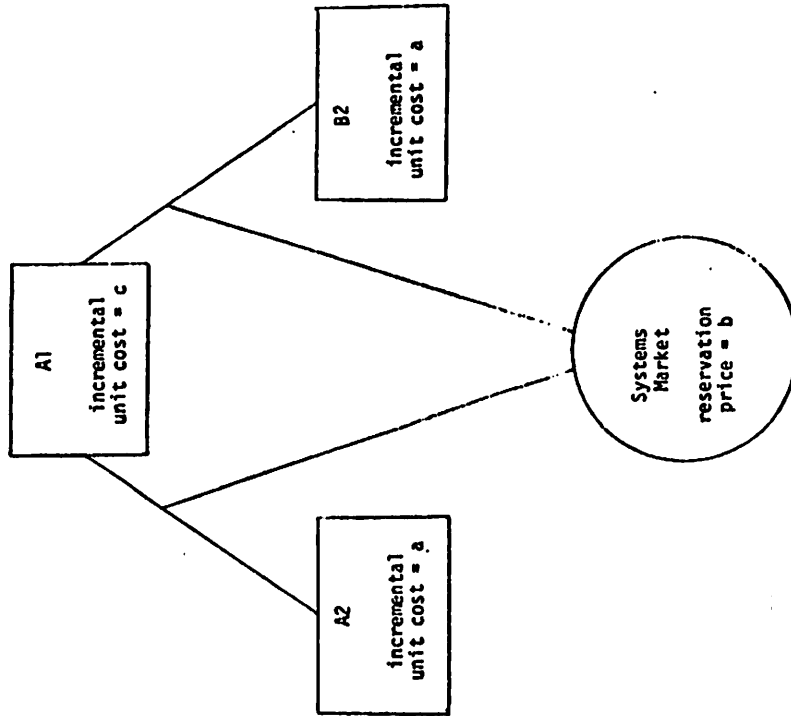


Figure 3

However, as we now show, such incentives do arise if the structure of the market scenario presented in Figure 3 is enriched by postulating the existence of an inferior source of supply. In this case, only the exit of the rival will enable the monopolist to secure the maximum available monopoly profits in the systems market.

In Figure 4, we illustrate the market scenario in which the extant monopoly power of the dominant firm is limited by another inferior source of supply. There are now three firms in the market: the dominant firm A which manufactures both components and the specialized firms, B and C, each producing only one component. We assume that the dominant firm has a slight cost advantage equal to d over the other manufacturer of the first component. This small advantage could, however, be levered into substantial monopoly profits, in the absence of the rival manufacturer of the second component.

In the market scenario of Figure 4, the presence of firm B substantially reduces the profits of the dominant firm. In the absence of that rival, the dominant firm can set the system price at b and earn the maximal profit of  $b - (a+c)$  on each unit sold. With firm B actively competing, on the other hand, the incremental profit of A is reduced to d. This follows because the competing perfect substitute system of C1 and B2 can be sold for a total price of  $a+c+d$ , and at that systems price, the profit margin of A would be only d.

Of course, in this scenario, in the absence of the competing firm C, the dominant firm would be able to earn the full monopoly profits by implementing a perfect vertical price squeeze. We assume that the viability of firm C, and its offering of component C1, do not rest on events in the markets in question. Instead, we hypothesize that C1 has alternative uses to which A1 need not apply, which is consistent with the postulated cost advantage of A1 over C1 in this market. Consequently, only the tactical inducement of the exit of B will enable A to capture the full monopoly profit available in the systems market.

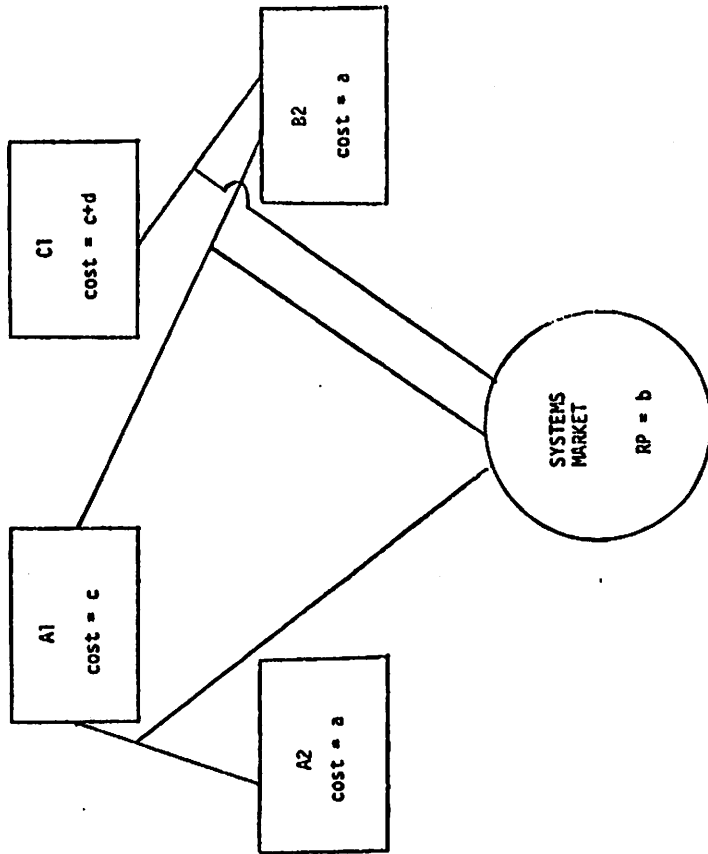


Figure 4

In this simple scenario, the most direct tactic for inducing the exit of firm B involves a combination of a refusal to deal with a low systems price. In this instance, the dominant firm refuses to sell the first component in the open market and prices its systems just below  $a+c+d$ . At this price, consumers will not demand systems assembled from the components C and B, unless firms B or C are willing to sell their components below cost.

In the event that the dominant firm cannot refuse to deal with the rival, it still can induce exit by selling the second component below cost. For example, the dominant firm could sell the first component for  $c+d$ , but price the second component below a, its incremental unit cost. This tactic obviously violates the Areeda-Turner, and our, cost-based price floor for non-predatory prices. More subtly, the dominant firm may induce the exit of its rival by charging it a discriminatory price for A that is slightly below  $c+d$ , while setting a lower internal transfer price for A and an internal price for A equal to a. However, this tactic can be uncovered by means of the following calculation of the internal transfer price of A: The imputed price for A can be found by subtracting the imputed price for A from the price of the system comprised of A and A. The unit production cost provides a conservative estimate for the imputed price of A, because it implies a larger imputed price for A than would any other figure that were not below cost. Then, if this imputed price for A is smaller than the actual price charged B, the latter price is discriminatory and has the effect of excluding B from the market, to the profit advantage of A.<sup>29</sup>

This example of a market structure indicates that a dominant firm may be unable to obtain the maximum monopoly profit by means of a simple vertical price squeeze.<sup>30</sup> In this simple case, alternative and more profitable tactics rely on either refusal to deal or on discriminatory pricing with exclusionary effects.<sup>31</sup> Due to the existence of a robust inferior source

of supply, only the rival's exit would permit the monopolist maximal profits. The purpose of the foregoing analysis has been to identify some of the possible features of systems markets that could motivate tactical exit inducement. Plainly, alternative sources of supply, albeit inferior, are prevalent features of complex actual systems markets. Consequently, for legal scrutiny of alleged tactical exit inducement, we would not require detailed dispositive showing of their presence. However, to satisfy the motive element of our general test for predation, we would require demonstration of certain structural conditions in the systems market.

First, the defendant must possess monopoly power over some of the components of the system. Second, there must be hurdles to entry into the final systems market. Third, where there are robust, alternative, inferior sources of supply of some components, there must be entry hurdles and re-entry barriers into the supply of the components needed to complete a system. Finally, where market segmentation would be profitable, there must be entry hurdles and re-entry barriers into the supply of components that would undermine implicit price discrimination.

In the next section, we argue that a dominant firm can, where the requisite motives exist, avail itself of an exit-inducing tactic which has nothing "....odd,.... jarring or unnatural seeming about it. It will strike the informed observer as normal business conduct, as honestly industrial."<sup>32</sup> The tactic comprises an introduction of a new and not necessarily superior system, together with possible repricing of the old components.

VI D: Predatory Systems Rivalry And Compensatory Pricing of Complementary Components

In the preceding sections, we discussed in some detail the conceivable motives for inducing an exit of a rival who manufactures products which are

complementary with the monopolized component. We showed that when a vertical price squeeze fails to yield a maximum systems profit, the monopolist may attempt to eliminate the rival. Thus, in the preceding sections, we have focused on two prongs of our test for predation. In particular we (i) described some sets of actions which could induce an exit of a rival, if those actions were to persist and if the rival were also to assume that they will persist, and (ii) showed in what circumstances the alleged predator would have motives to undermine the viability of an existing rival.

We have not discussed, however, in the context of systems rivalry the third essential element of our predation test, namely the showing of sacrifice of profit. Following our earlier definition, there is a sacrifice of profit if a feasible action, less damaging to the rival than the action actually chosen by the alleged predator, would have yielded the innovator a higher expected level of profit than did the chosen action, given the competitive viability of the rival. When the rival manufactures complementary products, it is not surprising that the less damaging alternative action should involve prices that are lower than the actual prices of the necessary complementary components. The repricing or withdrawal policy of the innovator would entail predatory sacrifice of profit if the lower price were feasible<sup>33</sup> and yielded no less profit on the premise of the continued viability of the rival.

A lower price on the pre-existing component could have four distinct effects on the profits of the innovator. First, it could increase profit by the markup on additional stimulated sales of the pre-existing component and its complements sold by the innovator. Second, it could lower the revenue obtained from any inframarginal sales of the pre-existing component. Third, it could decrease profit by the markups on the diverted sales of the new components. Fourth, inasmuch as a lower price on a pre-existing component is

less likely to induce the rival's exit, the expected future profits of the innovator could be diminished by the resulting diminution of his future monopoly power in the systems market.

It is this fourth effect that could provide the motive for exit inducement through introducing the new components and repricing the old. Likewise, it is this effect on profit that is eliminated from consideration, under the premise of the rival's continued viability in the systems market. The test for predatory profit sacrifice should disregard profits that were made possible only by the actual exclusion of the rival from the systems market.<sup>34</sup> The inclusion of the gains from anti-competitive exit inducement in the calculation of profit sacrifice would render predatory sacrifice of profit logically impossible.<sup>35</sup>

We define as compensatory the lowest price for a pre-existing component which would compensate the innovator for making it available, given the rival's viability in the systems market. The implication of this definition is that an innovator who substantially damages rivals by refusing to offer pre-existing components, rather than offering them at compensatory prices, is sacrificing profit under our standard. However, the innovator need not be held to pricing at only a compensatory level if higher prices would yield him higher profit, still contingent on the rival's viability. Nonetheless, prices higher than the compensatory levels may be scrutinized for exclusionary profit sacrifice.

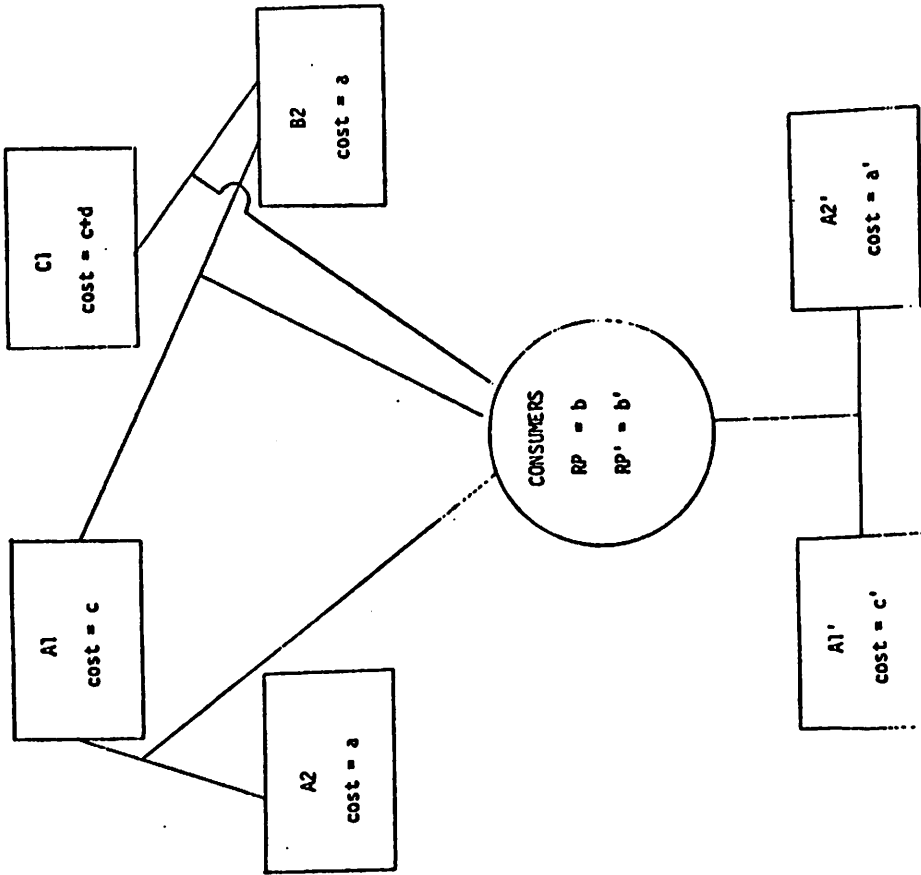
In the simplest case, the compensatory price yields a mark-up equal to that charged on the parallel component of the new line. This result obtains where the only relevant effects of the pricing on the innovator's profits arise from the sales of the pre-existing component and from the one-to-one diversions of sales of parallel new-line components. In the simplest case, such diversions occur if the price differential between systems comprised of

new and pre-existing components exceeds the consumers' evaluation of the quality differential. Here, there would be predatory profit sacrifice if the rival were induced to exit by a price above the compensatory level, and if he (or his customers) would be purchasing the pre-existing component at a lower, but supra-compensatory, price. Such a lower price would raise the relevant profits of the innovator by yielding him a markup on the stimulated sales of the pre-existing component that exceeds the markup on the diverted sales on the component in the new line.

In more complex situations, the equal markup rule for compensatory pricing may have to be modified. For example, if the sale of one pre-existing component diverts the sale of more than the one parallel new-line component, then the compensatory markup must equal the sum of the thus forgone markups. And, in general, the compensatory price must reflect the aforementioned three profit effects of post-innovation policies towards the pricing of pre-existing components, all under the premise of the rival's viability in the systems market.

We now provide a detailed exposition of the determination and effects of compensatory levels of prices, in the context of the already exemplified market structure that provides the clearest incentives for predatory product innovation. In this context, we show the social optimality of our tests of the intent underlying the innovator's pricing of the pre-existing components and his decision to undertake his R&D investment.

Figure 5 depicts an expansion of the market structure, diagrammed above as Figure 4, in which the dominant firm's rival has access to an inferior source of supply. Here,  $A_1'$  and  $A_2'$  stand for the components of the new system introduced by the dominant firm  $A$ . As indicated, the new components are incompatible with the old ones. The associated unit costs are  $c'$  and  $a'$ , and consumers' reservation price for the new system is  $b'$ . We make no



Legend: RP = reservation price for the old system  
 RP' = reservation price for the new system

Figure 5

assumptions at this point regarding the technological or economic superiority of the new system.

In this market scenario, the tactic that A can employ to induce the exit of B has two parts. First, A sets the price of A1 at the level denoted  $P_1$ . Second, A offers the new system at a price,  $P_2$ , low enough to induce all consumers to choose it over the old system comprised of A1 and B2, sold at a total price of  $P_2 + a$ , and over the old system comprised of C1 and B2, even when the latter is sold at its cost of  $c+d+a$ . Thus,  $P_2$  is set to make  $b' - P_2$ , the consumer surplus from the new system, greater than both  $b - (P_2 + a)$  and  $b - (c+d+a)$ , the consumer surplus evaluations of the systems comprised of A1 and B2 and of C1 and B2 respectively. As a consequence, sales of component B2 fall to zero, and the viability of the rival, firm B, is endangered. The motive of A for such exit inducement in this scenario, explicated in Section VI C, *supra*, is the additional monopoly profit that will be available to A in the systems market, after firm B has irreversibly exited.

To ascertain whether predatory sacrifice has occurred, the fact-finder must inquire whether a price for A1 lower than that actually charged would be less damaging to firm B and would simultaneously raise the profit of A, under the viability premise. Since firm B remains viable in the systems market until the dispersal of its productive assets, due to the availability of the compatible component C1, this inquiry can be based on data pertaining to the period that is both post-innovation and pre-exit.

During this period, the price of A1 that may induce the exit of B chokes off all sales of both B2 and A1. Then, if a lower price would stimulate sales of A1 at a markup greater than those earned on the diverted sales, the actual choke price of A1 would entail predatory sacrifice. The lowest price for A1 that would compensate for the lost markups on diverted sales, the compensatory price, is  $c + P_2' - a' - c'$ .<sup>36</sup> Consequently, a refusal by

A to drop the price of A1 towards the compensatory level, in preference to holding the price higher and thereby effecting no sales, would entail predatory sacrifice of profit.

The information we have thus far hypothesized about this market structure permits the compensatory price level for A1 to be either above or below the aforementioned actual price of  $P_2$ . We now indicate why the exit-inducing tactic can entail a compensatory price for A1 if and only if the new system is economically superior to the old one without consideration (yet) of the R&D costs needed for innovation.<sup>37</sup>

Let us first consider the case in which  $b' - (c' + a')$ , the net social benefit from the production and consumption of a new system (exclusive of initial R&D outlays), exceeds  $b - (c + a)$ , that of an old system. Then, A could set  $P_2$  just below  $b' - b - c + d + a$ ,  $P_2$  at the corresponding compensatory level just below  $(b' - (c' + a')) - (b - (c + a)) + (c + d)$ , and thereby induce the exit of B. At these prices for A1's components, B can make no sales of B2 components at any price at or above production cost. This follows because, here, consumers' surpluses from the C1, B2 system offered at cost,  $b - (c + d + a)$ , is just below consumers' surpluses from the A1' system,  $b' - P_2$ . And, here, A1 is offered at a price above  $(c + d)$ , the cost of C1, so that consumers prefer C1, offered at cost, to A1 offered at price  $P_2$ . Thus, in this case, A can induce the exit of B without violating the compensatory price test.

Now let us consider the converse case in which the old system is economically superior to the new one, even without accounting for the needed R&D costs, so that  $b - (c + a)$  exceeds  $b' - (c' + a')$ . Here, we show that A cannot diminish the appeal to consumers of the old system vis-a-vis the new one sufficiently to induce B's exit, without violating the compensatory price test. Suppose, first, that A sets the price of A1,  $P_2$ , above  $c + d$  so that C1, sold at cost, is preferred to A1. Then, to induce all consumers to purchase

the new system rather than the C, B combination, A must set  $p_i$  low enough to make  $b'-p_i$  exceed  $b-(c+d+a)$ . This means that  $p_i$  must be less than  $b'-b+c+d+a$ . Consequently, the compensatory price level,  $c+p_i-a'-c'$ , must be less than  $(c+d)+(b'-a'-c)-(b-a-c)$ , which is, in this case, in turn less than  $(c+d)$ . Thus, here, the compensatory price test is failed because  $p$  was assumed to exceed  $c+d$ .

Instead, suppose that A sets  $p$  below  $c+d$ , so that the A, B system is the best alternative to the new system. Then, to drive the demand for B to zero, A must set  $p_i$  low enough to make  $b'-p_i$  exceed  $b-(p+a)$ . But, then,  $p$  must exceed  $p_i+b-a-b'$ , which in turn is equal to the sum of the compensatory price,  $c+p_i-a'-c'$ , and  $(b-c-a)-(b'-c'-a')$ , the positive difference between the net benefits of the old and new systems. Thus, here too, any prices set by A that could induce the exit of B, must fail the compensatory price test.

The argument thus far has established that A is able to find a price for the new system at which (i) all consumers prefer it to the old; (ii) B's exit is induced; and (iii) the offering of A satisfies the compensatory price test; if and only if the displacement of the old system by the (already developed) new one is socially beneficial.

Let us now turn to the second part of the test for predatory sacrifice - the examination of the motive for the R&D investment needed to introduce the new system. As described earlier, our basic standard dictates that the R&D expenses be compared with the additional net revenues they make possible, given that a compensatory price for A is maintained. Assuming that  $b' - (c'+a')$  does exceed  $b - (c+a)$ , so that the exit-inducing tactic is consistent with compensatory pricing of A, the maximal net revenues obtain from the highest feasible level of  $p_i$ . This is equal to  $b'-b+c+d+a$ , as in the instance described above. The associated net revenues are  $(b'-b+c+d+a) - (a'-c')$  per systems consumer. Without the development of the new system, as

explicated in Section VI C, the maximal net revenues available to A would be  $d$  per systems consumer. Then, the incremental net revenue made possible by the innovation is the difference between these two figures; i.e.,  $b'-b+c+a'-c'$  per systems consumer.

The test for predatory sacrifice is whether this difference in total net revenue is large enough to justify the R&D outlay. If it is, then the R&D investment can be attributed to an innocent profit motive, even though it results in the exit of B. If it is not, however, then intent to monopolize is evidenced because only that motive can rationalize the innovation.

This test exactly coincides with the test of whether the R&D investment is socially warranted. If and only if  $(b'-c'-a')$  -  $(b-c-a)$  times the number of systems customers exceeds the R&D expense, the social benefits from replacing the old system with the new one exceeds the costs of the requisite innovation. Thus, the presented tests for compensatory pricing and for the R&D motive would conduce to social welfare. They would permit socially desirable innovations, whatever their effects on market structure. And they would simultaneously restrain socially wasteful innovations whose only motivation were the additional monopoly profits enabled by their anticompetitive effects.

For example, if the new system were technologically inferior to the old one, and if its incremental production costs were not substantially lower, then such a system could not then be used as a vehicle for monopolization, or for attempt to monopolize under our standard. Indeed, if the new system were inferior, the compensatory price for the old component would be such that an equally efficient rival would be able to sell the old system at a price which yields consumers greater net benefits than would the purchase of a new system. Thus, the socially wasteful investment needed to develop the new system would be deterred.



More surprisingly, technological superiority of a new system does not automatically immunize it from the finding of predation. Instead, the requisite R&D investment may be scrutinized for the motive underlying it. This scrutiny proceeds on the assumption that the innovator is required to offer the old components at compensatory prices. This requirement places a ceiling on the markup that an innovating monopolist can earn on a sale of each new system. Stated differently, the incremental profit from the innovation must be calculated on the assumption of the continued viability of the rival, which is tantamount to his ability to purchase components at compensatory prices. Thus a technologically superior new system would be developed if and only if the value to consumers of its superiority over the pre-existing systems were greater than the required development costs.

Our standard avoids repressing socially valuable innovations by positing that, in the context of systems competition, the relevant market in which monopolization is to be assessed is not the market for components compatible with those of the alleged predator. Such a narrow market definition would incorrectly suggest that an introduction of a new system might be anticompetitive just because it were to create incompatibilities between the complementary products of the rival and those of the alleged predator. It would further incorrectly suggest that the monopolist might be obligated to permit competitors to avail themselves of the new components in order to compete with the innovator in the production and marketing of the new system. We see no reason why the innovator should open up new systems to rivals' components. Forcing him to do so would only endanger the incentives for investment in the development of new products insofar as innovators require quasi-monopoly (at least temporarily) in new designs to encourage and recover R&D investment (on this point, see our discussion of preannouncements of new products in Appendix 1, *infra*). Consequently, focusing on incompatibilities among

various generations of components distracts from the realization that anticompetitive effects of systems innovations should rather be traced to the manipulation of prices of the old components. Introduction of new systems makes possible seemingly innocent price increases on the old components which disadvantage the rival. However, when the innovator offers pre-existing components at compensatory prices, his ability to damage his rivals and induce their exit is, as we have shown, appropriately constrained.

It must be noted that the precise optimality properties of the tests for compensatory pricing and for the R&D motive have not been formally demonstrated in models more general than that analyzed in this section.<sup>38</sup> In particular, far more research is necessary to analytically characterize the tests' normative properties in models with a diversity of consumer types. Nonetheless, we feel that we have shown that our viewpoint on product introductions in systems markets enables socially beneficial appraisals of possibly anticompetitive behavior.

#### VI E: The Burden of Proof

Our analysis has shown that anti-trust scrutiny of product innovation, under our suggested standard, can conduce to social welfare by deterring some anti-competitive conduct, without stifling pro-competitive and socially beneficial behavior. However, our analysis has not yet explicitly considered whether or not our standard would spur costly and stifling excessive litigation over product innovations. In this concluding section, we argue that our standard would restrain excessive litigation by means of the burden of proof that it places on prospective plaintiffs.

As we have emphasized throughout, our standard narrowly delineates the set of circumstances in which the actual behavior of an innovating firm is appropriately examined. Since, in our view, innovation is presumptively beneficial, it is the plaintiff who should carry the burden of demonstrating

that the preconditions for scrutiny of innovating behavior obtain.

In the first place, the plaintiff must establish structural conditions on various facets of the systems market: possession of monopoly power by the defendant over certain of the system's components; hurdles to entry into the final systems market as well as into the production of certain of the system's components; and substantial weakening of competition in the system market from the alleged induced exit.

Second, the plaintiff must convincingly argue that, given the defendant's actions, the rival's exit from the systems market is highly likely.<sup>39</sup> Here, such exit may entail either dispersal of productive assets or unavailability of economically requisite complementary components.

Next, the plaintiff must show that the rival's likelihood of exit was substantially increased by the defendant's actions. If he shows, in addition, that the rival's exit probability was significantly raised by the rejection or withdrawal of the defendant's pre-existing complementary components, then, and only then should the attention of the fact-finder focus on these policies. To demonstrate that these policies had the alleged effect, it is necessary that the plaintiff show that the defendant's components are, in fact, vital to the viability of the innovator's rivals as competitors in the systems market. The pre-existing components must be shown to be strongly complementary to those of the defendant's rivals, and to have been the most preferred complements to the rival's offerings before the innovation, where the comparison includes both marketed and potentially self-produced alternatives.

With these preconditions met, the plaintiff may argue that the defendant's post-innovation policies towards his pre-existing components entailed predatory sacrifice of profit. As we have shown, such sacrifice is tantamount to a refusal to sell these pre-existing components for prices that are

at or above compensatory levels. Thus, the plaintiff must demonstrate that the rival of the defendant was willing to purchase the requisite components for prices that were at least compensatory, but that the defendant was unwilling to accept any such offer.

Our requirement that the system innovator make available the old components at compensatory prices may appear to be quite harsh on the innovating firm. In fact the opposite is the truth. First of all, even if the monopolist refuses to provide his rival with the needed components at compensatory prices, he can nevertheless defend himself against a charge of predation. Such a defense would entail a showing that his refusal to sell the components at compensatory rates was a part of a bargaining strategy aimed at securing supra-compensatory prices for his components. For this defense to be admissible, the monopolist must demonstrate that he and his rivals were engaged in good-faith bargaining over the relevant prices.

Second of all, the required offering of complementary components need only be of limited duration. Thus, if rivals do not avail themselves of the option during twelve months, for example, the option can be discontinued without engendering further culpability. This closure rule raises a potentially dangerous possibility that the innovator will keep the price of the new system low during the period the option is in force, only to raise it when the option expires, if at that time the rival still remains a threat. For two reasons, this danger should not be exaggerated: first, compensatory prices are linked to the prices of new components in such a way that when the latter decline, so do the former. Thus, a temporary reduction in the prices of new components confers some benefits on the rival in terms of lower compensatory prices; second, if systems prices are kept low, implying low markups and low compensatory prices, the price structure may run afoul of the second stage of the predation test which requires that the initial R&D be

rational, in that it yields sufficiently large incremental profit.

Third, our rule need not burden the innovator unduly because the required compensatory prices for old components are determined on the basis of their current unit costs. These must include all costs that can be reasonably attributed to the provision of the requisite capital equipment. This equipment may be substantially more scarce and congested than it was prior to the new introduction, due to its being shared with the new line. It is possible, on the other hand, that the requisite capital will be under-utilized due to the loss of economies of scale that were previously enjoyed in the absence of diversion of demand to the new line. Also, the rival of the defendant could offer a long term purchase agreement to assure coverage of the capital costs of maintaining the production of the pre-existing components. Such assurances have the effect of reducing the compensatory level of price.

Even if the plaintiff is unable to meet all the preconditions for the compensatory price test, or to show that the defendant violated it, he may nevertheless carry the burden of proving that the R&D investment was anti-competitive. This entails showing first that the various facets of the systems market satisfy the strict structural conditions for the possibility of predation to occur; second, that the innovation significantly raises to a dangerous level the probability that the defendant's rival will be induced to exit the systems market; and finally that the R&D investment entails predatory sacrifice of profit (as indicated in Section V, supra). This substantial burden of proof should be placed on the plaintiff to discourage socially wasteful litigation, to conserve judicial resources, and to avoid chilling the innovative process.

As we have demonstrated, however, where this burden of proof can be met, anti-trust scrutiny of product innovation is warranted. Guided by our pro-

posed standard, such scrutiny can protect competition and deter anti-competitive behavior without distorting incentives for pro-competitive innovation.

Appendix 1: Product Preannouncements

The timing of the announcement of a new product is an element of the complex of decisions that comprise a product innovation strategy. In general, to apprise consumers about the new product, the innovator will preannounce the offering before it becomes commercially available. In some important recent cases, it has been suggested that the choice of timing may be considered an anticompetitive tactic.<sup>40</sup> It is instructive to note, however, that whereas in at least one instance a product announcement was attacked as being anticompetitive because it was made substantially ahead of the actual introduction of the new product, in other instances, announcements were considered to be anticompetitive for precisely the opposite reason: that they were not made sufficiently ahead of the actual introduction of the new product.

This disparity of views regarding the proper timing of announcements of new products should alert us to the possibility that it may be difficult to develop workable tests for the legality of timing of product announcements. Under our basic standard, the trier of fact would have to determine whether the timing of the preannouncement would have been any different if the innovator were to anticipate that the rival would remain a viable competitor until the moment of the market introduction of the new product.

What are the considerations that inform the timing of the announcement? The first possibly anticompetitive consideration is the negative effect that the preannouncement could have on the revenues of the innovator's rivals. If, as a result of an early announcement, the prospective buyers postpone their purchases until the new model becomes commercially available, the

innovator and some of his rivals may experience substantial reductions in their cash flows. Such a reduction could endanger the viability of a rival.

When the innovator assumes that the rival would remain viable, pre-announcement would most likely be delayed for the following two reasons: (a) If the rival were to exit before the new product is introduced, the innovator's sales of the existing models would increase and would thereby diminish the negative impact of the preannouncement on his sales; (b) The incremental profit of the new product would be increased if the rivals were to exit before the new product is introduced. Thus, the continuing presence of viable rivals increases the costs and reduces the benefits of early preannouncement.

The second consideration which informs the innovator's timing of pre-announcement is (a) the ability of the rivals to copy, or "reverse engineer," the components of the new system and (b) their ability to redirect their R&D expenditures to those substitute products which would be more effective in competing with the newly announced product. Since an innovator requires a temporary quasi-monopoly on the new products in order to recoup his sunk cost on R&D, preannouncement may deprive him of that necessary lead time over his competitors. It is perhaps plausible that the innovating firm will build features into the new product which hamper the ability of the rivals to reverse engineer the new product. If consumers are not willing to pay for these extra features, our test for the innocent recoupment of the sunk R&D expenditures will identify expenditures on them as predatory. However, we do not wish to prescribe the socially optimal length of the imitation lag. Nor do we want to regulate product design.

Lastly, the innovator must be guided in his choice of the timing of the preannouncement by the need to secure the availability of complementary components when the new product is introduced commercially. If old components

are compatible with the new line, or if the innovating firm produces the requisite components, preannouncement is not necessary. In the former case, the problem of coordinating the availability of the components is solved by virtue of the fact that no new products are needed. In the latter case, the coordination problem is solved internally by the innovator who manufactures all the requisite components. In the remaining situations, a general preannouncement may be made by the innovator to aid the market in correctly solving the coordination problem. Also, the innovator may enter into a joint venture with a component manufacturer forming, by contract, a temporarily integrated company. In either case, antitrust scrutiny of the timing of preannouncements may only confound the coordination problem, retard the innovation process, and deprive consumers of socially beneficial innovation. We conclude, therefore, that any choice of the timing of a preannouncement should be presumptively legal. The diversity of considerations that may underlie the decision to predisclose the new product make it difficult to fashion an easily implementable test for anticompetitive product preannouncements. Furthermore, the need for such a test is substantially reduced by our requirement that the innovating firm stand ready to provide its rivals with complementary components at compensatory prices.

Appendix 2: Retailistery Market Entry.

Retailistery market entry occurs when, in response to the entrant's inroads into the incumbent's market, the incumbent cross-enters the entrant's (geographical) market. The purpose of such a response, when predatorily motivated, is to induce the initial entrant to exit from the incumbent's market and not from his own.

The application of our basic standard of predation requires that the plaintiff demonstrate that, for the entrant, exit is the best response to the defendant's actions. Yet, as we noted above, it is highly implausible to

assume that the entrant will be induced to exit from his market when cross-entered by the incumbent. Given that exit is not imminent, the plaintiff must provide another cause of action. That he can do by putting forth the argument that only the desire to punish the entrant could have motivated the incumbent to retaliate with entry. This argument rests on the observation that if the entrant's market promised adequate returns prior to the entrant's invasion of the incumbent's market, the incumbent should have entered it then. The fact that the entrant moved into the incumbent's market should not have, on the face of it, changed the market conditions there sufficiently to suddenly justify entry.

Whereas the showing that the incumbent cross-entered the entrant's market is sufficient to establish a cause of action, it does not establish a prima facie case of predation. The reason for this stand is that the incumbent can carry the burden of proving that the entrant's appearance in the incumbent's market changed market conditions sufficiently to make entry worthwhile. For instance, the entrant's preoccupation with the expansion in the incumbent's market might have weakened his position in his own market. Alternatively, his success in the incumbent's market could have left the incumbent with sufficient excess capacity to make the cross-entry worthwhile, especially if severe price cutting in his own market would be necessary before he could recapture his market share.

There is also another reason why regarding retaliatory entry as prima facie illegal would not be socially desirable. This reason stems from the fact that the incumbent who cross-enters the entrant's own market increases the competitive pressure in that market and benefits the consumers there. Because it is desirable to stimulate competition, it may be preferable to place the burden of proof on the plaintiff, who must show that a presumptively competitive behavior is in fact motivated by retaliatory considerations.

Stated differently, cross-market entry forces a choice between trying to stop the deterring effects of retaliation and promoting procompetitive cross-market entry. We think the balance should be in favor of encouraging competitive cross-market entry. Consequently, such entry should be presumptively legal.

Nevertheless, a cross-entered firm may establish its case of predatory cross-entry by demonstrating that the incumbent's price in the newly entered market is below the correct cost-based price floor. If the entrant begins with excess capacity, then for output levels less than full capacity, average variable cost is the correct floor. If the incumbent expands output beyond his existing capacity, the price floor must be raised to the full long-run marginal cost. Promotional pricing is the only, albeit weak, defense against this showing of predatory sacrifice of profit in the context of retaliatory market entry.

Footnotes

115 U.S.C. §§ 1-7 (1976). Predatory behavior comes also within the purview of the Clayton Act, 15 U.S.C. §§ 12-27, of the Robinson-Patman Act, 15 U.S.C. §§ 13-136, 21a (1976), and of the Federal Trade Commission Act, U.S.C. §§ 41-51 (1976).

2Early cases of alleged predation are briefly reviewed in L. Sullivan, Antitrust (1977), chap. 2. See also ABA Antitrust Section Monograph No.4, The Robinson-Patman Act: Policy and Law Volume I (1980). For an extensive review of the post-Areeda-Turner cases see J. Hurwitz et al., Current Legal Standard of Predation, in Strategic Views of Predation (S. Salop ed. (1981)).

3The recent outpouring of writing on predation has been stimulated by P. Areeda and D. Turner, Predatory Pricing and Related Practices under Section 2 of the Sherman Act, 88 Harv. L. Rev. 679 (1975). Scholarly responses to this article are critically examined in P. Joskow and A. Klevorick, A Framework for Analyzing Predatory Pricing Policy, 89 Yale L. J. 213 (1979) and in J. McGee, Predatory Pricing Revisited, 23 J. of Law and Econ. 289 (1980).

4For a fuller discussion of our general definition see J. A. Order and R. D. Willig, An Economic Definition of Predation, Economics Discussion Paper (1981).

5The importance of sunk and fixed costs for market organization is fully explicated in W. J. Baumol and R. D. Willig, Fixed Costs, Sunk Costs, Entry Barriers, Public Goods, and the Sustainability of Monopoly, Quarterly Journal of Economics, forthcoming.

6It is interesting to note in this regard that Robert Bork's argument that successful predation is impossible, or unlikely, depends significantly on his unstated assumption that rivals of the alleged predator do not face significant reentry barriers. See R. Bork, The Antitrust Paradox 149-154 (1978).

7In this regard we are in agreement with the two tier approach advocated by P. Joskow and A. Klevorick. Id., A Framework for Analyzing Predatory Pricing Policy, 89 Yale L. J. 213 (1979).

8This conception of viability is amplified in Section VI A, infra, to allow for certain analytic complications that arise in the context of systems competition.

9An alternative display of these data focuses on two different measures of the profit of the incumbent, given his action: the true profit and the profit he would earn given the viability of the rival. For Table 1, these figures are

	Actual Action	Alternative action
True profit	110	105
Profit with viable rival	100	105

The actual action is rational, inasmuch as 110 exceeds 105, but it is predatory, because 100 is less than 105. This viewpoint permits uncertainty in the rival's response to be readily incorporated in the test for predation, by regarding the profit figures as expected values.

10For a complete analysis see J. A. Order and R. D. Willig, An Economic Definition of Predation, Economics Discussion Paper (1981).

11 For example, we have derived workable tests from our general standard that apply where the incumbent invests or disinvests in capital facilities as part of his response. See J. A. Ordoover and R. D. Willig, op. cit. Also, we discuss the treatment of responses that include R&D investment in Section V, infra.

12 That is, let  $p'$  and  $p$  be, respectively, the alternative and actual prices, and let  $q^*-\delta$  and  $q^*$  be the associated levels of output. Then, with  $p' > p$ , the reduction in revenues is  $pq^* - p'(q^*-\delta) \leq pq^* - p(q^*-\delta) = p\delta$ , as stated in the text.

13 That is, with  $C(q^*)$  and  $C(q^*-\delta)$  denoting the total cost flows incurred for output levels  $q^*$  and  $q^*-\delta$ , respectively, there is evidence of predatory sacrifice if

$$p < \frac{C(q^*) - C(q^*-\delta)}{\delta}$$

14 Other sized cutbacks yield additional cost-based price floors that are particularly germane in various circumstances. For example, if the incumbent has expanded output following the rival's entry, the relevant size of cutback is equal to the post-entry output expansion. The resulting test is whether the price is below the average cost incurred for that expansion. See J. A. Ordoover and R. D. Willig, op. cit., for a detailed discussion.

15 The relative stringency of these tests will depend on the particular circumstances in which they are applied. For example, where there are economies of scale in avoidable costs, the average cost test is the more stringent one.

16 See J.A. Ordoover and R. D. Willig, op. cit., for a fuller treatment of these issues.

17 These results, it should be noted, do not imply that application of the standard would necessarily raise the level of social welfare if the incumbent and its rivals fail to actively compete.

In fact, hypothetical examples can be constructed in which all extant firms exhibit non-competitive behavior; the standard protects an existing firm from exit inducement; but the exit of that firm would raise social welfare. Rather, the standard is only assured to raise social welfare if firms behave competitively in the absence of predation. However, the standard would also raise social welfare in any scenario in which society would be benefited by the survival of a firm that would be part of the social optimum. We regard such scenarios to be the normal case.

18 The courts have had difficulty in assessing the proper method of accomplishing this. See *In re IBM Peripheral EDP Devices Antitrust Litigation*, 459 F. Supp. 626 (N.D. Cal. 1978); *Transamerica Computer Co. v. IBM*, 481 F. Supp. 965 (N. D. Cal. 1979).

19 To be precise, the contraction of  $\delta$  would increase the incumbent's current profit if  $p'(q^*-\delta) + w(y^*+\Delta y) - C(q^*-\delta, y^*+\Delta y) > pq^* + wy^* - C(q^*, y^*)$ , where  $C$  now denotes the multiproduct cost function. With  $p' > p$ , a sufficient condition for this inequality to hold is:

$$p < \frac{C(q^*, y^*) - C(q^*-\delta, y^*)}{\delta} + \frac{\Delta y}{\delta} \left[ \frac{w - C(q^*-\delta, y^*+\Delta y) - C(q^*, y^*)}{\Delta y} \right]$$

20 Such complementary components have been misleadingly characterized as "physical tie-ins" in Comment, *Physical Tie-ins as Antitrust Violations*, 1975 Ill. L.F. 224. They have been usefully analyzed in Note, *An Economic and Legal Analysis of Physical Tie-ins*, 89 Yale L.J. 769 (1980).

21W. Bowman, Tying Arrangements and the Leverage Problem, 67 Yale L.J. 19 (1957); L. Telser, A Theory of Monopoly of Complementary Goods, 52 J. Business 211 (1979); R. Posner, Antitrust Law: An Economic Perspective 171-211 (1976).

22Compare *Berkey Photo, Inc. v. Eastman Kodak Co.*, 457 F. Supp. 404 (1978), 603 F.2d 263 (2d Cir. 1979), cert. denied, 100 S. Ct. 1061 (1980). See Note, An Economic and Legal Analysis of Physical Tie-Ins, 89 Yale L. J. 769 (1980) for an argument with a similar thrust.

23R. Gilbert, Patents, Sleeping Patents and Entry Deterrence, in *Strategic Views of Predation* (S. Salop ed. 1981); R. Schmalensee, Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry, 9 Bell J. Econ. 305 (1978).

24F. H. Chamberlin, *The Theory of Monopolistic Competition* (6th ed. 1948); A. M. Spence, Product Selection, Fixed Costs, and Monopolistic Competition, 43 Rev. Econ. Stud. 217 (1976); A. K. Dixit and J. E. Stiglitz, Monopolistic Competition and Optimum Product Diversity, 67 Amer. Econ. Rev. 297 (1977); R. D. Willig, Welfare Analysis of Policies Affecting Prices and Products (1979).

25California Computer Products, Inc. v. International Business Machines Corp., 613 F.2d 727 (9th Cir. 1979); *Greyhound Computer Corp. v. International Business Machines Corp.* 559 F.2d 488 (9th Cir. 1977), cert. denied, 434 U.S. 1040 (1978); *Telex Corp. v. International Business Machines Corp.* 510 F.2d 894 (10th Cir.) cert. dismissed, 423 U.S. 802 (1975); *In re IBM Peripheral EDP Devices Antitrust Litigation*, 481 F. Supp. 965 (N.D. Cal. 1979), appeal pending No. 79- (9th Cir.) ("Transamerica"); *ILC Peripherals Leasing Corp. v. International Business Machines Corp.*, 458 F. Supp. 423 (N.D. Cal. 1978), appeals pending, No. 78-3050 and 78-3236 (9th Cir. 1978) ("Mmorex"); *Berkey Photo, Inc. v. Eastman Kodak, Co.*, 603 F.2d 263 (2d Cir. 1979), cert. denied, 100 S. Ct. 1061 (1980).

26See *ILC Peripherals Leasing Corp. v. IBM*, 458 F. Supp. 423, 439 (N.D. Cal. 1978); *Berkey Photo Inc. v. Eastman Kodak Co.*, 603 F.2d 263, 287 (concluding that market acceptance of an innovation is the best indicator of product quality and of benefit to the public so long as the market is characterized by the free choice of consumers); Comment, Antitrust Scrutiny of Monopolists' Innovations: *Berkey Photo Inc. v. Eastman Kodak Co.*, 93 Harv. L. Rev. 408 (1979).

27In fact, if the rival were a more efficient producer of component two, the profits of firm A would be larger with a viable firm B than without. See n. 28, *infra*.

28As mentioned in n. 27, *supra*, if firm B could produce type two components at a lower cost than firm A, namely a', A could still extract the maximal profits available from the entire systems market; but only if firm B remains viable. Here, the profit maximizing tactic for firm A is to set a price of b-a' for component A1 and a price just above b for an entire system. Then firm B will be unable to price B2 above a', since a higher price would raise the total cost of a system to consumers above their willingness to pay. As a result, firm A would sell no components of type two and would earn a profit of b-a'-c on each system sold. This is the maximal profit available from the entire systems market, and is greater than b-a-c on each system, the maximum profit that would be available to A in the absence of firm B.

29This is not to say that where there are both direct sales of a component and bundled sales, that the direct sales price should be used for such comparisons to the exclusion of the other available, albeit indirect, price data.

30Other examples are developed in J. A. Ordover and R. D. Willig, An Economic Definition of Predation: A Report to The Federal Trade Commission



(1981). These turn on rivals' interference with the dominant firm's ability to implement profit maximizing segmentation of the systems market by means of implicit price discrimination. In these examples, unlike the one in the text, tactics other than exit inducement can be utilized by the dominant firm, in conjunction with price squeezes, to secure maximal monopoly profits.

31As we have emphasized before, in more complex market scenarios price discrimination and refusals to deal may have sound business motives and procompetitive effects.

32L. Sullivan, Handbook of Antitrust: 111 (1978).

33However, in instances where the costs of providing the pre-existing components are prohibitive, the compensatory price will be driven by cost considerations alone to a prohibitive level. This could occur, in particular, if the provision of the new components were to render physically impossible the provision of the old ones. Yet, in such cases, our standard would suggest scrutiny of the design of the new components for anti-competitive intent.

34A useful rule of thumb in this regard in some circumstances may be to exclude from consideration losses of profits earned on new line components that are parallel to the rival's components. Precedence should be given, however, to whatever data are available that pertain to the period following the introduction of the innovation, but prior to the actual exclusion of the rival from the systems market. Where data limitations render ambiguous the attribution of incremental profits to the various components, we would urge that conservative methods be chosen to bias the scrutiny of profit sacrifice towards the innovator. The example presented below shows that such conservatism is not necessarily inappropriate.

35These same issues arise in the more familiar context of pure price predation. There an allegedly predatory price may be defended as being below cost for promotional reasons. With future sales intertemporally complementary with current sales, the low or even negative markup on current sales may be rationalized by higher future net revenues. However, if the allegedly promotional prices induce the exit of a rival, the question arises as to how future net revenues should be calculated. If the future markup of price over cost were calculated on the basis of the rival's induced exit, then predatory pricing could never be identified. By definition, predation involves sacrifice of profits for the sake of additional monopoly gains. If the monopolist rationally engages in predatory behavior, the discounted present value of his profits is increased as a result of successful predation. Consequently, if future revenues were calculated using the markups that could be applied after the exit of a rival, then on the basis of those calculations, there would be no profit sacrifice. It follows, therefore, that when there is intertemporal complementary cross-elasticity, the future markups utilized to assess profit sacrifice must reflect the counterfactual viability of the rival; that is, they must be lower than the markups that would obtain in the absence of the rival.

36This compensatory price can be calculated in either of two ways, in this scenario. First, it is the price which yields the same incremental profit as would the cross-elastic sales of the other components (A1' and A2'), under the usual premise. Second, it yields the same markup as that on the parallel new component, A1', when that is calculated conservatively, as suggested in a. 34, supra.

37 Specifically, there exist  $p$  and  $p_2$  such that (i)  $b-(p+a) < b'-p_2$ ; (ii)  $b - (c+d+a) < b'-p_2$ ; and (iii)  $p < c+p_2-a'-c'$ , if and only if  $b'-(c'+a') > b-(c+a)$ . Condition (i) is that consumers prefer the new system to  $A_1$  and  $B_2$ , when  $B_2$  is priced at cost; (ii) is that consumers prefer the new system to  $C_1$  and  $B_2$ , when they are both priced at cost; and (iii) is that the price of  $A_1$  does not exceed its compensatory level. The relationship  $b'-(c'+a') > b-(c+a)$  means that the net social benefit from the production and consumption of a new system exceeds that from an old one. The truth of the proposition can be established by straightforward algebra.

38 It should be noted that in the model we have analyzed here, the behavior of firms vis-a-vis product introductions would be socially optimal in the absence of tactical exit inducement. Thus, in this model, the only possible cause of social inefficiency is predation. We conjecture that: this is why our standard enables the social optimum to be achieved here. In contrast, more general models induce causes of social inefficiency additional to predation. For example, the works cited in n. 24, supra, find other reasons for some profitable product introductions to be socially inefficient. We would be neither surprised nor disillusioned to discover that our suggested tests for predatory innovations sometimes ameliorate and sometimes exacerbate such other imperfections in market performance. We feel that it is unreasonable to expect workable tests for predatory conduct to accomplish more than the cure of the social ills from predation.

39 This requirement stems from the fact that the pro-competitive benefit to social welfare from the application of our standard arises from the forestalled exits of socially desirable competitors. On the other hand, the social costs of litigation under our standard would be smaller the more demanding were the standing requirements applied to the plaintiff. Thus, requiring a truly dangerous probability of the exit of the defendant's

rivals restrains excessive litigation while maintaining the standard's efficacy.

40 Complaint, 20-21, United States v. IBM Corp., No. 69 Cir. 200

(S.D.N.Y., Jan. 12, 1969); ILC Peripherals Leasing Corp. v. IBM Corp., 458 F. Supp. 423, 436 (N.D. Cal. 1978) ("Memorex"); Berkey Photo, Inc. v.

Eastman Kodak Corp., 603 F.2d 263, (2d Cir. 1979). In general see Note, Berkey Photo, Inc., v. Eastman Kodak Co.; The Predisclosure Requirement--

A New Remedy for Predatory Marketing of Product Innovations, 10 Rut. - Cam. L.J. 395 (1979).

Appendix : Mathematical Formulation of the Basic Standard

In Section I we defined predatory behavior as a response to entry that under competitive circumstances sacrifices part of the profit that could be earned, were the entrant to remain viable, in order to induce exit and gain consequent additional monopoly profits. In this Appendix we rephrase our standard in abstract mathematical terms for the sake of precision and generality.

Let us assume therefore that entry has already taken place. Let us denote by  $\pi$  the post-entry level of incumbent's profit. (Other things being equal, the value of  $\pi$  depends on the production and marketing plans of the entrant. It will also depend on the response by the incumbent to that plan. We denote the response by  $\underline{x}$ . Depending on the problem at hand,  $\underline{x}$  can be a vector reflecting the coordinated responses of the incumbent on the tactical dimensions available to him. These dimensions can include prices, capacity investments, advertising expenditures, R & D investments, and so forth. Also, cross-market entry, product withdrawals, product introductions, and product redesigns can be represented (as described in the text) by appropriate complexes of price changes. This notion of response can accommodate the possibility that the incumbent persists with his pre-entry value of  $\underline{x}$ ; we regard no-response as any other response.

We assume that the response, the choice of  $\underline{x}$ , is made in the "current" period with a full awareness of the consequences of that choice for the future level of monopoly profits. Let  $\pi^o(\underline{x})$  denote the suitably discounted value of the expected future profits, given the current response  $\underline{x}$  and given that the entrant has exited at the end of the "current" period. (Here, the superscript "o" indicates "the future," and the superscript "o" indicates that the entrant is "out.") The value of  $\pi^o(\underline{x})$  can incorporate

the effect of the present action on the height of future entry barriers. For example, if future potential entrants are deterred by the predatory action against the actual entrant,  $\pi^o(\underline{x})$  will capture this demonstration effect.

It is obvious that not all current responses induce exit. Let us denote by  $K$  the collection of all the responses by the incumbent to which the best response by the entrant is to exit. More formally,  $K = \{x \mid \text{exit induced}\}$ . If, in response to some action  $\underline{x}$ , the entrant does not exit at the end of the "current" period, the incumbent's expected future profit, suitably discounted, is  $\pi^i(\underline{x})$ . (Here, the superscript "i" indicates that the entrant is "in.") The value of  $\pi^i(\underline{x})$  may reflect the fact that the entrant shuts down in response to action  $\underline{x}$ . Finally,  $\pi^v(\underline{x})$  measures the incumbent's future profits, given current action  $\underline{x}$  and given that the entrant remains a viable competitor. If  $\underline{x}$  is in the set  $K$ , so that the entrant is induced to exit, the  $\pi^v(\underline{x})$  is the counterfactual measure of future profits based on the premise of the continued viability of the entrant. If exit is not induced, then  $\pi^i(\underline{x}) = \pi^v(\underline{x})$  because the former measure encompasses the possibility of shutdown without dispersal of the productive assets.

It should be noted that the future profits of the incumbent will depend not only on the present decision,  $\underline{x}$ , and on whether or not the entrant remains in the market, but also on the entire sequence of future decisions on the parts of the incumbent and of his present and future rivals. These decisions are subsumed in the symbols  $\pi^v(\underline{x})$ ,  $\pi^o(\underline{x})$  and  $\pi^i(\underline{x})$ , which permit the decisions to be different in the different scenarios, and which, moreover, permit them to depend on  $\underline{x}$ .

With this formalization of the model of predatory behavior, legal response to entry is a choice of  $\underline{x}$  which is consistent with the objective

$\pi^c(x) + \pi^{fv}(x)$ , whether or not it induces exit. And an illegal response to entry is a choice of  $x$  that induces exit and that is so motivated, in that it is inconsistent with the profit measure based on the premise of the continued viability of the entrant.

Stated precisely, a response  $x$  violates our standard if

- (i)  $x \notin K$  and there is an  $x'/K$  such that
- (ii)  $\pi^c(x) + \pi^{fo}(x) > \pi^c(x') + \pi^{fi}(x')$ ; and
- (iii)  $\pi^c(x) + \pi^{fv}(x) < \pi^c(x') + \pi^{fi}(x')$

Restated verbally,  $x$  violates our standard if (i) it induces exit and if there is a different response,  $x'$ , which does not induce exit and which

satisfies the following conditions: (ii) Taking account of the facts that  $x$  induces exit, while  $x'$  does not, and taking into account both current and future profits,  $x$  is more profitable than  $x'$  for the incumbent; (iii) Taking account of current and future profits, under the premise of the continued viability of the entrant,  $x$  is less profitable than  $x'$  for the incumbent.

Thus, the sacrifice of profit entailed by  $x$ , under the premise of the continued viability of the entrant, is at least  $[\pi^c(x') + \pi^{fi}(x')] - [\pi^c(x) + \pi^{fv}(x)]$ , which is positive under condition (iii). The profit motive experienced by the incumbent to undertake the response  $x$  rather than  $x'$  is given by  $[\pi^c(x) + \pi^{fo}(x)] - [\pi^c(x') + \pi^{fi}(x')]$ , which is positive under condition (ii).

Conditions (ii) and (iii) cannot simultaneously hold unless  $\pi^{fo}(x) > \pi^{fv}(x)$ . This inequality states that the future profits of the incumbent, given response  $x$ , would be greater if the rival incumbent were to exit and disperse its productive assets than if the rival were to remain viable. Thus, there can be no predation by our standard if  $\pi^{fo}(x) = \pi^{fv}(x)$ , that is, if the exit of the entrant does not increase the future profits of the incumbent. As such, if there were no entry hurdles, but only barriers

to operation, (ii) and (iii) could not both hold because prospective entrants and actual (if dormant) competitors would then exert equal competitive pressure on incumbents. Hence, a showing of no entry hurdles would rebut an allegation of predation.

What other defenses could be attempted by the incumbent? First, the incumbent could argue that he could not have induced exit because the set  $K$  is empty: there is no action to which the best response of the entrant is to exit. As discussed in the text, this possibility arises when the entrant's investment is fully irreversible.

Second, the incumbent could argue that exit was induced innocently. This would be the case if the allegedly predatory response,  $x$ , optimized the innocent objective,  $\pi^c + \pi^{fv}$ , regardless of whether the response actually induced exit, and regardless of whether it maximized the incumbent's actual profit (with full account taken of the profit consequences of exit).

Then, the incumbent could maintain that his intent was not anti-competitive. More complicated issues arise if we abandon this deterministic model in favor of a stochastic version in which any given action  $x$  induces exit with some probability  $z(x)$  which is not necessarily equal to zero or one. Here, since exit is uncertain, the fact that exit is the best response for the entrant to the action of the incumbent cannot constitute a necessary element

in the showing of predation. Neither can the absence of exit be a dispositive proof that predation did not occur. The entrant can exit because of the natural vicissitudes of competition, or the entrant may fail to exit even though the incumbent's actions were designed to push him back over the entry hurdle.

Thus, in the stochastic model, the tests for illegality developed above cannot be directly applied. Here, we need a test which does not rely on the concept of the exit-inducing set of actions,  $K$ . In order to develop such a

test, we note that the expected profit of the incumbent can be written as

$$\pi(x) = \pi^c(x) + z(x)\pi^o(x) + (1-z(x))\pi^i(x)$$

where  $\pi^c(x)$  is the current post-entry profit and where  $\pi^o(x)$  and  $\pi^i(x)$  are the future profits with the entrant out and in, respectively. In contrast the expected profit of the incumbent under the premise of the continued viability of the entrant is

$$\pi^v(x) = \pi^c(x) + z(x)\pi^v(x) + (1-z(x))\pi^i(x)$$

Here,  $\pi^v(x)$  is the discounted future expected profit of the incumbent, conditional on the response  $\underline{x}$  and on the event that the entrant's best response to  $\underline{x}$  is to exit. It is easily seen that the profit measures in the deterministic model presented above are the special cases of these stochastic profit measures that apply when  $z(x) = 1$  if  $x \leq \bar{x}$  and  $z(x) = 0$  if  $x > \bar{x}$ .

In the general context, a response  $\underline{x}$  violates our standard for predation if there is an alternative response,  $\underline{x}'$ , that satisfies the following conditions:

- (i)  $z(x) > z(x')$
- (ii)  $\pi(x) > \pi(x')$
- (iii)  $\pi^v(x) < \pi^v(x')$

Restated verbally, a response  $\underline{x}$  is predatory if (i) there exists an alternative response,  $\underline{x}'$ , which causes a smaller probability of exit and which satisfies these conditions: (ii) taking account of the probabilities of exit and of both present and future profits,  $\underline{x}$  yields the incumbent greater expected profit than does  $\underline{x}'$ ; (iii) taking account of the

probabilities of exit, and of both present and future profits under the premise of the continued viability of the entrant,  $\underline{x}$  yields the incumbent lower expected profit than does  $\underline{x}'$ .

This definition of predation is a true generalization of the definition we proposed above for the case in which there is no uncertainty associated with the competitive process. The stochastic formulation permits an assessment of the appropriate interpretation of the phrase, "the dangerous probability of success in attempting to monopolize an industry." This phrase appears in the case law definition of "attempt to monopolize." It should not be understood as an assessment of only the (equilibrium) level of  $z(x)$  that results from competitive interactions. Rather, it should also reflect an assessment of the change in  $z(x)$  brought about by the incumbent's choice of action. Speaking heuristically, a response which can be rationalized mainly on the basis of the large increase to a high level which it induces in the exit probability can be considered illegal.

In order to lay the logical foundation for practical tests of predation, it is necessary to clarify the precise relationships between the profit concepts  $\pi$  and  $\pi^v$ . In the deterministic context,  $\pi^i(x) = \pi^v(x)$  because they both represent the future profit of the incumbent given the response  $\underline{x}$  and given that the entrant remains viable after the close of the current period. However, in the stochastic context the two profit measures are unequal because  $\pi^i(x)$  is conditional on the eventualities (states of nature) that, given  $\underline{x}$ , cause the entrant to remain in, while  $\pi^v(x)$  is conditional on the different set of eventualities that, given  $\underline{x}$ , cause the entrant to exit. Here, it is only true that the two profit measures coincide if they are conditioned on identical sets of eventualities.

It is instructive to derive the forms taken on by the tests (ii) and (iii) in the special case in which the responses  $\underline{x}$  and  $\underline{x}'$  have no different

effects on the future profit measures, in each eventuality. Nonetheless, in this special case of intertemporal separability,  $\underline{x}$  and  $\underline{x}'$  may well yield different overall levels of expected future profits by dint of the different levels of probabilities that they cause. Then (iii) holds if and only if

$$f(\underline{x}') > f(\underline{x})$$

and (ii) holds if and only if

$$[s(\underline{x}) - s(\underline{x}')][E(s^0) - s^i] > f(\underline{x}') - f(\underline{x})$$

Here,  $E(s^0 - s^i)$ , is the expected value of the difference in discounted future profits between the scenario with the entrant out and in, conditioned on the eventualities that would cause exit with response  $\underline{x}$  and that would not cause exit with response  $\underline{x}'$ .

The first relationship has the interpretation that the sacrifice of profit condition, (iii), is indicated simply by the sacrifice of current period profit, given intertemporal separability. The second relationship says that the motive condition for predation, (ii), obtains if the sacrifice in current period profit is exceeded by the expected gain in future profit caused by the entrant's exit, weighted by the induced increase in the probability of that exit.

These relationships clarify the nature of the data required for the elements of the predation standard. The sacrifice condition, (iii), may turn on comparisons of current period profits earned with the actual response  $\underline{x}$  and with some proposed alternative response  $\underline{x}'$ . Similarly, the probability of exit condition, (i), only turns on comparisons of the entrant's likelihood of viability at the close of the current period, given the action  $\underline{x}$  and given the

proposed alternative  $\underline{x}'$ . In contrast, the motive condition, (ii), interpreted precisely, would require predictions of profits, with and without the entrant's viability, over the future course of the industry.

Because of these differences in data requirements, different evidentiary standards are appropriate for the different conditions. The plaintiff should be required to show in a detailed fashion from current firm and industry data that his likelihood of exit has been substantially raised by a response of the defendant that entails sacrifice of profit. In contrast, the plaintiff should only be required to argue that general industry structural conditions indicate that there is a motive for predation.