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Several antitrust cases have involved allegations of anticompetitive innovation or product design and some plaintiffs and antitrust scholars have argued that investment in research and development that excludes competition can have predatory effects similar to predatory pricing. This article analyzes several tests for predatory innovation, including the rule of reason based on total and consumer welfare and profit sacrifice tests. All of these tests are likely to produce false positives that chill incentives for beneficial investments in research and development. Most courts that have considered allegations of anticompetitive innovation, including the appellate court in *U.S. v. Microsoft*, have concluded that innovation is not anticompetitive if it has plausible efficiencies. This is close to a test of whether innovation is a sham. While a sham test may fail to identify innovations that harm competition, that risk is acceptable given the high cost of penalizing beneficial innovation.

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I. Introduction

Innovation is the lifeblood of the economy. Firms should be encouraged to invest in research and development (R&D), as studies of the social rate of return to investment in R&D often yield estimates that substantially exceed the private cost of capital.¹ Nevertheless, innovation often disrupts markets, and several antitrust cases have alleged that innovation has harmed competition and, by inference, lowered economic welfare. This paper considers the standards that antitrust policy should apply to evaluate whether innovation contributes to unlawful monopolization. While innovation occurs in many different contexts, the focus in this article is on single firm conduct that creates new products or alters the characteristics of existing products. The conduct may affect markets for products that are substitutes or complements for the products sold by the innovating firm. An example of conduct that affects complements is an interface design that affects the compatibility of complementary components for a computer network. An example of conduct that affects substitutes is a product line extension for a patented pharmaceutical that has consequences for generic competition.

In an idealized world, market performance, including price and quality, would be mapped into an outcome measure, and conduct that lowers this measure would be anticompetitive. Economic welfare is an example of such an outcome measure. Total economic welfare is the sum of producer profits and consumer benefits that result from economic activity, while consumer welfare ignores profits. Whether antitrust policy should be concerned with total economic welfare or only consumer welfare is a subject of considerable controversy, although neither welfare measure correctly captures the objectives of antitrust policy.² Firms have wide discretion to choose the prices of their goods and services without running afoul of U.S. antitrust law, despite the fact that at least in the short run an increase in price unambiguously lowers consumer welfare and lowers total economic welfare when price is above marginal production cost. Similarly, if a firm fails to take advantage of an opportunity to create a better product, the result is an increase in the product's quality-adjusted price relative to a baseline in which the innovation occurs. A failure to innovate would lower consumer welfare and

1 Estimates of the average social rate of return to R&D range from 20 to 40 percent per annum and sometimes higher. See, e.g., Zvi Griliches, *R&D and Productivity: Econometric Results and Measurement Issues*, in *HANDBOOK OF ECONOMICS OF INNOVATION AND TECHNOLOGICAL CHANGE* 53-89 (P. Stoneman ed., 1995); E. Mansfield et al., *Social and Private Rates of Return from Industrial Innovations*, 91(2) Q. J. ECON. 221-40 (1977); and, Bernstein & Nadiri, *Interindustry R&D spillovers, rates of return, and production in high-tech industries*, 78 AM. ECON. REV. 429 (1988).

2 Compare K. Heyer, *Welfare Standards and Merger Analysis: Why Not the Best*, 2(2) COMPETITION POL'Y INT'L 29 (2006) (arguing for a total economic welfare standard) with Steven C. Salop, *Exclusionary conduct, effect on consumers, and the flawed profit-sacrifice standard*, 73(2) ANTITRUST L.J. 311, 336 (2006) (antitrust law focuses on consumer welfare). Joseph Farrell and Michael Katz conclude that there is a strong case for using total surplus along with other criteria for antitrust enforcement, but observe that a consumer welfare standard can perform better in some circumstances. Joseph Farrell & Michael Katz, *Welfare Standards in Competition Policy*, 2(2) COMPETITION POL'Y INT'L 3, 28 (2006).

would lower total economic welfare if the cost of the innovation were less than the value of the quality improvement. Yet a failure by a firm, acting independently, to take advantage of an innovation opportunity would not violate the antitrust laws.³

Although economic welfare does not determine whether conduct is anticompetitive, measures of economic welfare can inform antitrust policy by providing objective estimates of the impact of the conduct on market performance. This article explores the utility of different welfare standards that imply alternative tests for antitrust liability arising from innovation by a single firm, including total economic welfare and consumer welfare, and others, such as profit sacrifice, that are only indirectly related to economic welfare. These standards have been applied with varying success to inform the analysis of predatory pricing. While some suggest an analogy between predatory pricing and predatory innovation, the consequences of innovation and the link between competitive effects and the incentives to invest in R&D are difficult to evaluate with any welfare measure.

Section II develops a simple model to illustrate how alternative antitrust standards may apply to innovation, with a focus on innovation that affects competition for substitutes. The model shows why conventional approaches may give incorrect signals for antitrust enforcement in an innovation context. Section III reviews how courts have responded to evaluations of anticompetitive innovation in industries where new products or changes in existing product characteristics have created incompatibilities with complementary products. Section IV examines the special case of innovation in the patented pharmaceuticals industry. Manufacturers of generic pharmaceuticals have alleged that branded drug manufacturers have harmed competition by patenting modifications to existing drugs. These patented modifications may extend the effective length of exclusivity for a drug and delay generic competition. Allegations of anticompetitive innovation in the pharmaceutical industry differ from most other innovation cases in that the affected products are substitutes, not complements for the products of the innovating firm, patents and agency considerations are important, and market conduct and outcomes are heavily influenced by legislation and regulation.

The risk of enforcement error is high in cases that allege predatory innovation. A welfare test may find that innovation is predatory when it has no anticompetitive effect or may fail to identify innovation that could make consumers worse off. The risk of excessive enforcement is much higher than the risk of too little intervention because most innovation is beneficial and would be chilled by attempts to police the rare cases in which innovation might harm welfare. Noting that antitrust policy is informed by measures of economic welfare, but intended to protect the competitive process, Section V analogizes innovation to

3 The focus in this article is on innovation by a single firm. Coordinated conduct related to innovation can raise additional antitrust concerns. For example, an agreement by competitors not to invest in R&D could be a source of antitrust liability.

other single firm conduct that has antitrust implications. The competitive impacts from a change in interface standards that prevents interoperability of complementary products are no more severe than the effects of a decision not to deal with the suppliers of these products. Given the skepticism expressed by the U.S. Supreme Court in *Verizon v. Trinko* regarding the obligation of a firm to deal with a rival, it is likely that a refusal to deal with no other anticompetitive conduct would escape antitrust liability in most circumstances.⁴ A product innovation that has the same effect should not be subject to greater antitrust scrutiny.

I conclude that welfare and the efficient use of judicial resources would be best served by a policy that presumes that innovation is pro-competitive and condemns innovation by a single firm in only the most extraordinary circumstances. I stop short of endorsing a policy of per se legality for innovation by a single firm because innovation may involve other conduct, such as exclusive dealing, that should be subject to careful review. A monopolist should not be able to shield potentially anticompetitive conduct from antitrust scrutiny merely because the arrangement relates to a product innovation. In assessing whether innovation by a single firm, alone or with other conduct, violates antitrust law, courts could apply a rule of reason analysis or a different test that presumes that innovation is not anticompetitive when it has a valid business justification. Under either approach, innovation by a single firm would not have a safe harbor from Section 2 liability, but would be protected by a strong presumption that innovation is beneficial for the economy.

II. A Simple Model of Innovation

I begin with a simple model of innovation for substitute products that highlights the incentives to innovate and the competitive effects that are likely to result from the innovation. The purpose of this simple model is to illustrate how an antitrust analysis of innovation should differ from an analysis of conduct that affects the prices and outputs of existing products. The potentially anticompetitive conduct considered here is a form of predation. The allegation is that innovation by a single firm can harm welfare even if it generates benefits in the short run, just as excessively low prices can harm welfare if they result in exit or significantly impair the ability of rivals to compete and contribute to monopoly pricing in the long run. The point of this exercise is to show that an antitrust standard that isolates socially harmful innovation is extremely difficult to define, even more so than a standard that defines socially harmful pricing.

Consumers are identical in this simple model. Each consumer has a demand for one unit of a product. A product j has quality v_j and that is also the maximum amount that a consumer would pay for the product. The total number of con-

4 *Verizon Communications Inc., Petitioner v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398 (decided Jan. 13, 2004) [hereinafter *Trinko*].

sumers is N . Before innovation occurs there is a single product with quality v_0 . By spending an amount R , a firm can develop a new product with quality $v_1 > v_0$. The innovation is the product with quality v_1 and the size of the innovation is $v_1 - v_0$. To keep the example very simple, I assume that there are zero production costs for both the old product and the new product.

Ignoring spillover benefits or costs from the innovation that might affect other consumers or firms, and ignoring possible future benefits or costs, the innovation is socially desirable if $N(v_1 - v_0) > R$.⁵ Suppose the old product was available at a price P_0 and the new product is available at a price P_1 . Assume for now that $v_1 - P_1 > v_0 - P_0 > 0$.⁶ These inequalities imply that all consumers purchased the old product before the innovation and switch to the new product when it becomes available. The profit from innovation depends on the prices before and after innovation and on whether the innovator also sold the old product. If a firm is the only seller of the old and the new product, its incentive to innovate is $N(P_1 - P_0)$. If the innovator does not sell the old product and becomes the only seller of the new product, its incentive to innovate is NP_1 .

The private incentives to innovate depend on the prices and need not correspond to the social benefit from the innovation. A firm that is the only seller of the old and the new product would profit from the innovation if $N(P_1 - P_0) > R$. If $N(P_1 - P_0) > R > N(v_1 - v_0)$, the innovation would be privately profitable but socially undesirable. That cannot occur if consumers prefer the new product when both are available, if the quality of the old product remains unchanged when the new product becomes available, and if the products' private values to consumers are the same as their social values. Under these assumptions $v_1 - P_1 > v_0 - P_0$ implies that if $N(P_1 - P_0) > R$, then $N(v_1 - v_0) > R$. These are strong assumptions, however. Social values can differ substantially from private values due to large spillover effects,⁷ and the quality of the old product could deteriorate if it is no longer in demand. Thus the innovation could be privately profitable but socially undesirable. The opposite would hold if $N(P_1 - P_0) < R < N(v_1 - v_0)$. In this case, innovation would be socially desirable, but not privately profitable. A firm that sells only the new product also can have the wrong signal for innovation. Innovation can be privately profitable but socially undesirable if

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- 5 The left-hand side is the social benefit from the innovation and the right-hand side is its cost. The innovation has net social value if the left-hand side exceeds the right-hand side. The number of users, N , is fixed in this example. This understates the social and private values of an innovation that expands the use of the technology (i.e., increases N).
- 6 In this example, a firm that is the only seller of the new technology would set a price equal to its value, but this would not be the case in a more general model with heterogeneous consumers.
- 7 Bernstein and Nadiri estimate social rates of return from R&D in different industries that range from 16 percent to more than 100 percent in 1981, compared to private rates of return of from 12 to 24 percent. The social benefits include productivity gains in industries other than the industry where the R&D investments occurred. Bernstein & Nadiri, *supra* note 1, at 432-33.

$NP_1 > R > v_1 - v_0$, and innovation can be unprofitable but socially desirable if $NP_1 < R < v_1 - v_0$.

A challenge for any standard applied to innovation is that antitrust analysis is likely to occur after the innovation, but ex post outcomes reveal little about whether the innovation was a good decision ex ante, when the decision was made. If the goal of antitrust policy is to promote socially desirable conduct and deter undesirable conduct, then the conduct should be evaluated based on the information that was available when it occurred. For innovation, this means an ex ante analysis of expected costs and benefits. An innovation investment could generate nothing of value and look unprofitable ex post even if its expected profit was high. Alternatively, a poor investment decision can turn out lucky and generate significant value. An innovation could be unprofitable, yet still generate social benefits for consumers and other firms that the investing firm cannot appropriate. An innovation also can generate private benefits as a stepping stone to other, more profitable discoveries, or because the innovation signals something of value to consumers, which the firm can appropriate in its reputation.⁸

An innovation can be privately profitable but not socially desirable, or socially desirable but not privately profitable. It can be profitable for some firms but not for others, or it can benefit some consumers but disadvantage others.⁹ Although there are conditions under which the private incentive for innovation corresponds to the innovation's social value, this is not true in general. The market can offer too little or too much reward compared to an innovation's social value. Private and social incentives are better aligned for changes in price. A reduction in price usually increases consumer welfare and increases economic welfare (in the short run) provided that the price is above marginal production cost. A price below marginal cost is unprofitable in the short run and socially inefficient because the cost of an incremental unit of supply exceeds its value to consumers. Thus it is not unreasonable for antitrust policy to scrutinize pricing below marginal cost in order to exclude competition. For innovation, analogous conduct is an innovation that is unprofitable in the short run and excludes competition. A rule that identifies conduct with these properties as "predatory innovation" likely would lead to false positives and chill socially desirable innovation. Innovation typically involves a sacrifice of short-run profits. Firms have to invest to develop a new interface standard or a new medicine. Really good innovations make old technologies obsolete, and the prospect of developing a new

8 Pittman make a plausible case that IBM invested excessively in the 360/90 computer to signal technical superiority. Russell W. Pittman, *Predatory Investment: U.S. vs. IBM*, 2(4) INT'L J. INDUS. ORG. 341, 363 (1984).

9 An example is an industry with switching costs and network effects. An innovation can shift the market to a new technology, leaving the installed base of customers stranded. Consumers of digital audio tape were stranded after the introduction of compact disks reduced the supply of music in the digital audio tape format. See, e.g., Joseph Farrell & Garth Saloner, *Installed base and compatibility: innovation, product preannouncement, and predation*, 76 AM. ECON. REV. 940-55 (1986).

product or process that dramatically alters the competitive landscape drives the incentive to invent. The conditions associated with predatory conduct could exist for innovation, namely a sacrifice of profit in the short run followed by elimination of rivals and higher prices (or lower consumer surplus), even though the innovation has no predatory effect or intent.

THE CONDITIONS ASSOCIATED WITH PREDATORY CONDUCT COULD EXIST FOR INNOVATION, EVEN THOUGH THE INNOVATION HAS NO PREDATORY EFFECT OR INTENT.

I now turn to alternative tests or standards that could be applied to assess whether innovation is anticompetitive.

A. TOTAL ECONOMIC WELFARE STANDARD (TOTAL RULE OF REASON TEST)

A rule of reason (ROR) test based on total economic welfare asks whether innovation increases total economic surplus, equal to the sum of producer profits and consumer benefits. If it does not, it fails the test and may incur antitrust liability. Whether total economic welfare is an appropriate standard for antitrust enforcement is a controversial question. Economists often favor a total welfare standard because resources are allocated efficiently when total economic welfare is maximized, and no individual in the economy can be made better off without making another individual worse off.

If total economic welfare is an appropriate objective for antitrust policy, then it follows that a total ROR test is the correct standard to evaluate conduct, including innovation. But this is just a tautology, and the more serious issue is whether a total economic welfare standard would lead to sensible antitrust enforcement outcomes when applied to innovation by a single firm. A total ROR test would have to consider the impacts of innovation on the innovator and on other firms and consumers in the present and the future, and should also account for the impacts of antitrust enforcement on future incentives to innovate. This is an enormously complex undertaking. It requires an assessment of impacts on all economic agents in the industry where the innovation occurred and also in other industries that may be affected by the innovation. The difficulties associated with identifying and quantifying the impacts of innovation on consumers and firms are so large that a practical application of the total ROR test can lead to a conclusion that innovation fails the test when it has no anticompetitive element or passes the test when the innovation is arguably anticompetitive.

Rule of reason analysis is a complex undertaking whether applied to innovation or to other conduct, but the analysis is far more complicated for innovation because the benefits from innovation are uncertain and difficult to measure and innovation often has spillover benefits for other firms and consumers. Furthermore, in the context of innovation by a single firm, the analysis would take place after society has the benefit of the innovation and the issue would not be whether the innovation has value, but rather whether its value exceeds its

cost including any adverse impacts on competition. An antitrust policy that punished innovation in a specific situation where its benefits are less than its costs would be counterproductive if it deterred investments in the much more common situations where the benefits of innovation exceed its costs.

The simple example provides an illustration of innovation that fails the total ROR test, but is not anticompetitive. The net social value of the innovation is $W = N(v_1 - v_0) - R$. The innovation fails the total ROR test if $W < 0$, which it would for any significant value of R if v_1 is close enough to v_0 . Suppose a new entrant makes the innovation and offers it for sale at a price P_1 and all consumers purchase the innovation at that price. The innovation is profitable if $NP_1 - R > 0$. Profits and social value are equal if, but only if, $P_1 = v_1 - v_0$. This might be the case if the old product stays in the market and competes aggressively with the new product. But why would a supplier of the old product stay in the market if it wouldn't get any sales? It is more likely that suppliers of the old product would exit or not invest to maintain the quality of the old product. Then the firm could charge a price higher than $v_1 - v_0$ for the new product if it is costly for a firm to re-enter with the old product or reinvest to improve its quality. In that case the private value of the innovation can exceed its social value.¹⁰

Innovation in this example fails the total ROR test because the new firm benefits at the expense of the old firm, although there is nothing anticompetitive about the firm entering the industry with a new product. Taking market share from an incumbent is an important stimulus for innovation. According to Steve Jobs, CEO of Apple Computer, “[W]hat’s the point of focusing on making the product even better when the only company you can take business away from is yourself?”¹¹ Without the driving force of winning market share, the amount of innovation in the economy would be lower and consumers could be worse off, particularly after accounting for spillover benefits.

It is easy to underestimate the total social value of an innovation because benefits from new technologies are difficult to forecast and often occur in markets far removed from where the innovation occurred. A hypothetical example is a way to apply a thin film to glass beverage bottles that has application to liquid crystal displays. In the model terminology, the social value of the innovation can be much larger than the value v_1 in the market where the innovation occurs. When innovation has positive spillover benefits for consumers and firms in other industries, its true social value can be much larger than its value in any one industry. If $N(v_1 - v_0)$ only measures part of the social value of an innovation because other spillover benefits are hard to estimate, then it is not necessarily a

10 Another difficulty with a rule of reason standard is that benefits and costs that differ over time would have to be discounted in order to determine whether total net benefits exceed total net costs, however the choice of the discount rate often affects the sign as well as the total value of net benefits, and the appropriate discount rate can be controversial.

11 Interview with Steve Jobs, CEO, Apple, *BUSINESS WEEK* (Oct. 11, 2004), at 96.

waste of social resources to reward innovation with a payoff that exceeds the measured, but underestimated, social value.

A total ROR test that does not take spillovers fully into account can produce false positives and condemn socially desirable innovation. The total ROR test is also flawed because it can generate false negatives; an innovation can pass the total ROR test, yet be anticompetitive. Consider the following variation on the simple example. Before entry occurs, the incumbent sells the old product at a price $P_0 < v_0$. Consumers earn a total surplus $N(v_0 - P_0) > 0$. A firm enters with a new product for which $W = N(v_1 - v_0) - R > 0$, which passes the total ROR test. The new firm signs up distributors for its product under the condition that they deal exclusively with its product. Firms that offer the old product cannot make any sales; they exit the market or fail to make investments necessary to compete effectively and do not discipline the new firm's price. As a result the new firm charges the monopoly price $P^m = v_1$ and consumers are worse off. This conduct is arguably anticompetitive absent a business justification for the exclusive dealing. Yet it passes the total ROR test for the value of the innovation.

A total ROR test for innovation should account for spillover benefits and costs in the present and the future, is very complex to perform, and requires courts to assess the values of innovations, which they are not in a position to do. A total ROR test can lead to false positives and false negatives and undermine incentives for innovation. Although it is theoretically possible to construct a rule of reason standard for innovation that would condemn only socially harmful innovation, such a rule would not be practical. The benefits from innovation are hard to quantify, but likely to be large, and a ROR analysis could mistakenly assign a predatory label to conduct that has positive net social value.

B. CONSUMER WELFARE STANDARD (CONSUMER RULE OF REASON TEST)

A number of antitrust scholars have argued that antitrust policy is about protecting consumer welfare and therefore conduct should be evaluated using a rule of reason standard that emphasizes consumer rather than total welfare. Innovation would pass a consumer rule of reason test (consumer ROR) only if it does not lower consumer surplus, defined by total consumer benefits less total expenditures.¹² A consumer ROR test obviously can condemn innovation that increases total economic welfare because the consumer ROR test ignores the effects of an innovation on producer profits. Suppose there is a competitive industry with marginal production cost c_0 , which is also equal to the market price. A new firm enters the market with a breakthrough technology that enables production at a cost c_1 so low that firms cannot compete using the old technology. The more efficient firm makes the old industry obsolete or greatly reduces its sales. The obso-

12 As in the case of a total economic welfare standard, consumer benefits that differ over time would have to be normalized by applying a discount rate.

lete or shrunken old industry exerts less pricing discipline on the new technology and as a result prices increase above c_0 . Consumers can be worse off because the relaxation of pricing discipline from the old technology allows the firm with the new technology to increase price above c_0 . But the innovation increases total welfare if $N(c_0 - c_1) > R$. The innovation could generate very large cost savings (and hence be socially desirable), yet fail the consumer ROR test even if the price increase is very small relative to the cost savings.

Some of the most important innovations in recent times have proceeded in steps with little or no consumer benefit at the early stages of the innovation. An example is a research tool such as the Cohen-Boyer technology for gene splicing. The Cohen-Boyer technology made possible major advances in medicine and agriculture that would have been difficult to predict when the technology was first discovered. Yet in its early stage, the Cohen-Boyer technology was just a tool for inserting genetic material into a cell and had no immediate consumer benefits. In its infancy the Cohen-Boyer technology, revolutionary as it was, would not have scored particularly well on a consumer ROR test.

The consumer ROR test has the advantage that it is aligned with antitrust goals if the objective of antitrust policy is to protect the welfare of consumers. Nevertheless, antitrust enforcement for innovation based on a consumer welfare standard would be difficult to do correctly and likely would generate false positives and false negatives. The consumer ROR test for anticompetitive innovation ignores the impacts that innovations can have on firm values, whether positive or negative. Furthermore, innovation can make some consumers worse off, but make other consumers better off, either through price discrimination or through spillover benefits in other markets. In theory, a consumer ROR test could take these impacts into account, but that is difficult to do in practice.

A particularly worrisome objection to a consumer welfare standard for innovation is that it can too easily fail to take into account the chilling effects of antitrust enforcement on decisions to invest in R&D. A consumer welfare analysis typically takes as given the economy's existing production possibilities. In this sense a consumer welfare analysis is *ex post*, after investments have been made. An *ex post* consumer welfare analysis can easily overlook that investments were made in the past with the expectation of future profits. These investments created the goods and services that benefit today's consumers.

There is an additional informational issue with a consumer or total welfare standard. Firms have limited information when they estimate the private (or social) value of an investment in R&D. An *ex post* antitrust analysis can draw on new information and information available from other firms. An innovation

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may fail a ROR test ex post because, as a result of investments made by others and observed ex post, the incremental value of a firm's R&D falls short of its costs. However, the firm that made the investment could have no way to know what other investments were planned when it made its ex ante R&D decision.

Innovation is uncertain. Some innovations may not make consumers better off because they did not turn out as well as expected, although the expected benefits were positive when the investments were made. Furthermore, innovations typically build on other innovations. A particular incremental innovation may not improve consumer welfare, but that innovation builds on other innovations that generate benefits for consumers. In some cases, the profits from incremental innovations are necessary to justify the earlier innovations that consumers desire. Firms would not invest in the first place if they could not anticipate additional profits from subsequent innovations. Moreover, an antitrust standard that focuses only on consumer benefits discounts efficiency benefits and spillovers from innovations that show up as higher profits.

While a consumer rule of reason analysis may be aligned with the goals of antitrust policy, the practical difficulties of applying a consumer rule of reason analysis to innovation creates a risk that consumers would be harmed, not benefited, by a zealous application of such an antitrust standard to innovation by a single firm.

C. THE PROFIT SACRIFICE TEST

According to Janusz Ordover and Robert Willig (O-W), “predatory intentions are present if a practice would be unprofitable without the exit that it causes, but profitable with the exit.”¹³ I refer to this as the profit sacrifice test for predatory conduct.¹⁴ O-W apply their test to identify predatory innovation as well as predatory pricing, arguing that pricing and innovation can have similar motives and effects. An improvement in the quality of a product is similar to a reduction in its price. Rivals may be unable to compete with the new and improved product and may exit the industry or fail to make investments necessary to remain as effective competitors. If the investment in the product would not have been profitable but for the exit of rivals, the Ordover and Willig test would ascribe predatory intentions to the investment.

A profit sacrifice test has inherent limitations to evaluate anticompetitive innovation. Innovation is about sacrificing short-term profits for long-term rewards. A firm incurs costs that reduce profits in the short run in order to devel-

13 Janusz Ordover & Robert Willig, *An economic definition of predation: pricing and product innovation*, 91(1) *YALE L.J.* 8-53, 9 (1981).

14 Anticompetitive conduct does not require a reduction in profit in the short run. Conduct such as exclusive dealing can harm competition with no reduction in profit. See, e.g., Aaron S. Edlin, *Stopping Above-Cost Predatory Pricing*, 111 *YALE L.J.* 941 (2002).

op new products or processes that generate profits in the longer run. It is difficult to determine when the sacrifice of short-run profit by investing in R&D is excessive. A price below marginal cost is inefficient because the cost of an incremental unit of supply is less than its value (although pricing below marginal cost can have other benefits, such as overcoming switching costs or signaling to consumers that they will enjoy the product once they try it). There is no corresponding guidance for investment in innovation. The innovation may be economically inefficient if it costs more than the value it creates, but that entails evaluation of expected rather than realized costs and benefits, and requires complex measurement of the social and private values of the innovation.

A PROFIT SACRIFICE TEST HAS INHERENT LIMITATIONS TO EVALUATE ANTICOMPETITIVE INNOVATION. INNOVATION IS ABOUT SACRIFICING SHORT-TERM PROFITS FOR LONG-TERM REWARDS.

A second prong of the O-W test is that the practice is unprofitable without the exit that it causes, but profitable with the exit. Successful innovation often disrupts markets and leads to the exit of firms that use technologies that are made obsolete by the innovation. Xerography was not a predatory innovation because it required a short-term sacrifice in profit and led to the exit of manufacturers of mimeograph machines. Just as a sacrifice of short-run profit says nothing about whether innovation has a predatory intent or effect, neither does the resulting exclusion of competition.

Whether a firm exits or becomes a less effective competitor as a consequence of innovation cannot control whether the innovation is anticompetitive. Significant and pro-competitive innovations often displace rivals. A possible alternative interpretation of the exit prong in the O-W test is whether an innovation would have been profitable assuming that firms remain in the market as actual or potential competitors with their old technologies, even if they have no sales because they are not competitive with the new and improved products or processes. This is a difficult inquiry not only because it is hard to conceptualize the effects of potential competitors that are displaced by the innovation, but also because the profit that the innovator could earn under the assumption that actual or potential competitors remain in the market depends on the intensity of the competition that would occur. The test would yield one profit level if, but-for exclusion, competition is assumed to be intense, and would yield another, higher profit level if, but-for exclusion, the innovator and rivals would have shared the market at a high price.

Returning to the example of a product innovation that increases value from v_0 to v_1 , the profit sacrifice test would ask whether the innovation was profitable assuming actual or potential competition from firms with the old product. Suppose P_1 is the price for the new product. Ignoring production costs, the profit sacrifice test would require $NP_1 > R$ without exclusion of the old product. With

intense competition from the old product, the most that a firm can charge for the new product is $P_1 = v_1 - v_0$. At this price the innovation passes the profit sacrifice test if it is socially desirable, ignoring spillover benefits, under a total rule of reason standard; i.e., if $N(v_1 - v_0) > R$. In this respect the profit sacrifice test provides a screen for innovations that are socially beneficial. There are, however, many circumstances in which the price for the new product would be greater or less than $v_1 - v_0$, depending on the strength of actual or potential competition from the old product and other constraints that affect pricing, and there are many circumstances in which innovation generates large spillover benefits. When P_1 diverges from the social value of the innovation, the profit sacrifice test becomes less useful.

The profit sacrifice test requires that a court evaluate an innovator's profit under the counterfactual that the innovator does not benefit from changes in market conditions caused by the innovation. This is a complicated calculation. Even if it could be done accurately, there is no assurance that it leads to the right answer except in special circumstances. Profits earned from changes in market conditions may be essential to drive pro-competitive innovation. A better mousetrap can destroy the market for other mousetraps, but that is part of the reward that motivated the invention, and the incentive to innovate may be inadequate without that prospect.

Even if we cast these difficulties aside, application of a profit sacrifice test likely would ignore the spillover benefits from innovation for consumers and for firms, and for consumers in other markets and at future points in time. As with the consumer ROR test, a profit sacrifice test also runs the risk of performing the wrong calculation by ignoring incentives for innovation and by evaluating ex post rather than ex ante benefits and costs.

While there are problems with the profit sacrifice test as a test of predatory innovation, it could have value as a screen to identify when innovation is not anticompetitive, although there are also potential pitfalls in this application. Suppose an innovation produces a new product with a value of \$100. There are other competitors with the same production cost that could supply a product worth \$90. These other firms choose not to enter the market because with aggressive competition they can't expect to make any sales. Assuming the same production costs, a firm with a product that is worth \$100 can beat competition from a product that is worth only \$90; the better product can capture all sales at a price slightly less than its incremental value of \$10. If other competitors choose not to enter because they do not anticipate any sales, then the innovator can charge the full value of \$100. A correct application of the profit sacrifice test would use \$10 as the social value of the innovation. This is its incremental value relative to other products. Yet if other products never enter the market because they are deterred by the innovation, it would be difficult to ascertain the innovation's true incremental value and easy, albeit incorrect, to conclude that the

social value of the innovation is its full value of \$100 rather than its incremental value of \$10.¹⁵

The profit sacrifice test is not a cure for the problems raised by the total or the consumer rule of reason tests to evaluate predatory innovation. It is complex to perform and can lead to false positives and false negatives.

D. NO ECONOMIC SENSE TEST

Under the no economic sense test, “conduct is not exclusionary or predatory unless it would make no economic sense for the defendant but for the tendency to eliminate or lessen competition.”¹⁶ While similar to the profit sacrifice test in some respects, the no economic sense test has important differences. The profit sacrifice test makes a positive statement that predatory intentions are present if a practice would be unprofitable without the exit that it causes, but profitable with the exit, although a finding of predatory intent is neither necessary nor sufficient for innovation to be anticompetitive. The no economic sense test instead implies that there is no antitrust liability for predatory conduct unless the conduct would make no economic sense but for the tendency to eliminate or lessen competition.¹⁷

A second difference is the focus in the profit sacrifice test on the short-run cost of a strategy. The profit sacrifice test compares a loss in short-run profit against future benefits from the exclusion of competition. There is no specific mention of a profit sacrifice in the no economic sense test. To some extent this is merely semantics. If conduct makes no economic sense, then it is likely because it entails a reduction in profit relative to another course of conduct. The difference in short-run profit with and without exclusionary conduct is a measure of the cost of that conduct.

15 Farrell and Katz show that the profit sacrifice also can produce false positives and false negatives when technologies have network effects. With network effects, the technologies that would represent actual or potential competition in the absence of exclusion depend on consumer expectations, which are not uniquely determined. See Joseph Farrell & Michael Katz, *Competition or Predation? Consumer Coordination, Strategic Pricing, and Price Floors in Network Markets*, 53(2) J. INDUS. ECON. 203-31 (2005).

16 Gregory Werden, *Identifying exclusionary conduct under Section 2: The “No Economic Sense” Test*, 73(2) ANTITRUST L.J. 413 (2006). See also Gregory Werden, *Identifying Single-Firm Exclusionary Conduct: From Vague Concepts to Administrable Rules* ch. 22, Fordham Competition Law Institute, at 557-88; A. Douglas Melamed, *Exclusive Dealing Agreements and Other Exclusionary Conduct - Are There Unifying Principles?*, 73(2) ANTITRUST L. J. 375, 391 (2006) and A. Douglas Melamed, *Exclusionary Conduct Under the Antitrust Laws: Balancing, Sacrifice, and Refusal to Deal*, 20(2) BERKELEY TECH. L. J. 1248 (2005).

17 According to Gregory Werden, conduct by a single firm is unlawfully exclusionary if it makes no economic sense but for its effect of eliminating competition and thus creating and maintaining market power. Furthermore, the conduct must be reasonably capable of making a significant contribution to maintaining monopoly power or give rise to a dangerous probability of creating monopoly power and not fall within any safe harbor or established exemption. See *id.* Werden, *Identifying Single-Firm Exclusionary Conduct: From Vague Concepts to Administrable Rules*, at 576.

Under some circumstances, conduct could harm competition even if it costs very little. Exclusive dealing, raising rivals' costs, and tying can exclude competitors without incurring significant costs in the short run. Gregory Werden offers an example of a firm that sets fire to its competitors' factories in a hypothetical world with no arson laws and costless matches. The profit sacrifice test might not catch this anticompetitive conduct because the arson does not require a sacrifice of short-run profit in this extreme hypothetical. The no economic sense test would properly alert an antitrust enforcer to possible anticompetitive conduct because it would make no economic sense for a firm to set fire to its competitors except to accomplish an anticompetitive end.

Conduct that has a valid business justification other than the exclusion of competition would escape liability under the no economic sense test. In this respect the test could exempt conduct such as innovation that is usually beneficial, although this turns on interpretation of the business justification for innovation. It makes economic sense for a firm to try to reduce its costs or raise the value of its product, even if the investment does not produce a positive return. Some investment in innovation, however, may be clearly unprofitable if it does not exclude competition. Nevertheless, there is a plausible case to assign a valid business justification to such investment because the benefits from innovation are difficult to assess and society could be better off from an innovation that excludes competitors. Alternatively, one might place innovation in the category of conduct that falls within a safe harbor for unlawful exclusion by a single firm.

Some might argue that a safe harbor for single firm innovation is unwarranted. Suppose a firm is the only supplier of an essential component of a system, such as access to a telecommunications local loop. Furthermore, suppose that the firm cannot charge a profit-maximizing price for access, but instead must accept a much lower price. As a result, other firms combine cheap access to the local loop with other complementary valued added services to offer systems, such as voice and Internet access, that consumers desire and sell these systems in competition with each other at low prices. Now suppose that the owner of the local loop invests in an innovation that makes the local loop incompatible with the value added services provided by other firms. The innovation could have an anticompetitive effect, but could escape liability under the no economic sense test if the owner of the loop could supply a plausible justification for the innovation other than the elimination of competition, or if the test provides a safe harbor for innovation. This may not be a bad result, given that the innovation could have significant social benefits. Moreover, it is consistent with the deference that courts give to firms in their decisions about when and how to deal with their rivals, as reflected in the Supreme Court's *Trinko* decision.

E. SHAM TEST

If innovation is construed to be an activity that always makes economic sense, then the no economic sense test provides a broad pass for innovation even if the

innovation may have anticompetitive consequences. That is an acceptable tradeoff. Antitrust policy has to strike a balance between over- and under-deterrence, and the risk of chilling innovation with too much antitrust enforcement is much greater than the risk of allowing some anticompetitive innovation to slip through the antitrust cracks.

If innovation always makes economic sense, then the no economic sense test is similar to a test of whether the innovation is a sham. Under a sham test, single-firm innovation would escape Section 2 liability if the innovation is not a sham. The problem, of course, is in the definition of a sham innovation. One might apply a sham innovation test in our simple example by requiring that $v_1 - v_0$ be above some minimum threshold value to establish that the innovation is not a fraud, but there is little to guide the choice of the minimum threshold. There are many innovations that appear to have a low incremental social value, yet consumers value them highly. Consider downloadable ring tones or computers that come in different colors.

A possible definition of a sham innovation is an innovation resulting from an investment that no firm would possibly make except for its adverse effect on competition, although this interpretation as well can lead to enforcement errors. Taking an existing technology as a given component of a firm's production possibilities, investment in an improvement to that technology may make no economic sense but for the improvement's adverse effects on competition, and hence the investment may fail either the no economic sense test or a sham test. But this conclusion may be incorrect. The profit from the improvement could be essential to justify the investments that created the technology that is the baseline for the improvement. If the firm could not improve the technology without incurring antitrust liability, the firm may not have invested in the underlying technology, and society could be worse off. An alternative definition of a sham innovation is whether the innovation makes at least some consumers better off. If it does, it is not a sham. This standard would be easier to apply than a no economic sense test or a minimum threshold for innovation and would be less likely to result in excessive deterrence of investment in R&D.

III. Strategic Innovation with Complements

Conventional approaches to evaluate predatory conduct can yield both false positives and false negatives when applied to innovation that changes the competitive landscape for substitute products. Given the potentially large benefits from innovation and the risks of judicial error, antitrust policy should restrain innovation by a single firm that affects substitute products only in exceptional circumstances, if at all. Further supporting this conclusion is that innovation does not preclude a rival from inventing around or improving on new technology that is the subject of an alleged predatory scheme.

In some circumstances, however, it can be difficult for rivals to invent around or improve on even a minor innovation. An example is an interface standard that affects the compatibility of complementary components for a computer network. In a series of cases decided in the late 1970s, plaintiffs alleged that IBM redesigned its mainframe computers to make them incompatible with products sold by independent vendors and chose prices and lease terms to advantage its own components. The product designs arguably achieved some cost savings or technical efficiencies, but also erected barriers to independent suppliers of peripheral components. While the coexistence of efficiencies and adverse effects on competition suggests cause for some rule of reason balancing, none of the courts involved in the IBM peripheral cases engaged in an express comparison of benefits and harms. Instead, they generally concluded that plausible efficiencies from product design placed the conduct in the category of monopolization (if it occurs) that is the result of a superior product or business acumen, and hence was not an offense under the Sherman Act.¹⁸

Courts have dismissed allegations of monopolization in other cases involving innovation by a single firm. *Berkey Photo* alleged that Kodak's introduction of a new camera and film format and its failure to disclose information about the new format to other camera manufacturers and film processors was part of an unlawful monopolization scheme.¹⁹ The appellate court ruled that Kodak did not have a duty to disclose information about its products to its competitors and its introduction of a new camera and film was not anticompetitive. The court emphasized the special place of innovation in antitrust policy, stating that "Because [...] a monopolist is permitted, and indeed encouraged, by § 2 to compete aggressively on the merits, any success that it may achieve through 'the process of invention and innovation' is clearly tolerated by the antitrust laws."²⁰ In a more recent case, a district court held that a manufacturer of insulin pumps did not violate the antitrust laws when it modified its pumps to be incompatible with components sold by another firm.²¹

In other cases, courts have implicated product design and innovation as elements of a monopolization strategy. In *C.R. Bard v. M3 Sys., Inc.*, a manufacturer of biopsy guns and needles (C.R. Bard) changed the design of its biopsy gun

18 See, e.g., *California Computer Products, Inc. v. IBM*, 613 F.2d 727 (9th Cir. 1979) and *In re IBM Peripheral EDP Devices Antitrust Litigation*, 481 F. Supp. 965 (N.D. Cal. 1979) ("Where there is a difference of opinion as to the advantages of two alternatives which can both be defended from an engineering standpoint, the court will not allow itself to be enmeshed 'in a technical inquiry into the justifiability of product innovations.'" *ILC Peripherals Leasing Corp. v. IBM Corp.*, 458 F. Supp. 423, 439 (N.D. Cal. 1978)).

19 *Berkey Photo, Inc. v. Eastman Kodak Co.*, 603 F.2d 263, 281 (1979).

20 *Id.* at 281.

21 *Medtronic Minimed Inc. v. Smiths Med. MD Inc.*, 371 F. Supp. 2d 578 (D. Del. 2005).

in a way that made it incompatible with the needles sold by M3 Systems.²² A district court held that Bard unlawfully leveraged its monopoly power in biopsy guns to obtain a competitive advantage in replacement needles by modifying its gun to accept only Bard needles. A divided panel of the U.S. Court of Appeals for the Federal Circuit sustained the verdict. The precedent value of this opinion is limited, however, because Bard advanced only limited arguments in its appeal.²³ Furthermore, the opinion is apparently inconsistent with a later Federal Circuit case in which the court held that a patent holder may exclude others from making, using, or selling the claimed invention free from liability under the antitrust laws.²⁴ Bard held patents on its biopsy gun and needles.

The question of predatory product design took center stage in the antitrust case brought by the U.S. Department of Justice (DOJ) and several states against Microsoft. The plaintiffs alleged a pattern of anticompetitive conduct in violation of Sections 1 and 2 of the Sherman Act. The district court found that Microsoft maintained a monopoly in the market for Intel-compatible PC operating systems and attempted to gain a monopoly in the market for Internet browsers in violation of § 2. The district court's findings with regard to anticompetitive product design identified three actions by Microsoft that interfered with competition from suppliers of rival Internet browsers:

- (1) excluding Internet Explorer (IE) from the Add/Remove Programs utility;
- (2) designing Windows so as in certain circumstances to override the user's choice of a default browser other than IE; and
- (3) commingling code related to browsing and other code in the same files, so that any attempt to delete the files containing IE would, at the same time, cripple the operating system.²⁵

The appellate court applied a test to evaluate the question of anticompetitive product design that included the following steps.²⁶

- The plaintiff must demonstrate that the conduct harmed consumers (an anticompetitive effect);

22 C.R. Bard, Inc. v. M3 Systems, Inc., 157 F.3d 1340 (decided Sep. 30, 1998).

23 The jury instructions concerning monopolization may have been misleading, however Bard did not challenge the lower court's instructions in its appeal.

24 *In re Independent Service Organizations Antitrust Litig.*, 203 F.3d 1322 (Fed. Cir. 2000).

25 *U.S. v. Microsoft*, U.S. Court of Appeals for the DC Circuit, 253 F.3d 34 (2001).

26 The Court described five principles, including the principle that the focus of the analysis is on the effect of that conduct, not on the intent behind it. I have condensed the first two principles into one principle dealing with competitive effects.

- if a plaintiff successfully demonstrates anticompetitive effect, then the monopolist may proffer a pro-competitive justification for its conduct; and
- the plaintiff can rebut the proffered pro-competitive justification or, if the justification stands unrebutted, then the plaintiff must demonstrate that the anticompetitive harm of the conduct outweighs the pro-competitive benefit.

The third step implies a rule of reason type of balancing of benefit and harm. The *Microsoft* court did not provide a manual for how to balance benefits and harms from innovation because the court never got to the third step in its analysis. The court concluded that Microsoft had not demonstrated any pro-competitive justifications for two of three contested elements: excluding IE from the Add/Remove utility and commingling code related to browsing and other code in the same files. Having satisfied the other requirements for a § 2 offense, the court concluded that these actions contributed to monopolization of the market for Intel-compatible personal computer operating systems.²⁷ For the third element—designing Windows to override the user’s choice of a default browser other than IE—the court concluded that Microsoft offered a pro-competitive justification, which the plaintiff neither rebutted nor demonstrated was outweighed by the harm to competition.

The welfare implications of product design that affects interoperability are ambiguous. Markets for systems with complementary components can have multiple equilibria that have different consequences for consumer and total welfare.²⁸

THE WELFARE IMPLICATIONS
OF PRODUCT DESIGN THAT
AFFECTS INTEROPERABILITY
ARE AMBIGUOUS.

Permitting the owner of an essential component to design the component so that it does not interoperate with other firms’ components may or may not lower consumer or total welfare, depending on the equilibrium that would have occurred with compatible components. A

prohibition against incompatible technology designs can generate errors by prohibiting conduct that increases welfare, and the frequency of these errors would depend on the particular welfare standard that is applied.

27 Offering an inferior product can be part of a product differentiation strategy that has benefits for consumers as well as the seller. The Intel 386SX microprocessor was an Intel 386 device with a severed connection between the central processor and the math co-processor. This allowed Intel to offer consumers products with different functionality at different prices. See Raymond J. Deneckere & R. Preston McAfee, *Damaged Goods*, 5(2) J. ECON. & MGMT STRATEGY 149-74 (1996). Microsoft’s design for Windows 98 did not appear to be part of a product differentiation strategy that could have similar effects.

28 Richard Gilbert & Michael Riordan, *Product Improvement and Technological Tying in a Winner-Take-All Market*, J. INDUS. ECON (forthcoming 2007) and Farrell & Katz, *supra* note 15.

None of the courts that considered cases involving product design, including *Microsoft*, engaged in a quantitative weighing of costs and benefits from the exclusionary effects of a product design according to either a total welfare or consumer welfare standard, nor did courts apply a profit sacrifice test. Most courts that have dealt with cases alleging anticompetitive innovation have applied a standard that more closely agrees with a no economic sense test, although not articulated as such.²⁹ Courts generally have refused to assign antitrust liability to innovation when there was a valid reason for a particular product design, and this threshold was met when the design produced plausible efficiencies. The *Microsoft* court purported to do a rule of reason balancing of the benefits and harms from the design of the Microsoft Windows 98 operating system and described a sequence of steps to perform the calculation. In fact, the court held that the design of the operating system was not anticompetitive when Microsoft could demonstrate plausible and unrebutted efficiencies, and held that design elements were anticompetitive only when Microsoft did not offer any efficiency justification. The *Microsoft* court never reached the point in its analytical roadmap that would require a comparison of benefits and adverse competitive effects from innovation.

IV. Product Line Extensions in the Pharmaceuticals Industry

The innovation cases discussed in the previous section involved complementary products that interoperate with each other. Allegations of anticompetitive innovation for substitute products have appeared in the pharmaceutical industry. Characteristics of the pharmaceuticals industry interact to create special circumstances for innovation and competition. Consumers have limited information about the therapeutic benefits of alternative prescription drugs and rely on their doctors to recommend a particular therapy. Price is often a secondary consideration. Patients and their physicians care about health outcomes and insurance often shields patients from the full price of a drug. As in most agency relationships, the objectives of the physician and his patient are not perfectly aligned. A patient's doctor may be relatively insensitive to cost even if the patient is not insured or faces a high co-payment.

Patent protection further limits the extent of price competition in the pharmaceuticals industry. Most patented drugs are available only from a single supplier. For example, in the class of statin drugs that are used to lower the levels of low density lipids (cholesterol) in the blood, atorvastatin calcium is available only as the branded drug Lipitor manufactured and sold by Pfizer. Until Pfizer's patent expires, price competition for atorvastatin calcium can occur only by sub-

²⁹ Mark S. Popofsky, *Defining Exclusionary Conduct: Section 2, the Rule of Reason, and the Unifying Principle Underlying the Antitrust Laws*, 73(2) ANTITRUST L.J. 435, 445 (in practice, Microsoft and other courts have subjected product design to a no economic sense test).

stituting a different drug or therapy, not by substituting among different suppliers of the same drug. Other drugs could be as effective or nearly as effective as atorvastatin calcium in controlling blood lipid levels. These include other statin drugs, such as lovastatin (sold as the branded drug Mevacor), pravastatin (sold as Pravachol), or simvastatin (sold as Zocor), as well as drugs with a different mechanism of action, such as fenofibrate (sold under the brand name Tricor), gemfibrozil, bile acid sequestrants, or nicotinic acid.

In a typical market a consumer would comparison shop among many brands and types of products. If a consumer wants to purchase a car, she might consider sedans, station wagons, vans and SUVs and in each category compare different brands of new and possibly used vehicles. Armed with information from *Consumer Reports* and other sources, the consumer would choose the vehicle that offered the best value. The shopping experience is different for prescription drugs. If a consumer desires a better blood lipid profile, she cannot independently choose between the statins and other prescription drugs that can control lipid levels. She may only purchase what her doctor prescribes. Limited information about the benefits and costs of different therapies on the part of the patient, and in some cases her doctor as well, and insurance plans that isolate the consumer from drug prices act to moderate price competition between different drug therapies.

For drugs whose patents have expired, patients can benefit from price competition between different suppliers of the generic chemical compound.³⁰ Drugs with generic equivalents are called multi-source drugs. The original patented drug is alternatively called the pioneer or innovator drug or identified by a brand name rather than the name of the active ingredient. Many states allow pharmacists to dispense a therapeutically equivalent generic drug to fill a prescription for a branded product unless the doctor requires that the pharmacist dispense the brand. Price competition for generic equivalents can be intense because they are functionally identical products and a drug retailer is free to choose among multi-source generic suppliers when the law permits generic substitution.

The U.S. Food and Drug Administration (FDA) publishes *Approved Drug Products with Therapeutic Equivalence Evaluations*, also called the *Orange Book*, which lists all drug products approved by the FDA and has information on generic drug equivalents as well as active ingredients and proprietary names. Patent protection for the statin drug Zocor expired on June 20, 2006. In January 2007 the *Orange Book* listed eight suppliers of simvastatin in addition to Merck, the supplier of the Zocor branded product. The price of generic simvastatin is a fraction of the price of Zocor. In January 2007, packages of fifty 20mg pills of the

30 See, e.g., A. COOK ET AL., HOW INCREASED COMPETITION FROM GENERIC DRUGS HAS AFFECTED PRICES AND RETURNS IN THE PHARMACEUTICAL INDUSTRY (Congressional Budget Office, Jul.1998).

generic simvastatin were available for \$14.37, while Zocor in the same package size and dose cost \$137.45 from the same retailer.³¹

The Drug Price Competition and Patent Term Restoration Act of 1984 (often called the Hatch-Waxman Act after its sponsors) sought to balance the benefits of patent protection for drug innovation against the benefits of lower prices from generic competition. Prior to 1984, a generic manufacturer had to file a separate New Drug Application (NDA), which required proof of safety and effectiveness before the drug could be sold. The Hatch-Waxman Act introduced an Abbreviated New Drug Application (ANDA), which accelerates FDA approval by allowing a generic manufacturer to demonstrate that its drug is therapeutically equivalent to an already approved drug. Drugs are therapeutically equivalent if:

- (1) there are no known or suspected bioequivalence problems, or
- (2) actual or potential bioequivalence problems have been resolved with adequate evidence.

The FDA *Orange Book* designates drugs in conventional oral dosage forms in the first category as AA and those in the second category as AB.

A manufacturer of a pioneer drug can attempt to mitigate generic competition by introducing a related drug that provides new therapeutic benefits or by changing the delivery form or dosage strength of the drug. I refer to all of these tactics as product line extensions of the pioneer drug.³² Many industries employ product line extensions (e.g., a low fat version of a yogurt brand). Product line extensions capitalize on consumer recognition of the underlying brand and are a valuable way to maintain or improve the market position of the brand.³³

FDA rules and legislation such as the Hatch-Waxman Act contribute to the value of product line extensions for brand name drug manufacturers. Drugs that appear to be similar may not qualify as therapeutic equivalents and would not be listed as such in reference databases used by pharmacists. For example, a drug that differs from a pioneer drug in its delivery form would not be therapeutically equivalent to the pioneer drug and therefore would not be AB substitutable as a generic alternative. The same would apply to a similar new drug with a different

31 Prices available from Costco.com Pharmacy, at <http://www.costco.com/Pharmacy/frameset.asp?trg=HCFrame.asp&hcbn=Banner.asp&hctar=DrugInfo.asp&log=&rxbox=&fromscript=1&qf=&srch=zocor&Drug=ZOCOR&Article=ZOCOR>, (accessed on Jan. 19, 2006).

32 Janis, Hovenkamp, and Lemley call this "product hopping". See MARK JANIS ET AL., *IP AND ANTITRUST: AN ANALYSIS OF ANTITRUST PRINCIPLES APPLIED TO INTELLECTUAL PROPERTY LAW* (Aspen Law & Business, 2001).

33 Product line extensions represent the majority of new product introductions in all industries by some estimates. See, e.g., V. Kadiyali, N. J. Vilcassim, & P. K. Chintagunta, *Product line extensions and competitive market interactions: an empirical analysis*, 89(1-2) *J. ECONOMETRICS* 339-63 (1998) and Morris A. Cohen et al., *An Anatomy of a Decision-Support System for Developing and Launching Line Extensions*, 34(1) *J. MARKETING RES.* 117-29 (1997).

chemical composition. Furthermore, under the Hatch-Waxman Act, if the branded drug or its product line extension is protected by a patent, the branded manufacturer can obtain an automatic stay that prevents generic entry for a period equal to the lesser of 30 months or the time required for the generic manufacturer to prove that the patent is not valid or would not be infringed.

In two recent cases plaintiffs have alleged that manufacturers of branded products have engaged in anticompetitive innovation through product line extensions.³⁴ *Walgreen v. AstraZeneca*³⁵ involved Prilosec and Nexium, drugs in the class of proton pump inhibitors used to block excess production of stomach acid. AstraZeneca, the manufacturer of Prilosec, introduced Nexium prior to expiration of patents on Prilosec. The active ingredient in Nexium is esomeprazole, which is an isomer of the active ingredient omeprazole in Prilosec. Isomers are different arrangements of the same molecule and have similar but not identical effects in the body. The plaintiffs alleged that Nexium was not therapeutically superior to Prilosec for treatment of ordinary persistent heartburn (although there was some indication that Nexium has benefits for treatment of esophageal and duodenal ulcers) and that by promoting Nexium over Prilosec AstraZeneca undermined the market for generic omeprazole. The plaintiffs further alleged that AstraZeneca spoiled the market for generic omeprazole by promoting an over the counter version of Prilosec; managed care organizations typically do not reimburse drugs that are available over the counter.

In *Abbott v. Teva*³⁶ the manufacturer of the drug Tricor reformulated the drug, changed the pill from a capsule to a tablet with lower dosage, and introduced the new tablet with a broader FDA indication, and on a second occasion offered a tablet with a new composition of the active ingredient with a further reduction in dosage that could be absorbed into the bloodstream without the requirement that it be taken with food. Both of the product changes were based on patented technologies. When the manufacturer made the changes, Abbott stopped marketing the older version of the drug and notified the National Drug Data File (NDDF), a widely used database of prescription drugs, that it was no longer selling the older drug. The active ingredient in Tricor is fenofibrate, which is used to control triglyceride and lipid levels. Generic manufacturers complained that they were foreclosed from the market for fenofibrate because pharmacists could not freely substitute the older drugs for prescriptions written

34 In at least one other case the U.S. Federal Trade Commission alleged that a branded drug manufacturer abused the Hatch-Waxman process and the special statutory thirty-month stay by listing a patent in the *Orange Book* that was not related to the actual drug and was used to delay generic entry. I do not address these types of allegations in this article.

35 *Walgreen Co. et al. v. AstraZeneca Pharmaceuticals*, U.S. District Court for the District of Columbia, Case No. 06-cv-02084-RWR.

36 *Abbott Labs. v. Teva Pharms. USA, Inc.*, 432 F. Supp. 2d 408 (D. Del. 2006). The author consulted for Abbott Labs and Fournier in this case.

for the newer drugs, even though the older drugs were not significantly dissimilar from their newer versions.

In both cases, the improvements to the branded drug did not prevent generic or other drug manufacturers from competing with older versions of the drug. A generic manufacturer can sell omeprazole or older versions of fenofibrate without infringing patents held by the branded drug companies. The improvements only precluded the generic suppliers from obtaining automatic substitution of their drugs for the newer versions of the branded drugs. The new and old drugs were not AB substitutes for each other, and patents on the new drugs invoked the thirty-month stay of generic entry under the Hatch-Waxman Act.

In both cases the plaintiffs alleged that the conduct of the branded drug manufacturers frustrated the intent of the Hatch-Waxman Act, which was to facilitate generic competition. This is a misreading of the Act. The Hatch-Waxman Act offered a compromise between promoting generic competition and assuring a period of exclusivity for the branded product. The thirty-month stay provision was intended to protect the owner of a drug patent when challenged by generic entry.

A second objection was that the drug improvements were not significant and therefore should not be treated with deference under the antitrust laws as genuine product innovations. The basic premise is debatable. Nexium offers benefits compared to Prilosec for some patients. Some consumers prefer a tablet to a capsule and the move to a new formulation gave Abbott an additional opportunity to market the drug with a new FDA-approved indication. Furthermore, in both cases the changes to the drugs qualified for patent protection. In the case of fenofibrate, the improvements related to the absorption of the chemical in the bloodstream. While the patent office has been known to apply a low threshold for invention, it would be odd to conclude that an invention that wins a valid patent obtained by legal means is a sham. Furthermore, to the extent that a patent protects a minor invention, it should be possible for other firms to invent around the patent or sell other competitive products. This is true in the pharmaceutical industry as well as in other industries, although the cost of doing so is likely to be higher for drugs given the lack of consumer information, price insensitivity, and provisions in the Hatch-Waxman Act that limit generic entry.³⁷

Plaintiffs in the Abbott case made a third objection that Abbott should not have removed the older versions of the drug from the NDDF and accepted returns of the older products. The effects of removing the older versions of the drug from the NDDF are unclear. A pharmacist could not substitute older versions of these drugs for prescriptions of the newer drugs even if they were available, because they are not AB rated with the newer drugs.

³⁷ Organizations that provide a managed drug benefit have an incentive to identify drugs that offer similar therapeutic benefits at lower costs. These organizations are marketing opportunities for suppliers of low-cost older versions of drugs, provided that these older versions offer similar therapeutic benefits.

Clearly, many manufacturers discontinue their older products when they introduce newer versions. Ford does not sell its 2006 trucks after it moves to the 2007 model year. Suppliers of home electronics do not sell older models after they introduce new models. And some software vendors do not sell or support older versions of their software after they issue upgrades. There are legitimate reasons for a manufacturer to stop selling and even recall older products. It reduces consumer confusion and support costs and focuses retailers on the objective of promoting the new product, all of which can generate consumer benefits. A general rule that prohibits firms, even firms with monopoly power, from discontinuing older products would be unwise.

A determination that product line extension is anticompetitive should follow from the application of one or more tests for anticompetitive innovation, but all of the conventional tests have significant flaws. A total rule of reason test is likely to show that product line extensions for prescription drugs do not decrease total economic welfare. Generic competition transfers revenues from the brand-

A DETERMINATION THAT PRODUCT LINE EXTENSION IS ANTICOMPETITIVE SHOULD FOLLOW FROM THE APPLICATION OF ONE OR MORE TESTS FOR ANTICOMPETITIVE INNOVATION, BUT ALL OF THE CONVENTIONAL TESTS HAVE SIGNIFICANT FLAWS.

ed manufacturer to consumers through lower prices. A revenue transfer has no effect on total economic welfare.³⁸ Furthermore, generic competition may cause output of the generic and the branded drug to fall relative to a baseline without generic competition. Branded manufacturers may reduce expenditures on promotion for drugs that face generic competition. Reduced promotion may lower sales,³⁹ which implies lower total economic welfare in the short run. Under these conditions a product

line extension could increase output even in the short run, which would reinforce the conclusion that the product line extension is not anticompetitive under a total rule of reason test.

A consumer rule of reason test could conclude that a product line extension is anticompetitive if it slows the erosion of market power, however this finding may be mistaken. Most innovations throughout the economy are extensions of existing products. Product line extensions may appear to be inconsequential, yet have significant value for consumers. Berndt et al. find that incremental prescription drug innovations in the form of supplementary approvals for new dosages, formulations, and indications account for a substantial share of drug utilization and

38 There would be a deadweight loss if higher prices resulted in lower output.

39 Scott Morton finds no significant relationship between brand advertising, including promotion expenditures, and generic entry or market share. Fiona Scott Morton, *Barriers to entry, brand advertising, and generic entry in the US pharmaceutical industry*, 18(7) INT'L J. INDUS. ORG. 1085-104 (2000). These results are not inconsistent with brand promotion increasing generic sales by expanding the potential for pharmacy substitution.

associated economic and medical benefits.⁴⁰ It would be incorrect to adopt a rule that would generally condemn these innovations.

In practice, a rule of reason analysis typically focuses attention on short-run benefits and tends to ignore the long-run benefit from innovative activity. The drug cases provide an instructive example. It is easy, but not generally correct, to conclude that consumers are harmed by a policy that delays generic competition. The ability to delay generic competition provides an incentive for firms to invest in the pioneer drugs that generic manufacturers copy. A proper balancing must account for the positive effects of product line extensions for investment in new drugs. After firms have invested to create a new product, consumers gain if the innovation is made available at its marginal cost, although a policy of zero-cost compulsory licensing for new inventions ultimately would harm consumers by undermining the incentive to invent. The situation is analogous for pharmaceutical product line extensions. One cannot measure economic benefit solely by considering the short-term benefit to consumers from generic competition. It is essential to account for the negative effects of generic competition on the incentive to create new drugs.

There are flaws in other tests for anticompetitive innovation. The profit sacrifice test compares the cost of the product line extension to its benefit assuming no exclusion of generic competition. This comparison is misleading because it assumes that the innovator product exists, although profits earned from the product line extension could be instrumental for investing in the innovator product in the first place. The profit sacrifice test also should take into account that the very conduct that threatens generic competition may be necessary for its viability. The supplier of the branded product could reduce expenditures on product promotion and physician detailing if generic competition greatly eroded profits from sales of the brand. Without support from the manufacturer, sales of the brand could fall. Fewer prescriptions for the brand mean fewer opportunities for pharmacists to make generic substitutions. As a result, sales of the generic could fall as well. Generic sales depend on doctors writing prescriptions for the generic molecule, which they likely would do for a popular branded drug that has recently gone off patent, such as Zocor, or for a drug that has been around for a long time, such as ampicillin. For drugs that are neither blockbuster products nor generics that have achieved common name recognition, generic competition could be its own undoing because sales of the generic from pharmacy substitutions depend on promotion of the brand.

If generic competition causes sales to fall, a profit sacrifice test could show predatory intent from a product line extension even though consumers as well as the brand manufacturer would be better off with the extension. Consider an extreme example in which generic competition eliminates prescriptions for a

40 Ernst R. Berndt et al., *The Impact of Incremental Innovation in Biopharmaceuticals*, 24(2) PHARMACOECONOMICS 69 (2006).

branded drug because the manufacturer stops promoting the brand. With generic competition, the brand would have zero sales and the manufacturer would not invest to improve the drug. With the product line extension, consumers benefit from consumption of the branded drug. Without the extension, doctors do not prescribe the drug and consumers are worse off. The brand manufacturer would be worse off without the extension and the generic manufacturers would be no better off if doctors are not prescribing the drug. Thus, in the alternative world that assumes no exclusion of generic manufacturers, it is possible that every participant in the market would be worse off (or no better off) than in the world in which generic manufacturers are excluded. Lower profits from sales of the brand without the product line extension also would contribute to lower consumer and producer surplus in the long run by eroding incentives for investment in innovator drugs. Nonetheless, the profit sacrifice test could ascribe predatory intentions to a product line extension that excluded generic competition.

According to Ordover and Willig, the profit sacrifice test could account for the dependence of generic sales on sales of the branded product and avoid this erroneous conclusion. The test should consider whether the generic manufacturer could profitably compete if it had to compensate the manufacturer of the brand for promotion expenditures and for any negative effects on other products.⁴¹ This would bring the profit sacrifice test closer to a total rule of reason analysis, although it still would not consider the incentives to invent the pioneer drug in the first place.

The no economic sense test may escape some of the difficulties with the other tests, although that depends on its interpretation. One could argue that it makes no economic sense to spend millions on a product line extension for a drug unless the extension excludes generic competition. With this interpretation the no economic sense test essentially reduces to the profit sacrifice test, with its associated difficulties. Alternatively, one can interpret investment to improve a product as being outside the scope of activities that make no economic sense. With this interpretation the no economic sense test is similar to a test of whether the innovation is a sham. Given the difficulties in applying other tests to identify anticompetitive innovation in the pharmaceutical industry and the social cost of antitrust liability that deters investment in R&D, a rule that focuses on whether the innovation is a sham is good policy and consistent with the treatment of single firm innovation in Section 2 cases by most courts.

Innovation can delay entry of generic equivalents in part because provisions of the Hatch-Waxman Act, such as the automatic thirty-month stay when the holder of a drug patent sues a generic manufacturer for infringing the patent, protect innovator drugs from generic competition. The thirty-month stay creates an opportunity for strategic patenting by a branded manufacturer to delay generic

⁴¹ Ordover & Willig, *supra* note 13, at 45-7.

competition, which can be particularly effective if the Patent Office has a low threshold for patentability. If one were to conclude that innovation raises unique antitrust concerns in this industry, a logical remedy would be to ease generic substitution requirements or the application of the thirty-month stay, rather than to carve out special antitrust rules. The FDA could develop policies to facilitate generic substitution and limit new drug approvals to drugs that meet a threshold level of utility, and the U.S. Congress could further amend the Hatch-Waxman Act.⁴² This would address unique causes of competitive effects from innovation in the pharmaceutical industry without imposing flawed antitrust rules.

V. Consistent Rules

Suppose a computer manufacturer changes an interface standard so that another firm's disk drive is no longer compatible. Unable to supply drives for this computer, other disk drive manufacturers may not be able to achieve economies of scale and may not be viable competitors in markets for disk drives. Suppose instead that the computer manufacturer simply refused to supply the information necessary for other firms to offer compatible drives. This refusal to deal would have the same competitive effect in markets for disk drives as the changed interface standard, but likely would have fewer efficiency benefits. In light of the skepticism expressed in the recent Supreme Court decision in *Verizon v. Trinko* concerning the obligation of a firm to assist a rival, it seems unlikely that the refusal to deal with no other anticompetitive conduct would incur antitrust liability. A pharmaceutical product line extension that excludes a generic competitor also has aspects of a unilateral refusal to deal. The generic manufacturer needs prescriptions for the branded product to take advantage of automatic generic substitution by the pharmacist. Although the branded product and the generic are substitutes, in a sense they are complements. The generic requires the brand to make automatic substitution sales. The strategy of introducing a newer drug along with retirement or failure to support the older version of the drug is similar to a refusal to supply the older version of the drug to allow generic substitution. Consistency suggests that product designs with exclusionary effects should have no greater antitrust scrutiny than a unilateral refusal to deal.

Antitrust policy applies a different standard to conduct by a firm with monopoly power that denies competitors access to necessary inputs or markets (other than access to the firm's own facilities) or imposes unnecessary costs on those who would deal with competitors. Such exclusive dealing can violate sections 1

IF ONE WERE TO CONCLUDE THAT INNOVATION RAISES UNIQUE ANTITRUST CONCERNS IN THIS INDUSTRY, A LOGICAL REMEDY WOULD BE TO EASE GENERIC SUBSTITUTION REQUIREMENTS OR THE APPLICATION OF THE THIRTY-MONTH STAY, RATHER THAN TO CARVE OUT SPECIAL ANTITRUST RULES.

⁴² For example, 2003 amendments permit only one thirty-month stay per ANDA.

and 2 of the Sherman Act if there are no offsetting efficiencies from the exclusionary conduct. Product designs could have effects that are similar to an exclusive dealing strategy. An extreme example is the introduction of a new computer reservation system by an airline that automatically penalizes travel agents for bookings on rival airlines. The DOJ and state plaintiffs in the *Microsoft* case alleged that the design of Windows 98 operating system increased the cost to computer vendors of offering computers with rival browsers.

Einer Elhauge supports a distinction in the treatment of single firm innovation depending on whether innovation furthers monopoly power though an increase in the firm's efficiency or by impairing rival efficiency, with no antitrust liability for the former.⁴³ His proposal has appeal for the rare innovations that are clearly intended to harm rivals or for design features that impose costs on rivals, but can be removed without significantly compromising the performance of the product. In the *Microsoft* case, the court concluded that two design elements were intended to impose costs on rivals and were not essential to the performance of the operating system. In many cases, however, the exclusionary effects from an innovation are entwined with the innovation's efficiency benefits and it is impossible to treat them separately. A new interface standard that permits faster data transfers but is incompatible with rival products creates efficiencies and can exclude rivals. An improvement to a branded drug creates benefits for consumers and can prevent automatic substitution by generic competitors. In such a situation it could be tempting to require alternative designs that have less of an exclusionary effect, but a search for less restrictive alternatives would involve courts in product design activities where they have little or no expertise, and would risk deterring beneficial innovation. If the exclusionary effects are an unavoidable consequence of an innovation that has actual benefits for product quality or cost, then the effects should be treated as part of the innovation and should not be a source of antitrust liability.

One might object that deference to innovation by a single firm is inconsistent with the treatment of innovation in other contexts. In merger analysis, competition authorities engage in a rule of reason balancing of likely pro-competitive effects of a merger against any likely competitive harm, and take into account both potential benefits for innovation and possible harm from a reduction of innovation.⁴⁴ Innovation benefits do not trump competitive effects in merger analysis, but plausible efficiencies can be sufficient for innovation to escape antitrust liability for monopolization. The different approaches to the treatment of innovation reflect the different treatment of unilateral conduct and mergers under the antitrust laws. Merger analysis is a prospective inquiry into the merg-

43 Einer Elhauge, *Defining better monopolization standards*, 56 *STANFORD L. REV.* 253, 316, 320 (2003).

44 Richard Gilbert & Willard Tom, *Is Innovation King at the Antitrust Agencies? The Intellectual Property Guidelines Five Years Later*, 69 *ANTITRUST L. J.* 43-86 (2001) describes how the agencies have incorporated innovation effects in merger analysis.

er's likely future effects, including its effects on innovation. In some cases, mergers can create market structures that are more or less likely to promote investment in R&D and these effects should be taken into account along with any risks that the merger would lessen price competition. In the innovation cases considered here, innovation has already occurred and an important concern is that antitrust enforcement would chill future incentives for innovation investments. Furthermore, as noted above, the conduct at issue in most of the cases examined in this article is similar in many respects to a refusal to deal, for which courts have been reluctant to impose obligations.

Deference to innovation in cases that allege predatory innovation is justified in part because the profit from successful innovation is the motivating force to invest in R&D. Clearly, this argument can be taken too far. Price-fixing creates profits that may motivate investment in R&D, but this is not a valid defense for price-fixing conspiracies. The relationship between profit and investment in R&D is too tenuous to justify an innovation defense for price-fixing and other naked restraints of trade.

VI. Conclusions

No single welfare measure provides an accurate guide for antitrust policy. Firms have wide discretion to choose the prices of their goods and services without running afoul of U.S. antitrust law, despite the fact that at least in the short run an increase in price unambiguously lowers consumer welfare and lowers total economic welfare when price is above marginal cost. Nonetheless, welfare measures can help to inform whether certain types of conduct should be prohibited under the antitrust laws by providing objective estimates of the impact of the conduct on market performance. Antitrust scholars have endorsed different measures to assess liability for predatory conduct. These include a rule of reason analysis that includes producer as well as consumer welfare, a rule of reason analysis that focuses only on consumer welfare, and profit sacrifice tests. All of these approaches are seriously flawed when applied to innovation by a single firm. Rule of reason analysis, whether based on consumer or total economic welfare, generally fails to measure the spillover effects from innovation, focuses on ex post rather than ex ante benefits and costs, does not adequately account for uncertainty, ignores the value of innovation as an input into future innovations, and, perhaps most importantly, does not account for the chilling effect of antitrust scrutiny on incentives to innovate. The profit sacrifice test is ill-suited to identify anticompetitive innovation because investment in R&D necessitates a sacrifice of short-run profit and therefore is not an indicator of predatory intent or effect. Furthermore, exclusion that results from successful innovations may be a necessary reward to induce socially desirable levels of R&D. When applied to product line extensions in the pharmaceutical industry, a profit sacrifice test can mistakenly identify innovation as anticompetitive even though consumers would be worse off and profits would be lower if the innovation did not occur.

Rule of reason and profit sacrifice approaches to the analysis of the competitive effects of innovative activity typically assume the existence of the innovation. By doing so, it is easy to forget that the profits earned from the exclusion of competitors provide an incentive to make the innovation in the first place. The problem is similar to an analysis of the consequences of patent licensing that ignores the effects of licensing terms on the incentives to innovate. It is easy to reach the erroneous conclusion that licensing innovations at very low royalties would increase output and promote welfare. That conclusion is clearly incorrect because such a policy would undermine incentives to invest in new innovations and would lower economic welfare in the long run.

The no economic sense test potentially addresses some of the shortcomings of the profit sacrifice test when applied to innovation, although it depends on its interpretation. The test does not raise concerns about predatory conduct unless the conduct would make no economic sense but for the tendency to eliminate or lessen competition. The test is similar to a profit sacrifice test if the definition of

no economic sense turns on the ex ante profitability of the investment. If one instead concludes that innovation always makes some economic sense whatever its cost, then the no economic sense test provides a wide and deep safe harbor for innovation that is not a sham.

ANTITRUST POLICY SHOULD PROVIDE, IF NOT A SAFE HARBOR, AT LEAST A WIDE BERTH FOR INNOVATION BY A SINGLE FIRM BECAUSE INNOVATION NEARLY ALWAYS INCREASES ECONOMIC WELFARE AND THE ADVERSE EFFECTS OF INNOVATION THAT EXCLUDES RIVALS ARE TYPICALLY NO GREATER THAN THE EFFECTS OF A UNILATERAL REFUSAL TO DEAL.

Antitrust policy should provide, if not a safe harbor, at least a wide berth for innovation by a single firm because innovation nearly always increases economic welfare and the adverse effects of innovation that excludes rivals are typically no greater than the effects of a unilateral refusal to deal. Furthermore, antitrust courts are not well-equipped to analyze the

effects of innovation on the entire economy and to evaluate the negative consequence that their enforcement decisions can have on future innovative efforts. A wide berth for single firm innovation can be accomplished with a rule of reason analysis that includes a strong presumption that innovation is not anticompetitive or with a no economic sense test that presumes that innovation makes economic sense even if it is not profitable ex post, provided that the innovation is not a sham. While these analytical approaches differ, they wind up essentially in the same place: innovation by a single firm is not anticompetitive if it has a plausible business justification and is not accompanied by other anticompetitive conduct. Indeed, this is what most courts have concluded when faced with allegations of predatory innovation. ▼