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Merger Policy and Innovation: Must Enforcement Change to Account for Technological Change?

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Executive Summary

Merger policy is the most active area of U.S. antitrust policy. It is now widely believed that merger policy must move beyond its traditional focus on static efficiency to account for innovation and address dynamic efficiency. Innovation can fundamentally affect merger analysis in two ways. First, innovation can dramatically affect the relationship between the pre-merger marketplace and what is likely to happen if a proposed merger is consummated. Thus, innovation can fundamentally influence the appropriate analysis for addressing traditional, static efficiency concerns. Second, innovation can itself be an important dimension of market performance that is potentially affected by a merger. We explore how merger policy is meeting the challenges posed by innovation.

I. Introduction

Merger policy is the most active area of U.S. antitrust policy. From 1991 to 2002, for example, the Antitrust Division of the U.S. Department of Justice conducted an average of 161 merger investigations each year, which is more than all of the division's other civil and criminal investigations combined.[1] Merger investigations constitute a similarly important part of the Federal Trade Commission's Maintaining Competition Mission.[2]

Traditionally, merger policy focused on the question of whether a proposed transaction would lead to higher or lower prices, based on a static analysis that compared market power and efficiency effects. Dynamic considerations such as research and development (R&D), while not altogether absent, played relatively little role.[3] Today, innovation is widely recognized as an important driver of national economic welfare. Productivity growth driven by technological change has been credited with stimulating the major economic expansions of the

1960s, 1980s, and 1990s.[4] Although precise estimates of the particular percentages of economic output or growth that can be attributed to innovation are hard to make, policy makers and economists agree strongly that innovation is a critical component of a sustained, healthy economy.

The consensus about the value of innovation has spread to antitrust policy. It is now well recognized by antitrust enforcement officials that investment in research and the diffusion of innovations are among the most important dimensions of market performance. One official observed that "the more important that innovation becomes to society, the more important it is to preserve economic incentives to innovate,"[5] and another observed that, "as important as price competition is to us, a second major and possibly even greater concern is maintaining competition for innovation."[6] Merger policy has thus increasingly focused on innovation, although exactly what the new focus in merger policy means or how it translates into enforcement has proven difficult to ascertain.

In this paper, we examine the developing role of innovation in U.S. merger policy. Considerations of innovation are central to merger policy in at least two ways. First, because dynamic efficiency is critical to successful economic performance, the effects of a merger on innovation can generate considerable interest. In other words, *innovation can itself be an important dimension of market performance that is potentially affected by a merger*. Merging parties frequently assert that the transaction will allow them to engage in greater innovation, while antitrust enforcers may object to a transaction on the grounds that it will lead to a loss of competition that would otherwise spur innovation. To assess fully the impact of a merger on market performance, merger authorities and courts must examine how a proposed transaction changes market participants' incentives and abilities to undertake investments in innovation. We will refer to this first role for innovation in merger policy as the innovation incentives criterion.

A second way in which innovation is central to antitrust policy is that the presence of innovation can fundamentally alter the nature of the appropriate analysis even if one focuses on traditional performance measures, such as static pricing efficiency. In brief, merger analysis forms a prediction of a proposed transaction's effects on consumer welfare by examining present characteristics of the parties to the transaction and the market setting in which those parties operate. *Innovation can dramatically affect the relationship between the pre-merger marketplace*

and what is likely to happen if the proposed merger is consummated. For example, market shares are often used as a measure of market power. But in theory at least, significant innovation may lead to the rapid displacement of a supplier that, by traditional measures such as current market share, appears to be dominant. This situation raises the broad question of how merger analysis should form predictions about the likely competitive effects of a proposed transaction. We will refer to this second role for innovation in merger analysis as the innovation impact criterion.

Under the innovation incentives criterion, one asks how the change in market structure and competition brought about by a merger will likely affect consumer welfare through effects on the pace or nature of innovation that might reduce costs or bring new products to consumers. Under the innovation impact criterion, the situation is reversed. It refers not to how market structure will affect innovation but to how innovation will affect the evolution of market structure and competition. Innovation is a force that could make static measures of market structure unreliable or irrelevant, and the effects of innovation may be highly relevant to whether a merger should be challenged and to the kind of remedy antitrust authorities choose to adopt.

The two ways that innovation may factor into merger analysis have important policy implications. To the extent that innovation is itself a significant objective, antitrust agencies need to understand the relationship between market structure and innovation in a given case with sufficient depth to distinguish legitimate from merely opportunistic claims that the merger will benefit, or at least not harm, innovation incentives. Similarly, the fact that innovation may affect the post-merger marketplace in ways that are hard to predict challenges merger authorities to devise ways to distinguish mere claims by the merging parties that they face potential competition because of innovation from situations in which such potential entry really exists. Finally, the importance of innovation incentives raises the question of whether the enforcement guidelines and precedent aimed at promoting conventional competitive goals of low prices and high output are consistent with promoting the goal of efficient innovation.[7] To the extent that tension exists between innovation and static economic goals of merger policy, merger enforcement will have to develop a framework for deciding how to make trade-offs between those objectives. If merger authorities wish to take a more dynamic approach to maximizing consumer or social welfare, our analysis suggests that merger policy should

strengthen its basic framework by adding to its current set of tools and by developing a more sophisticated approach for incorporating uncertainty about future economic events into decision making.

In this paper, we explore both of the avenues through which innovation affects, and is affected by, merger policy. We begin in Section II by considering three illustrative scenarios of the impact of innovation on the central concerns of merger policy. As background, in Section III, we review the established framework for merger enforcement. In Sections IV and V, we examine how successfully that framework is likely to be in addressing the different challenges related to innovation. To illustrate how these challenges are met in practice, in Section VI we discuss and evaluate several merger cases in which the antitrust agencies have focused on innovation. We conclude in Section VII with some observations about the current relationship between merger policy and innovation and about the possible evolution of that relationship.

II. Defining Innovation in a Merger Context

Implicit in any discussion of how innovation might factor into merger analysis is a definition of innovation. The concept of innovation can span a spectrum of activities ranging from pure research aimed at making discoveries in basic science to developmental activities that apply known scientific results to the improvement of existing products or production processes. The closer the innovation at issue in a particular merger is to resulting in an identifiable, predictable product, the more likely the issue for merger review will be how the innovation will affect future structure and performance in the product market relevant to the transaction (i.e., the innovation impact criterion). The farther the innovation is from a tangible result, the more likely the question for merger authorities will be how the transaction will affect the likelihood and level of continued investment in R&D (i.e., the innovation incentives criterion). To illustrate further how the question for merger policy changes as the nature of the innovation changes, we next discuss three abstract cases showing the different problems that different forms of innovation present for merger review.

Case 1: Innovation that is well underway to create or improve defined products and processes. We begin by considering situations in which the innovation efforts of the merging parties and their rivals are largely complete.[8] In some cases, the firms may already be product-market competitors, with ongoing R&D efforts aimed at improving existing products and processes. In other

cases, the firms seeking to merge may not yet be competitors in any product market, but these firms may be developing products that will enable the firms to compete with one another in one or more product markets in the future. Where innovation efforts are well underway but have not yet resulted in a tangible product, the ongoing innovation may serve as evidence to support treating the merging firms as potential competitors: firms that have made substantial investment and progress toward entering a market are much more predictable entrants than are firms that merely *could* undertake such investment.

In the settings just described, the potential harms from a merger arise not from the elimination of competing R&D but rather from the elimination of future product-market competition between the merging parties. Hence, the focus of merger analysis is the conventional one of product-market competition rather than anything specially to do with innovation. However, the presence of not-yet-complete innovative efforts complicates the predictions of how the merger will affect product-market competition because the central task for merger analysis is to form predictions about what competition will look like in the future, with and without the merger. In the case of merging firms that do not yet compete in a product market, definitive evidence about cost and demand conditions on which to base predictions of the state of competition tends to be lacking. Even where firms are already product-market competitors, ongoing R&D efforts may change the future competitive positions of one or more suppliers. The potentially dramatic effects of innovation can greatly increase the difficulty of predicting a merger's effects on price competition.

*Case 2: **Innovation-based race to market dominance.*** We next consider situations in which the innovation efforts of the merging parties and their rivals are the focus of the merger analysis, and product-market competition is largely unaffected by the merger. Such situations arise when firms undertake competing R&D efforts and the winner of this R&D competition will achieve market dominance because of a patent, the realization of network effects, or some other winner-take-all phenomenon. If the process literally is winner-take-all, then the question of how the merger affects product-market competition, which lies at the heart of conventional merger analysis, simply does not arise. In these situations, the post-innovation product market is monopolized, whether or not the proposed merger is consummated. The public policy concern here is whether the merger will diminish R&D competition and thus either retard the introduction of a new product or result in a product that offers consumers smaller net benefits.

In some markets subject to strong technological progress, this process may play itself out repeatedly. That is, competition may take the form of a succession of so-called temporary monopolists who displace one another through innovation. At any one time, little or no head-to-head price competition exists, but significant innovation competition exists over time. This pattern of competition is often referred to as Schumpeterian rivalry, after Joseph Schumpeter, who asserted that it is a central feature of the modern economy. As we shall discuss below, some observers have questioned whether central elements of conventional merger analysis are at all helpful in understanding Schumpeterian competition.

Case 3: Commercially rational delay in competitive innovation. Our final case illustrates the fact that there can be a tension, and hence the need to make a trade-off, between static and dynamic policy objectives. When successful innovation cannot be protected from replication or imitation by competitors, perhaps because of weak intellectual property rights, a firm may not race for the lead but instead wait for another firm to do the hard work that the waiting firm can then copy. If all firms reason this way, then no firm will want to take the lead and subsidize its competitor's R&D, and the result will be a waiting game. Innovation will be delayed, possibly forever. In this case, antitrust agencies may face a choice between (1) allowing the waiting firms to merge and internalize the free-riding problem, which would then hasten innovation but end product-market competition, and (2) blocking the merger, which would preserve product-market competition for existing products but might significantly or permanently delay the development and introduction of new products. In other words, the choice is whether to promote long-run innovation or protect short-run product pricing competition.

As we discuss below, actual enforcement choices may not be as polarized as in this hypothetical. In particular, alternative institutions, such as research joint ventures—under which competing suppliers jointly invest in innovation and share the results among themselves—may allow firms to cooperate in the conduct of R&D while remaining product-market competitors. Hence, the evaluation of these alternative institutions may be an important component of merger analysis in certain situations where innovation is an important dimension of market performance.

Each of the three cases implies a distinct kind of merger inquiry and hence illustrates the different ways in which innovation can factor into merger policy. The first two cases represent the ends of a spectrum that begins with conventional considerations of actual or potential competition in product markets, where innovation serves as supporting evidence, and runs all the way to cases in which innovation is the sole or central concern of the merger analysis. The third case illustrates that situations can exist in the middle where there potentially are significant trade-offs between static and dynamic competition or there is a need to evaluate alternative institutions in terms of both types of efficiency considerations simultaneously.

III. A Brief Review of the U.S. Legal Process and Preview of the Issues Raised by Innovation

To understand the implications of innovation for the application of merger policy, we next present a brief survey of the current U.S. merger-review process and its substantive guidelines. Although our

focus is on the United States, it is worth observing that the European Commission and many other competition policy agencies in other regions and nations have modeled their merger-review processes in whole or in part on the U.S. approach.

Legal and Economic Underpinnings

The choice of welfare standard is a central feature of any public policy toward mergers. Economists generally favor some notion of economy-wide efficiency, while the statutes are often interpreted as imposing a consumer-welfare standard.[9] Although some antitrust commentators write as if the pursuit of economic efficiency and the maximization of consumer welfare are identical objectives, they are not.[10] The critical difference is that an economic efficiency objective considers the effects of actions on the welfare of both producers and consumers, while a consumer-welfare standard considers only the latter. As we will discuss below, the choice between these two standards can have profound effects on merger analysis, particularly when innovation is significant.

The fundamental premise of merger policy, and of antitrust policy in general, is that increased competition results in improved economic performance.[11] Specifically, antitrust policy is grounded on the belief that competitive markets do the best job of producing and delivering at the lowest feasible prices the goods and services consumers want. The vast majority of mergers that are challenged in the United States by federal antitrust agencies are challenged under Section 7 of the Clayton Act, which makes it illegal for one company to acquire some or all of the assets of a competitor where the effects "may be substantially to lessen competition, or to tend to create a monopoly."[12]

Both the Antitrust Division of the U.S. Department of Justice (Justice Department) and the Federal Trade Commission (FTC) are charged with enforcing the Clayton Act. The Justice Department can seek to block a merger by filing a complaint in federal district court. The FTC can bring a case before its own administrative law judges or in a federal district court.[13] The cases filed in district court only rarely proceed to trial. Typically an agency's filing of a complaint either causes the merger to be called off or to be resolved through a consent decree that incorporates remedies against potential post-merger harm to competition. Examples of each outcome, respectively, are the recently scuttled merger between Echostar and DirecTV, against which the Justice Department filed a complaint in 2003, and the merger between Pfizer and

Warner-Lambert, completed in 2000 subject to remedies after the FTC filed a complaint against that transaction.

The Justice Department and the FTC have issued a set of *Horizontal Merger Guidelines*, (*Merger Guidelines*) that purport to provide a blueprint for how the agencies will conduct their analysis of a merger.[14] Note that the *Merger Guidelines* do not have the force of law and, indeed, the *Merger Guidelines* explicitly (and accurately) state that the agencies may pursue different lines of argument in litigation.[15] Nonetheless, the *Merger Guidelines* are broadly adopted by the agencies and the courts.[16]

In practice, merger policy in the United States focuses on how the merging parties' combination will affect concentration in one or more relevant markets.[17] This determination is made because an increase in concentration in the relevant product and geographic markets is taken as a proxy for a decrease in competition that—if large enough—will lead to a significant increase in the prices faced by consumers.[18] In *United States v. Philadelphia National Bank*, for example, the Supreme Court defined the relevant product as a cluster of services that constitute commercial banking and defined the relevant geographic market as the four-county area in which the merging parties had offices.[19] The Court held that a merger between the region's first and second largest banks, which would have given the merged entity a 35 percent market share measured in terms of assets, created impermissible concentration and had to be enjoined.[20] As we shall discuss, ongoing debate discusses the degree to which changes in concentration levels are accurate predictors of the likely competitive effects of a merger, especially when innovation is an important feature of the industry under examination.

The Legal Analytical Process

The courts use a largely standardized process to evaluate mergers when the agencies bring legal challenges. We briefly outline the stages in that process.

Market Definition. Market-share calculations typically play a central role in merger litigation. To calculate shares, it is necessary to define the relevant market in which various suppliers have shares.[21] Thus, defining the boundaries of one or more markets with respect to their product and geographic scopes is a first step under the *Merger Guide-*

lines and is also typically an issue early in any antitrust case in the U.S. courts.[22]

A long-standing principle by which economists define the product scope of a market is to include two goods or services in the same relevant market if consumers view them as sufficiently close substitutes and not to include them in the same relevant market if consumers do not view them as sufficiently close substitutes.[23] A similar logic is used for geographic scope. When are substitutes sufficiently close to be included in the same market? To some extent, chocolates compete with automobiles for consumers' dollars, but one should not conclude that chocolates and automobiles are in the same product market. To give more precision to the concept of sufficiently close substitutes, economists undertaking market delineation exercises often conduct a so-called hypothetical monopolist test. This test asks whether a hypothetical, profit-maximizing monopolist over a group of products in a given area could profitably raise prices above a specified level by a small but significant amount for a sustained period of time.[24] The group of products considered in the test is a candidate relevant market. The smallest group of products that satisfies the test constitutes a relevant market.[25]

A price increase will raise a hypothetical monopolist's profits unless unit sales volume falls sufficiently to offset the higher price received for the units sold.[26] Thus, the hypothetical monopolist test indicates that a set of products or a geographical area constitutes a relevant market f the hypothetical monopolist could make a small but significant and non-transitory increase in price without causing so many consumers to switch to substitute goods that the price increase becomes unprofitable.

The hypothetical monopolist test is used both by enforcement agencies and by the courts that review agency actions. The U.S. Court of Appeals for the Eighth Circuit, for example, reversed the FTC's injunction of a merger between two hospitals in a single town on the grounds that the FTC had failed to show that its narrow definition of the relevant market could satisfy the hypothetical monopolist test.[27]

Although the courts and enforcement agencies emphasize defining relevant markets, it is widely believed among economists that a proper economic analysis does not require formal market definition and that an overreliance on the mechanics of market definition can be an obstacle to sound analysis. Professor Jonathan Baker, a former

Director of the U.S. Federal Trade Commission's Bureau of Economics, observed:

> Indeed, if a merger can be shown to harm competition directly, antitrust should not need to spend much effort on market definition.... [I]f the likely harm to competition from a merger can be demonstrated directly, there exists a market where harm will occur, but there is little need to specify the market's precise boundaries.[28]

Similarly, Professor Janusz Ordover, a former Deputy Assistant Attorney General for Economic Analysis at the Department of Justice, wrote:

> From the perspective of economic theory, antitrust law's preoccupation with market definition has always seemed somewhat peculiar. Arguments for and against a merger that turn upon distinctions between broad and narrow market definitions are, to an economic purist, an inadequate substitute for, and a diversion from, sound direct assessment of a merger's effect.[29]

Nonetheless, market definition continues to play an important role in practice. Indeed, it is often said that the outcome of merger litigation turns almost entirely on whether the market is defined narrowly or broadly.[30]

The "Analysis" of Market Shares. Once a relevant market has been defined, one can calculate shares. Legally, a rebuttable presumption maintains that a high resulting level of concentration indicates a competitive problem.[31] In addition, the Department of Justice and the FTC often take increases in concentration as a reason to be concerned about a merger when deciding whether to pursue an enforcement action.[32] No general theorem of economics proves that higher concentration leads to higher prices or lower output. However, absent innovation, one can expect this relationship for several reasons. First, many (but not all) formal economic models of markets likely to attract merger scrutiny (i.e., those markets in which only a few firms compete) indicate that equilibrium output falls and equilibrium prices rise as the number of firms declines. This situation is especially true in markets where firms cannot quickly and easily adjust output levels as they vie to take the market share of the exiting firm. Empirically, substantial evidence supports the theoretical correlation of prices and market concentration.[33] U.S. consumers have readily experienced this phenomenon in markets such as long-distance and wireless telephone services, air travel, and pharmaceuticals. To be sure, in other models and under

specified conditions, increased concentration may not lead to higher prices and entry may not lead to lower prices. Hence, the use of market shares is only the starting point for the analysis of market power.

The Analysis of Other Market Conditions. If the plaintiffs establish that a merger will lead to high levels of concentration, then the defendants attempt to rebut the presumption of a competitive problem by pointing to other factors, such as the possibility of entry by new competitors or certain market characteristics that can make it difficult to raise prices (e.g., the presence of large, sophisticated buyers who can exert bargaining pressure). As the *Merger Guidelines* recognize, "market share and concentration data provide only the starting point for analyzing the competitive impact of a merger."[34] A complete analysis considers both the abilities and incentives of competitors to expand their output levels and/or change the attributes of their products in response to price changes by the merging parties that would harm consumers.

Efficiencies. If the analysis of market shares and other market characteristics demonstrates that a proposed merger will not give rise to a significant competitive problem, one can conclude that the merger will not harm competition and consumers. But if a significant competitive problem is predicted by the preceding stages of analysis, then one must conduct another stage of review to predict correctly whether a proposed merger will benefit or harm consumers. Simply put, a merger that is expected to give the merging parties the ability to raise prices profitably might nonetheless lead to lower prices or at least to greater social welfare if the merger gives rise to sufficient cost savings of the right sort. These cost savings are referred to as efficiencies.[35]

Not all cost savings count as efficiencies. First, the savings must be merger-specific.[36] If a simple, arms-length transaction would allow the parties to reap the cost savings in some way that would not raise competitive concerns, then those cost savings do not justify the merger. As should be readily apparent, it can often be extremely difficult to assess whether a practical alternative exists for realizing the cost savings. More generally, it is typically difficult to predict with any certainty the magnitude of cost savings likely to result from a proposed merger because doing so entails making predictions about the results of combining complex operations and corporate cultures.

Remedies. Several public policy responses are available if analysis indicates that the effect of a merger in its proposed form may be substantially to lessen competition or to tend to create a monopoly. One, of course, is simply to block the transaction. Often, however, less drastic steps are available that can allow a modified version of the transaction to take place. In theory, such remedies allow the realization of efficiencies while averting the harms that might otherwise arise from the loss of competition between the two merging suppliers. Potential remedies include the divestiture of assets where competitive overlaps are particularly significant, the mandatory licensing of intellectual property to other firms to allow them to compete more effectively with the merging parties, and limitations on the merged firm's conduct (e.g., a requirement to offer the same prices to all customers to prevent the merged firm from targeting customers whose only practical options were the two merging suppliers).

The Interaction of Merger Policy and Intellectual Property Policy

Merger policy is part of a broader legal framework governing business behavior. Intellectual property law is another part of that framework of particular relevance to the interaction of merger policy and innovation. Various methods are available for obtaining intellectual property rights, including in-house invention, licensing, and merger. Patents, copyright, and trademarks are all assets subject to Clayton, Section 7. Even though intellectual property rights are sometimes said to give the holder the right to a monopoly, a merger doesn't get a free pass because it involves intellectual property.

In the past, a widely held view was that a fundamental tension existed between intellectual property rights and antitrust policy, such as merger enforcement.[37] In this view, intellectual property rights regimes create monopolies to spur innovation, while merger policy seeks to prevent monopolies from forming. The modern view holds that both intellectual property policy and merger policy seek to promote consumer welfare by creating an economic environment in which innovative activities are stimulated by both competition and the promise of returns to successful innovation.[38] In this regard, both sets of policies have something else in common: the relationships among public policy, market structure, and innovation are complex, and it is sometimes difficult to know what policy best promotes innovation and consumer welfare.

The intellectual property rights regime can interact with merger enforcement in interesting ways. The presence of strong intellectual property rights regimes, such as patent and copyright, may facilitate licensing by increasing the extent to which licensing contracts are enforceable. In contrast, licensing can be difficult in situations where intellectual property is protected through secrecy. For instance, a seller cannot afford to reveal its technology to a potential licensee because the licensee may then simply appropriate the information. And it is also difficult to limit a licensee's dissemination of the information. The feasibility of licensing due to a strong intellectual property rights regime has at least two consequences for merger policy. First, when the primary efficiencies claimed for a merger involve intellectual property assets, the question arises whether licensing could serve as a less-restrictive alternative to a full merger. Second, when licensing is feasible, it can be used in fashioning a remedy to a proposed merger that raises significant concerns of competitive harms.

The fact that licensing can form the basis for merger remedies suggests that intellectual property (IP) policy and merger policy can be complementary. A firm may merge and still reap the benefits of its innovation through licensing royalties, while that same licensing can preserve competition in innovation that the transaction would otherwise harm. As our later discussion of specific mergers will show, licensing remedies have become an important tool in the review and clearance of mergers in which innovation is a central feature. Only if one takes the extreme position that IP-related competitive harm can never form the basis for blocking a merger, ostensibly on grounds that such a basis would constitute a limitation of the IP right, do merger policy and IP policy necessarily come into conflict.

IV. The Impact of Innovation on Competition

The merger-review process described in Section III has well-known problems that arise whether or not innovation is significant. In the present section and the one following, we identify particular challenges created by the presence of significant innovation. In the present section, we address how the presence of significant actual or potential innovation affects application of the legal analytical framework to the consideration of product-market competition and traditional, static pricing concerns. In the next section, we will consider the issues that

arise for the legal analysis when one attempts to evaluate a merger in terms of its effects on innovation.

Market Definition

Significant innovation raises two issues with respect to market definition for an analysis of static pricing efficiency. First, the hypothetical monopolist test typically is applied to price changes ranging from 5 to 10 percent. Some have questioned the value of such a test in markets where quality-adjusted prices may fall 20 percent or more per year. We believe that this objection is readily dealt with in theory, although it is somewhat more difficult in practice. Second, and more important, rapid innovation can make it difficult to define relevant product markets because business executives and government officials alike may not yet know what the future products will be.

In American and European Union competition policy, a small but significant price increase in the context of the hypothetical monopolist test is often taken to mean a price change in the range of 5 to 10 percent.[39] Several different criticisms have been made regarding application of this approach to markets with rapid technological progress, where prices might fall by 20 percent or more annually.[40]

One critique is that a 5 or 10 percent price increase is "too small" when quality-adjusted prices are routinely changing by much greater amounts.[41] However, neither those offering this critique nor the *Merger Guidelines* themselves discuss the rationale for considering a price increase of any particular size. It is apparent that the intent of the *Guidelines'* approach is to consider a price change that would have a significant effect on consumer welfare. It is less apparent that a 10 percent increase becomes insignificant simply because the baseline is rapidly falling. One should also keep in mind that the hypothetical monopolist test is only one part of the competitive analysis.

Another criticism is that the hypothetical monopolist approach to defining market boundaries conducts a test based on the assumption that other suppliers hold their prices constant when such prices may in fact be falling. This criticism is somewhat misplaced: under the hypothetical monopolist test, the prices of potential substitute products are assumed not to change in response to a change in the monopolist's price, but this assumption does not preclude the possibility of technological progress as a driver of price changes over time. The criticism does, however, raise an important question: what baseline prices for

the hypothetical monopolist and other suppliers should be used in defining the product scope of a market with rapid technological progress? Specifically, should one use current or future prices?

Because the concern of merger analysis is with post-merger market performance, there is an argument that it is more appropriate to use projections of future prices. Of course, forming reliable projections can sometimes be difficult, and this difficulty can be compounded by the fact that innovation can itself be affected by the merger. And when technological progress is ongoing, the scope of the product market may continue to change, so that multiple projections are necessary. However, relying on current prices can lead to market definitions that are either too narrow (when technological progress in substitute products is rapid) or too broad (when the hypothetical monopolist's product is subject to greater technological progress than are substitute products).[42]

A second difficulty that arises in defining relevant markets when innovation is important is more fundamental. The issue is that the agencies and the courts may not know which products will be viable substitutes in the near future. Under the traditional approach to market definition, the central aim, whether one uses the hypothetical monopolist test or some other algorithm, is to identify existing products that are at present meaningful substitutes for one another from a consumer's perspective. When innovation is significant, the analysis may need to be much more forward-looking. Innovation may result in the creation of new products that compete in the relevant market, or innovation may lower the costs of producing existing products that are, at present, too expensive to be considered viable substitutes for the products of the merging parties.

The brevity of our discussion should not be taken as a sign that this problem is minor or readily dealt with. Conceptually, the issues are straightforward and are compatible with the *Merger Guidelines'* market definition framework, as long as that framework is applied on a forward-looking basis.[43] However, the practical difficulties of projecting future substitution possibilities in a fast-changing and highly uncertain environment should not be minimized.

The Use of Market Share in Dynamic Markets

Once a market has been delineated, the suppliers participating in that market can be identified and one can develop a measure or measures

of market shares. The difficulties in identifying future substitutes discussed in the previous subsection have important analogues in identifying market participants and calculating market shares.

Relatively little attention tends to be paid to the identification of competitors in most merger analyses perhaps because this part of the analysis is relatively easy or at least is perceived to be a simple counting exercise once market boundaries have been set. The conventional focus is on actual rather than potential competitors, the latter of which are included in the market only when certain conditions of imminence and probability are met. But when innovation is important, identifying potential innovation and product-market competitors may be particularly critical to understanding competition. Identifying potential competitors is often difficult, and competitive potentiality in the innovation context often hinges on the possession of certain skills and information assets that can be particularly hard to identify and measure. In the other direction, the existence of ongoing innovation efforts can render claims of potential product-market competition more readily verifiable.

Innovation also raises a fundamental question with respect to the calculation and interpretation of market shares as predictors of the static price and output effects of a merger.[44] That question is whether current product-market shares are meaningful predictors of future competitive conditions and thus relevant to the prediction of the price and output effects of a merger. If a market is in constant turmoil because of dramatic innovation, the argument goes, then what does one learn from current product sales?

Even without innovation, there are reasons to be cautious about the interpretation of market-share data. To generate sensible predictions of the effects of a merger, the measurement and analysis of market shares should always be tied to a coherent theory of competitive effects that fits the facts of the industry under consideration.[45] Put another way, the analysis of market shares can most confidently be used to predict adverse competitive effects of a merger when one has an empirically supported theory that market shares are informative of competitive conditions and that an increase in concentration will harm competition and consumers.

In general, high market share is not in itself sufficient to show market power. One reason is that many market-share measures are backward-looking (e.g., shares of installed base) or at best contemporaneous (e.g., shares of sales to customers who are new to the industry).

As such, market shares reflect where firms were or are but not necessarily where they are going. This shortcoming is particularly critical in industries characterized by significant innovation and dramatic technological change. Innovation may render market shares unstable and hard to predict. Even if the merged firms would have a dominant market share immediately post-merger, another firm in the market could produce the next great new advance and leave the merged entity behind.[46] Indeed, market shares may be altogether irrelevant in some cases because there may be markets in which innovation is so characteristic and sustained that firms compete not just for market share but for markets as a whole. A firm's monopoly today may say little about the firm's prospects one, two, or five years from now.

The *Merger Guidelines* recognize that, in changing markets, current market share may be an inaccurate measure of a firm's forward-looking competitive significance.[47] A strong consensus exists among economists that rival suppliers' capacity to enter and expand in a market must be considered in addition to market share data. It is especially imperative that merger enforcement agencies look beyond market share data in markets characterized by innovation.

Remedies

Innovation gives rise to intellectual property, which sometimes figures prominently in merger remedies. Merging firms sometimes agree to divest or license intellectual property to keep product-market competition from being lost. For example, in 2001, the U.S. Department of Justice filed a complaint challenging the proposed acquisition of DTM Corporation (DTM) by 3D Systems Corporation (3D).[48] The firms competed in the sale of rapid prototyping (RP) systems, which transform a digitally encoded design into a three-dimensional object. The process can be used to produce models and even low-volume production quantities by what might be loosely thought of as three-dimensional laser printing.

Both 3D and DTM held extensive patent portfolios related to RP systems production that prevented firms that sold RP systems abroad from competing in the United States. As discussed in Section VI, the Department of Justice was concerned that the merger would significantly reduce competition. The Department of Justice and the parties reached a settlement that required 3D and DTM to grant a nonexclusive license to manufacture and sell products under the defendants'

RP patent portfolios within specific fields of use.[49] The idea was to allow a foreign supplier to enter the U.S. market as a replacement for the loss of an independent competitor through merger. The licensee was required to be a firm currently manufacturing industrial RP systems in a foreign market, so that it would have a demonstrated ability to compete.[50]

As a general matter, there are two antitrust rationales for compulsory licensing: (1) to remedy a refusal to license that itself is held to be exclusionary and to constitute an antitrust violation, and (2) to ameliorate the effects of another action that is illegal or—absent licensing—would be prohibited under the antitrust laws. Licensing as a remedy in a merger case falls into this second category.

It is useful to distinguish between a duty to deal and licensing as a remedy because they may have completely different effects on incentives to innovate. A general duty to deal under antitrust law compromises the scope of intellectual property rights and may create disincentives to engage in certain innovative efforts. In contrast, compulsory licensing as a remedy that allows a merger to go through may not weaken innovation incentives and theoretically could even increase them. For example, suppose that the licensing allows a merger to be completed that would otherwise be blocked. To the extent that licensing is a means of restoring competition that is less costly to the defendant than are alternatives (e.g., dissolving the merger), the defendant benefits from having created intellectual property that can be incorporated into a remedy. While it is far from evident that these positive effects on R&D are significant, the argument does suggest that any negative incentive effects may be insignificant.

Post-Merger Considerations

Innovation considerations may also affect antitrust policy toward a merged entity after an acquisition is consummated. If a merger turns out to have anticompetitive effects, it is at least theoretically possible to "unscramble the eggs" and order the newly formed enterprise to break itself into its previous components or to divide along some other basis that would restore competition. Such divestiture is easier when the harm to competition stems from consolidation of physical assets that can be sold off cleanly. Post-merger divestiture is potentially a much messier prospect when the harm stems from consolidation of R&D assets in the form of human capital. Although a firm can be

ordered to sell off a research unit, employees cannot be required to remain with that unit, and the end result might be to weaken the merged entity without restoring competition.

Difficult challenges may arise in determining when and how the antimonopoly provisions of Section 2 of the Sherman Act should apply to innovative firms.[51] Suppose a merged entity turns out to become dominant. Separating the degree to which the dominance flows from beneficial innovation or from anticompetitive actions can be difficult. Much of the public debate surrounding the Department of Justice's pursuit of Microsoft, for example, involved precisely that question. Even defining a violation can be particularly difficult. Is integration of increasingly advanced functions into a product efficient innovation or anticompetitive tying or bundling? And once a violation is proven, it can be especially difficult to design a remedy in a fast-moving environment of technological change. Antitrust authorities face the challenge of crafting remedies that constrain anticompetitive behavior without reducing innovation or network benefits that may have accrued to consumers.

A detailed analysis of how innovation affects application of antitrust laws generally is beyond the scope of this paper. But the purpose of our brief discussion here is to show that, in considering the role antitrust might play in the post-merger environment, innovation cannot be ignored as a force after the merger there as well as in the merger context. The complexity that innovation may introduce into the possibilities for later antitrust scrutiny of the merged firm in turn lends particular importance to getting the merger review right in the first place.

V. The Impact of Competition on Innovation

Next we consider the issues that arise for the legal analytical process of merger review when one attempts to evaluate a merger in terms of its effects on innovation. As we shall discuss, incorporating innovation effects into the analysis poses fundamental challenges, although we believe that these challenges ultimately can be met.

Market Definition

The purpose of defining relevant markets is to identify the boundaries of competition. When competition takes the form of innovation, a fundamental issue is whether a focus on product markets is appropriate.

An argument in favor of taking a product-market focus is that the ultimate aim of innovation is to create products and processes that allow the innovator (or its licensees) to compete successfully in one or more product markets. An argument against this approach is that the notion of a well-defined product market is too limiting because the successful products of the future cannot be predicted with any degree of certainty. A potential response is to consider markets defined in terms of innovation capabilities rather than specific products. But even here, one must ultimately tie the analysis to some notion of (potentially) competing products to know which innovation capabilities are important. One way of reconciling these two views is to observe that product markets matter but that *future* boundaries and the possibility of *potential* competition play much greater roles than in static analyses.

Consider two firms wishing to merge that have strong R&D capabilities in similar areas but are not significant product-market competitors with one another either because they do not compete in any product market in common or because the markets in which they do compete with one another are unconcentrated. From the standpoint of static price competition, presumptively no public policy rationale exists for blocking the merger. But if the firms are the only two or are among the few firms that have the capability to undertake substantial innovation efforts, then the antitrust agencies might nonetheless be concerned with the consumer-welfare effects of the proposed merger.

Antitrust enforcers might be concerned either that (1) the two firms would have otherwise engaged in competing R&D efforts that would have led to their becoming direct product-market competitors, or (2) the merged firm will reduce R&D to the detriment of consumers. The first of these concerns is about potential competition in the particular product market(s) at issue in the merger. The second concern, however, is about innovation. This concern arises even when—in the non-merger counterfactual—the innovation under consideration might not lead to product-market competition. These two concerns raise legal and economic issues for market definition and the subsequent competitive-effects analysis.

A first issue arises from the fact that potential competition cases are difficult to bring successfully in the United States. Courts tend to be skeptical of claims that a merger will harm consumers by reducing future competition between two merging firms that are not at present competing with one another.[52] A second issue is that it may be extremely difficult to define a product market if one does not yet know

what the product will be. In response to these difficulties, Richard Gilbert and Steven Sunshine, then working at the Department of Justice, introduced the concept of innovation markets.[53] Instead of potential competition in product markets, the concept shifts attention to actual competition in innovation markets. As discussed above, one can question whether a separate concept is needed on the grounds that all competitive concerns ultimately tie to some market in which goods and services are offered to consumers. And in practice, although innovation markets were used in *United States v. General Motors Corp.*, since then they have been little mentioned.[54]

Whether or not a separate concept is useful, the underlying idea that the set of competitors is sometimes best identified by examining which firms have the skills and assets needed to compete effectively is a sound one. Thus, one of the challenges that arises in applying the current merger-review framework to innovation is to adapt a concept of market definition based on consumers' substitution among existing products to one based on firms' capabilities to engage in innovation to create new substitute products. Under a forward-looking approach, instead of identifying what products compete with each other today and which firms produce those products, antitrust authorities would have to determine which assets and skills are needed to innovate and how many firms possess those skills and assets. These inquiries are fundamentally different: one is based on the behavior of consumers and the other is based on the capabilities of firms.

Market Share and the Concentration-Competition Presumption

Even if the market in which innovation takes place can be well defined, the question arises of how changes in market structure will affect the performance of that market. The use of market-share data to predict a merger's likely effects on innovation competition raises two fundamental issues. The first is whether one should consider concentration of product sales or concentration of R&D capabilities. R&D is conducted with an eye toward the future. Thus, one can raise serious doubts about the value of current product-market sales as indexes of the state of innovation competition.[55] The threat of entry or potential competition may be a stronger spur to innovation efforts than to lowering current prices and increasing current output.[56] Indeed, even R&D programs that never succeed in developing new products or processes may nonetheless benefit consumers by stimulating potential rivals to

innovate. Although these issues are important, they are similar to those just discussed in the context of market definition.

Our focus in the remainder of this section is thus on the second issue: is concentration—whether measured by product-market sales or the number of viable R&D competitors—a reliable basis for predicting the strength of innovation competition? Even if market shares were likely to remain stable post-merger and the transaction truly would concentrate the market in a sustained way, that concentration may affect innovation incentives differently from how it affects static economic variables like price and output.

A central tenet of merger policy is that markets characterized by atomistic competition generally promote consumer welfare better than do concentrated markets.[57] The presumption that increased benefits come from an increased number of competitors is weaker, however, when the policy goal is not just lower prices for a given set of goods produced under a fixed set of technologies but also efficient innovative activity by firms over time. Economic theory has long raised questions about the degree to which increased product-market competition or an increase in the number of firms undertaking R&D leads to an increase in overall R&D investment.[58] Both the theoretical and empirical bases for predicting that an increase in concentration will lead to less innovation are mixed.

Consider, first, the theoretical basis. Economic theory identifies situations in which high market shares are conducive to R&D investment. For instance, the possibility of sudden and sweeping entry, combined with large up-front investment demands, can necessitate high initial returns to allow costs to be recouped before the next innovator supplants the incumbent investor. A firm with a large market share and significant market power may better amortize the fixed costs of R&D and appropriate a high percentage of the R&D benefits. Conversely, it has been said that "[the] best of all monopoly profits is a quiet life."[59] Considerable anecdotal evidence suggests that competition drives organizations to be more innovative than do protected monopoly positions.

The idea that the economic conditions that maximize innovation over time may not be the same conditions that allocate resources efficiently in the short run was suggested over fifty years ago by Joseph Schumpeter, who wrote that, for purposes of promoting economic welfare, "perfect competition is not only impossible but inferior, and has no title to being set up as the model of ideal efficiency."[60]

Schumpeter's argument that most technological innovation would come from large corporations with market power and organized R&D operations implied that the ideal of competition under antitrust law could have substantial social costs over time.[61]

Theoretical research has shown that, depending on various conditions, either monopoly power or competition may lead to greater total innovation.[62] Although Schumpeter wrote mostly about large firms, their associated economies of scale for R&D, and their ability to attract capital and talented scientists, his critique of perfect competition and discussion of the benefits of market power suggest that his ideal innovators were not only large but dominant as well. Early theoretical explorations of Schumpeter's claim found that when the polar cases of monopoly and perfect competition were compared, the latter provided stronger incentives for cost-reducing innovations.[63] Subsequent models found oligopoly—competition among a few firms—to be the market structure most conducive to development of new products and processes.[64]

Although many advances and refinements have been applied to the model described above,[65] much of the research on market structure and innovation has a straightforward intuition behind it. On the one hand, a firm facing strong product-market rivalry has an incentive to develop new products and processes that will help it improve or defend its market position. Similarly, a firm engaged in a race with several others to develop a new patentable technology will be under pressure to act quickly to win the race. On the other hand, suppliers with many product-market rivals may have less ability to appropriate the gains from innovation that make the investment worthwhile either because their innovations are readily copied or invented around by rivals or because atomistic competitors lack the other assets needed to exploit their innovations fully (e.g., a firm with a small share of the product market may not amortize its cost-reducing innovation over many units of output). Similarly, if many firms are racing to obtain a patent, each firm may conclude that its chances of winning the race are sufficiently small that it is not profitable to invest as much in R&D as it would without so many competitors.

Strong intellectual property rights can reduce some of the risks from innovation, specifically those associated with rapid imitation. And licensing may make it possible and profitable to diffuse an innovation throughout an industry with many firms. Even if intellectual property rights give the innovator a temporary monopoly, however, rivals may

develop similar or better advances and may circumvent the originator's patent. This risk exists for competitive firms and monopolists alike. But the risk that another firm will successfully innovate may grow with the number of firms competing in the relevant product market and, at some point, the expected return to innovation may not justify the cost.

A firm with significant product-market power or few R&D rivals, by contrast, probably has a better chance of recouping R&D investment. Large established firms might be particularly adept at marshaling resources for incremental innovation or for helping to bring a small firm's invention to market. And even a profit-maximizing monopolist—especially an unregulated one—has an incentive to engage in cost-reducing innovations. But, because a monopolist already has the market share for which competitive firms strive, it may have less incentive to pursue product innovations and improvements than firms facing competition. Further, a monopolist will have an incentive to innovate strategically to protect its monopoly by excluding rivals and by avoiding cannibalization of its existing business, perhaps delaying implementation of those innovations it does develop. Therefore, it might be a qualitatively inferior innovator from the perspective of consumers and overall economic welfare.[66]

Although economic intuition suggests an overarching presumption that innovation will be most intense in firms with a mix of competitive incentives and supracompetitive returns, it is also clear that, depending on assumptions, the theoretical balance could swing toward either greater competition or monopoly in a given case. Empirical data do not resolve the ambiguous theoretical relationship between competition and innovation. Many analyses supported the Schumpeterian view by finding a positive correlation between market concentration and R&D investment.[67] Other analyses, however, found data showing concentration to have a negative effect on innovation.[68] An early and influential study by F. M. Scherer indicated that both could be correct over a sufficiently large range of market structures because the relationship between innovation and concentration is nonlinear. His study, which corroborated the theoretical intuition discussed above, found the relationship between market structure and innovation to follow an inverted U pattern: innovation is observed to be low at high levels of competition, reach its peak at intermediate levels of oligopoly (where the four leading firms control roughly half the market), and then fall

off as market structure approaches monopoly.[69] Several studies replicated and confirmed Scherer's results.[70]

Later work raised serious doubts, however, about these findings. Indeed, in their review of the empirical literature, Cohen and Levin concluded that "[t]ogether, these results leave little support for the view that industrial concentration is an independent, significant, and important determinant of innovative behavior and performance."[71] One should be cautious in the interpretation of the empirical literature for several reasons. First, questions surround the statistical significance of the parameter estimates leading to a U-shaped relationship and whether they are, in fact, picking up the effects of omitted variables such as technological opportunity.[72] Second, extreme care must be taken in interpreting cross-sectional studies because the causality between market structure and innovation rates can run in both directions.[73] One detailed analysis of British data found that the higher profit expectations in concentrated markets increased innovative activity but that, over time, innovation reduced concentration levels in the sample industries.[74] Many empirical studies fail to account for the fact that market structure itself might be affected by the perceived possibilities for innovation and that market structure might therefore be a result, rather than a cause, of innovation incentives. The literature addressing how market structure affects innovation (and vice versa) in the end reveals an ambiguous relationship in which factors unrelated to competition play an important role.

The systematic presumption that favors increased competition for purposes of static pricing and output efficiency thus has no analog when it comes to creating the optimal conditions for innovation. By the same token, it should be observed that Schumpeterian claims that merger policy should favor increased concentration as a means of promoting innovation equally lack firm empirical grounding. Where does this observation leave merger authorities? Meaningful general presumptions have not been identified: innovation is affected by a variety of market factors other than concentration (as well as variables related to a firm's regulatory status, products, and technologies). While more rivalry rather than less will often remain the applicable rule of thumb, enforcement authorities cannot as confidently presume, as a matter of economic theory, that more competition is beneficial or that market power is detrimental for R&D. Although it is impossible to make definitive general statements about the linkage between market structure

and innovation, one can often make reasonable, unambiguous predictions about the effects of specific transactions or alternative institutional arrangements within a particular industry structure based on a fact-intensive investigation.

Other Market Characteristics and Competitive Effects Analysis

Even more so than with price competition, it is necessary to look beyond market share data to understand innovation competition. Here we make two brief points. First, for the reasons discussed above, it is important to understand the distribution of R&D assets among various actual and potential rivals. Second, there is a sound basis for predicting that suppliers will find it more difficult to coordinate their strategies to reduce R&D investments than to raise prices in the static sense. Although the underlying principles are generally the same, R&D activities have certain characteristics that give rise to differences in practice. For example, R&D efforts may be more complex and more difficult than prices for rivals to observe, and this greater complexity and difficulty observing actions both tend to make coordinated strategies more difficult.[75] Similarly, the stochastic nature of R&D output can greatly increase the difficulty of reaching and monitoring an agreement to restrict R&D efforts.

Innovation: Too Much of a Good Thing?

Once a merger's likely effect on innovation has been predicted, an issue arises that does not come up in the analysis of conventional, static concerns. Although it is extremely counterintuitive to many people, a large body of economics literature has established that profit-maximizing firms may invest more in R&D than is socially efficient.[76] An important implication is that the social welfare effects of an innovation-reducing merger may be positive. This situation can arise, for example, in patent races because of business stealing effects. In a race to obtain a pharmaceutical patent, preempting its rivals by a day may allow a pharmaceutical firm to obtain intellectual property rights whose value far exceeds the social benefits of having the patented drug available one day sooner.[77] In some cases, an innovation may allow a supplier to increase its share of the economic pie without increasing the total pie (e.g., a product or database innovation may fa-

cilitate price discrimination having these effects). Such an innovation might have private value for the innovator but no overall social value.

In most cases, firms will have little incentive to over-invest in R&D broadly. The theoretical possibility of excessive private incentives notwithstanding, as an empirical matter private incentives to invest in R&D typically are too low.[78] This situation arises because private firms are generally unable to appropriate fully the benefits that their R&D generates for the economy.[79] Additionally, consumers almost always benefit from additional R&D. Even in patent race models in which firms engage in more than the socially efficient levels of R&D expenditures, consumers would be better off if firms invested still more and thus brought the fruits of innovation to the market even faster.[80] Finally, firms can have socially excessive incentives under a specific set of conditions, and one can examine any particular market to determine if those conditions are present. Whether enforcement authorities would want to act when such conditions for overinvestment in innovation hold, however, raises the possible tension between consumer welfare and social welfare when merger policy focuses on innovation rather than static competition. We discuss this possible trade-off from allowing mergers that reduce inefficient innovation in the next section.

Efficiencies

Merging parties sometimes identify increased innovation capabilities as a significant efficiency that will result from their transaction. Thus, it may be necessary to predict whether a merger will improve the combined firm's innovation capabilities in ways that will generate consumer benefits. This undertaking can be difficult for several reasons. Indeed, the agencies themselves have expressed skepticism about this type of merger efficiency and have asserted that "[o]ther efficiencies, such as those relating to research and development, are potentially substantial but are generally less susceptible to verification and may be the result of anticompetitive output reductions."[81]

Potential Sources of Efficiencies. A first issue is how a merger will lower the costs of R&D or in other ways increase the merging firms' abilities to innovate successfully. There are at least three types of effects that the merging parties might assert would occur: (1) increased capabilities realized by combining complementary assets, (2) larger firm

size, which somehow gives rise to a greater ability to absorb the risks of or fund R&D, or (3) less competition and greater product-market profits, which can then fund R&D.

With respect to combining complementary assets, a fundamental issue is whether an alternative means (e.g., licensing of complementary intellectual property) can achieve the same efficiencies without removing a competitor. Mergers have specific institutional features that may give rise to certain advantages in facilitating the exchange of complementary assets, but the issue needs careful attention on a case-by-case basis.[82]

Considerable debate surrounds the relevance of firm size for innovation.[83] Following Schumpeter, some observers have praised large enterprises for their superior ability to attract financial and human capital, bear the risk, and recoup the investment required for sustained R&D activities.[84] Other analysts tout small firms as being more creative than larger, more bureaucratic enterprises.[85] Many empirical studies have addressed the relationship between firm size and innovation. Most recent research yields a consensus that, in general, R&D rises only proportionally, and only up to a point, with firm size.[86] The strength of the causal relationship between firm size and R&D remains somewhat questionable despite the observed correlations. Because many variables correlate with firm size, it is unclear in many studies whether firm size itself is a statistically significant factor in innovation. Although early studies did purport to find significance,[87] others have found that when other firm and industry characteristics are factored in, firm size does not significantly affect R&D investment.[88] When the focus of analysis shifts from innovation inputs such as R&D expenditures to outputs such as patents, large firms show no advantage at all over small ones.[89] Data matching R&D investment with patent output has in fact shown that smaller firms produce more innovations per R&D dollar and per employee than do large firms.[90]

The evidence overall thus suggests that, to the extent firm size has an effect on innovation, its magnitude and direction depend on associated industry-level variables and are susceptible to few general presumptions. The results suggest that especially large firms like those created by some recent mergers will have no special tendency—nor any predictable reluctance—to engage in innovation, and that small, fringe firms may play important roles over time in technologically advancing markets.[91]

Lastly, consider the argument that greater product-market profits make it possible for firms to conduct additional R&D. The profits-innovation linkage has two interpretations. One is that the potential for product-market profits generates innovation incentives. This interpretation involves an issue about competitive effects and was addressed earlier in this section. The other interpretation is that current profits can generate free cash to finance R&D efforts. This interpretation is more of a statement about the production of innovation, and we will treat it as a kind of efficiency. A first observation is that a remarkable and dangerous lack of a limiting principle exists in this argument. By this argument, for example, why not grant a monopoly in an unrelated market to generate the cash flow needed to conduct R&D in the market of concern? Second, given the overall efficiency of U.S. capital markets, this argument is inherently suspect. It is not surprising that, in their review of the empirical literature some years ago, Kamien and Schwartz found that "[i]n sum, the empirical evidence that either liquidity or profitability are conducive to innovative effort or output appears slim."[92]

Merger Specificity. As noted above, the possible use of alternative institutional arrangements, such as research joint ventures, raises complex issues in determining whether the efficiencies are merger-specific. These issues arise because, in theory, two firms might be able to separate cooperation regarding product-market activities from cooperation with respect to R&D activities. Thus, in some cases an important element of merger analysis is to determine whether the parties need a merger rather than a research joint venture or some other form of research cooperation (e.g., intellectual property licensing) that does not limit product-market competition. Although based on just one industry, a recent empirical study suggests that this issue is an important one. Gugler and Siebert found that research joint ventures in the semiconductor industry may achieve innovation efficiencies that are comparable to those attained through merger but may do so without having the adverse effects of mergers on product-market competition.[93]

Tensions between Efficiency and Consumer Welfare. Consideration of efficiencies in merger review typically brings to the fore the difference between a consumer-welfare standard and an economic-

efficiency, or total-surplus, standard. Under a consumer-welfare standard, cost savings are relevant only to the extent that they are passed on to consumers in the form of lower prices or better products. Thus, a consumer-welfare standard would not count as benefits any projected savings in corporate overhead that are predicted to have no effect on product prices. Nonetheless, such savings would represent real gains to the economy, and they would be counted as benefits under a total-surplus standard.

The analysis of efficiencies from a static pricing perspective often focuses solely on variable costs, on the grounds that changes in fixed costs will not affect the calculation of profit-maximizing prices. However, a change in the fixed costs of innovation may trigger a change in the resulting level of innovation (i.e., whether a project is undertaken or not), which then has consequences for consumer welfare. Consequently, it is important that fixed costs not be summarily excluded from the efficiencies analysis when innovation is at issue. Another way of describing this point is to state that it is important to remember that, over a long enough time horizon, everything is variable.

Note that, under an efficiency standard, one would take into account the fact that a merger might eliminate socially wasteful duplication of R&D, even if doing so did not speed up the date at which innovation occurred or reduce quality-adjusted product prices. Indeed, an economic-efficiency standard would in some circumstances count as a benefit the fact that a merger slowed the rate of innovation from a socially excessive level, but a consumer surplus standard would find the merger harmful. If merger policy focuses more on innovation, it may therefore have to deal with welfare trade-offs that antitrust does not confront in conventional product-market competition cases.

One way to resolve the social welfare/consumer welfare trade-off is to insist that the cost savings from any reduction in innovation be passed through in the form of lower prices to consumers, an issue that arises in the context of productive efficiencies in a static merger-review framework. But in the conventional, static-efficiencies situation, the consumer ideally gets the same product at a lower price post-merger. In contrast, when a merger reduces inefficient innovation, the consumer at best gets a different (less advanced) product at a lower price post-merger and the price reduction may not compensate for the difference in product characteristics. The inability to compensate consumers by passing-through cost-savings is one consequence of the fact, discussed next, that no correspondence may exist between the magnitude

of the R&D investment and the magnitude of the resulting consumer-welfare benefit.

Developing Reliable Projections of Consumer Benefits. Efficiencies are typically difficult to project with any confidence, even when innovation is not an issue. And for several reasons, innovation makes the task even more difficult. First, there is a large stochastic element of innovation, and R&D projects often have extremely long gestation periods. Second, as discussed above, the drivers of innovation are only imperfectly understood. Third, where efficiency leads to greater product innovation and consumers have heterogeneous valuations of quality, projecting net consumer benefits can be complex. Finally, to the extent that innovation involves discrete projects and fixed cost commitments, even a small change in fixed costs can lead to a large change in consumer welfare. This relationship holds when the cost change (or other merger efficiency) tips the balance in favor of a supplier's undertaking a discrete investment that generates a large amount of consumer surplus, such as the introduction of a new product. In principle, the consumer surplus generated by these new services made possible by an R&D investment can exceed the merger-specific reduction in the costs of conducting the R&D. Thus, the agencies have to be careful not to measure efficiencies purely in terms of cost savings.

Remedies

Merger remedies can involve the divestiture or licensing of assets, including intellectual property, to maintain innovation competition. The challenge for merger policy in crafting remedies for cases in which innovation is central is to identify the right assets for divestiture or, where those assets are intellectual property, for licensing. In the case where, for example, two drugstore chains seek to merge, divestiture is relatively straightforward in principle: the parties must divest stores where the pre-merger firms have overlapping territories. To be sure, assuring that those stores are divested in a way that maintains their competitive viability against the merged entity may present problems, but identifying which stores to divest tends to be easy.

The problem is much harder when the assets to be divested are intended to maintain competition in innovation.[94] Which personnel are central to an innovation effort and where in the company are they located? Is R&D conducted so that it is severable for purposes of

divestiture? What patents are needed for a particular R&D effort and are alternative technologies available? These questions are far from insurmountable, but they do point out the particular challenges that innovation creates for remedial merger policy. These questions also suggest that refocusing conventional analysis will be necessary for enforcement agencies in innovation cases.

Schumpeterian Competition and Merger Policy

As noted in Section II, competition in some markets may take the form of Schumpeterian rivalry in which a succession of temporary monopolists displace one another through innovation. At any one time, there is little or no head-to-head price competition but there is significant ongoing innovation competition. The nature of Schumpeterian competition suggests to some observers that antitrust policy should be less concerned with attacking business practices that might generate increased monopoly profits by harming competition within a market, or should at least be more circumspect about doing so.[95] However, an issue about specific practices' harming competition "for the market" still exists. And it is not at all clear that merger policy should not be more restrictive rather than less.

Proponents of the view that governmental intervention should be limited in this type of market generally argue that merger policy is likely to make costly errors through enforcement that will have the unintended effect of slowing innovation. As the argument goes, in dynamic markets, it is impossible to predict what will happen, current market positions are irrelevant to future competition, and at any point the market will be monopolized anyway.[96] Therefore, the argument concludes, firms should be allowed to combine with relatively little antitrust intervention in dynamic markets.

The analysis of this chapter suggests that the claim for systematic laissez faire in such markets is not soundly grounded in economics. Indeed, a merger policy designed to foster and protect Schumpeterian competition might appear fairly restrictive when viewed through the lens of conventional merger analysis. It will not always or even often be true that the conditions fostering the intense investment in new technology that leads to sequential competition "for the market" will be produced by unchecked consolidation. Indeed, Case 2 in Section II, is one in which a merger would be challenged precisely because it would otherwise undermine Schumpeterian competition.

Innovation would be at the center of the inquiry designed to determine when innovation requires antitrust agencies to intervene and when to stand back. To understand a proposed merger's potential effects on Schumpeterian competition, one would need to ask which firms had the potential to be the next temporary monopolist. The current shares of most firms might well be largely irrelevant to this assessment. (The large share of the current temporary monopolist would be relevant if it indicated what the status quo would be until the next wave of innovation comes crashing through the market.) But it would be a mistake to think the irrelevance of current market shares inexorably leads to permissive merger policy. For instance, the Schumpeterian approach might instead imply that the current dominant firm should be allowed to merge with essentially no other firm because any other firm might be the next successful rival. Similarly, it might be socially optimal to block a merger between two firms that had no sales of the final product at present because each may be involved in beneficial R&D that will make one of them the next market winner.

VI. Innovation Cases

The U.S. antitrust agencies have by now reviewed several merger cases in which innovation has been an important factor. A review of those cases helps one to understand how far the agencies have been willing to incorporate innovation concerns into merger policy and also to assess the kinds of cases in which the agencies have been, or can be, successful in that enterprise.

Early Merger Cases: Starting to Take Innovation Seriously

One of the first merger enforcement actions expressly motivated by innovation concerns occurred in 1990, when the FTC challenged Roche Holding's acquisition of Genentech as likely to lessen research and development in several biotech products.[97] Some of the concerns raised by the transaction were traditional ones of competition: for example, Roche was on the verge of becoming the major challenger to Genentech's dominant position in the market for products to treat human growth hormone deficiency. But more central to the FTC's complaint was that Roche and Genentech were actual competitors in the research and development of important therapies for the treatment of AIDS and HIV infection. Genentech was considered to be ahead of its rivals

in the development of such treatments, and Roche was actively involved in a competing development effort. Concerns about how consolidation of actual R&D efforts would affect the future product market and the pace of innovation drove the enforcement decision.[98]

In terms of the three abstract cases we discussed above, the Roche/Genentech case appears to fit Case 1 in Section II, in which the innovation concern is tied to potential competition in an identifiable product market. With respect to treatments for human growth hormone deficiency, Roche's potential competitive impact was imminent and reasonably certain. While the potential competition between Roche and Genentech in the AIDS/HIV therapy market was more speculative because both firms were still in the R&D phase, the competing R&D efforts were well underway, and the FTC found strong evidence to support its prediction that the relevant product market would develop and that Roche and Genentech would be important competitors in that market. The FTC's analysis was thus more one of potential competitive effects than of effects on innovation per se.

The Justice Department first challenged a merger on innovation grounds in 1993, when it investigated ZF Friedrichshafen's (ZF) proposed acquisition of General Motors' Allison division.[99] Allison and ZF together produced 85 percent of the world output of heavy-duty automatic transmissions for trucks and buses but actually competed head-to-head in few geographic markets.[100] The Justice Department nonetheless concluded that even markets whose concentration would be unaffected by the merger would be harmed by the transaction's reduction in Allison and ZF's incentives to develop new designs and products.[101] This case therefore reflects the economic conclusion that near-monopoly levels of concentration are detrimental for innovation, even in the absence of any changes in static efficiency and in the absence of any specific development effort that could be identified as being compromised.

The Roche/Genentech and ZF/Allison cases both considered innovation as an issue distinct from competition in an *existing* product market, but there were important differences between the cases. The FTC did not have to predict that a reduction in rival innovation efforts from the increase in industry concentration would have resulted from the acquisition. Rather, the increase in concentration was accompanied by concrete evidence that Roche was at an advanced stage in developing a competing human growth hormone treatment and that Roche and Genentech were the most promising of a small group of companies racing to develop certain AIDS/HIV treatments. Because Roche

appeared to have reached a point where its entry into the growth hormone market was no longer speculative, the question was more a conventional one of product-market competition than of innovation.

The FTC framed the issue with respect to AIDS/HIV therapies, however, purely as one of innovation. The FTC's focus was on the race to develop products, not on competition in the market for existing products. But the evidence was clear that both Roche and Genentech were among few serious participants in that development race. The merger would have substantially concentrated actual—not merely potential or speculative—R&D efforts. In turn, the merger would have reduced the number of players in an as yet nonexistent but likely and predictable future product market.

While the evidence that innovation efforts would be consolidated makes enforcement appear warranted, it raises an interesting question about enforcement rationale. The Roche/Genentech case is presented as one about preserving innovation incentives in the market for the drug therapies actually under development.[102] But it doesn't seem quite right to explain the case as being about fostering incentives for firms to undertake innovation that was in fact already occurring. To the extent that the case was about innovation, it seems more coherently explained as preserving a market structure that had proven itself conducive to innovation and that therefore should not be allowed to concentrate further and reduce the potential for future R&D. If that is the underlying rationale, then the case marks a significant departure from conventional antitrust analysis. But the case can also be explained as one about conventional product-market competition, with the evidence of innovation showing that the merger would combine two future rivals and create higher prices when the market for the infection treatments at issue does eventually develop. That interpretation is still a dynamic one to which innovation is crucial but, in the end, it is firmly within the traditional competitive framework of antitrust.

The Justice Department's action in the ZF/Allison case was different from that in Roche/Genentech in an important respect: the Justice Department found no specific R&D effort that would be compromised by the acquisition. But the decision indicates that, if the change in concentration is so great that it leaves an industry with a near-monopoly and without other potential sources of new developments, potential harm to the innovation market can justify a challenge to the transaction.

In the ZF/Allison case too, however, the underlying rationale is ambiguous. On the surface, it seems reasonable to block a merger that would result in an 85 percent share of the world market, even if fringe

firms may be capable of introducing innovations and additional competition. In most cases, such a merger would raise concerns about both allocational efficiency and innovation incentives. In the ZF/Allison case, the efficiency issue was less salient because the two companies' geographic territories and product lines only partially overlapped. Only a subset of the companies' customers would have faced a reduction in the number of competing suppliers due to the merger. The emphasis of the case was therefore more on preserving innovation incentives in the market for heavy-duty transmissions than on protecting traditional product competition in that market.

If companies do not compete in the product market, why is there any reason to believe they compete in the innovation market? To be sure, monopolists still have some incentive to reduce costs and increase profits, so the fact that the two companies do not compete in any geographical market does not mean they would not each have incentives to innovate. But the same logic—that innovation incentives do not vanish in the absence of competition—can be applied to the merged entity and thus does not supply a rationale for blocking a transaction between noncompeting entities. This conclusion does not mean the ZF/Allison decision was faulty. It does indicate that separating innovation incentives from product-market competition effects can be difficult, and it raises some of the difficulties in applying the framework designed for static competitive analysis to dynamic questions of innovation.

One possible rationale for the Justice Department's action is that it is better over time to have two potential innovators in the market rather than one to preserve the potential for a diversity of approaches to developing new technology and to preserve the possibility for future product-market competition. The ZF/Allison decision is novel because it preserves separate entities not for reasons of price competition but for reasons of future innovation. In the context of a merger to near-monopoly, the idea doesn't seem so radical, but in principle it represents an important change in traditional merger analysis. The agency's focus was not on preserving innovation tied to any particular product or identifiable line of research but instead on preserving conditions likely to be more conducive to any innovation in the market sector. The ZF/Allison merger presents a relatively easy example, however, of such a pure innovation case. The merger to monopoly certainly reduced the potential for competition between the two major firms. The case gives little insight, however, into how the agencies would

evaluate a case involving a greater number of firms in which only innovation, and not product-market competition, was at stake.

Transitional Cases: Innovation Moves to the Fore

The two factors central to the Roche/Genentech and ZF/Allison cases—high levels of concentration and parallel and competing innovation efforts—have also formed the basis for several more recent merger-enforcement actions through which the relationship between antitrust and innovation has further developed.

Aerospace Mergers. The aerospace industry is one of the most innovative economic sectors in the United States. The market is characterized by high concentration levels but also (outside the defense sector) by international competition. In the late 1990s, the FTC and the Department of Justice approved one major aerospace merger and blocked another, respectively. Innovation considerations were central to these enforcement decisions.

In 1997, the FTC approved the merger of Boeing and McDonnell Douglas, the two largest commercial aircraft manufacturers in the United States.[103] In that case, analysis of innovation in the aerospace industry supported the merger, not because the transaction was expected to increase R&D but because the analysis showed that McDonnell Douglas had fallen behind technologically and no longer could exert competitive pressure on its rivals.[104] Acquisition by Boeing would therefore not reduce future competition and would allow McDonnell Douglas's assets to be put to better use by a more technologically advanced enterprise.

Concerns about progress in aerospace led to a different conclusion in Lockheed Martin's proposed acquisition of Northrop Grumman. The Justice Department's challenge to the merger explained that Lockheed and Northrop were two of the leading suppliers of aircraft and electronics systems to the U.S. military.[105] The Justice Department concluded that the merger would give Lockheed a monopoly in systems for airborne early-warning radar, electro-optical missile warning, fiber-optic towed decoys, and infrared countermeasure systems.[106] In addition, the merger would reduce the number of competitors from three to two in high-performance, fixed-wing military airplanes; onboard radio countermeasures; and stealth technology.[107] The Justice Department contended that consolidation in these markets would lead

to higher prices, higher costs, and reduced innovation for products and systems required by the U.S. military.[108]

Although traditional competitive concerns about prices were an important part of the Justice Department's challenge to Lockheed's acquisition of Northrop, innovation concerns were central. For example, the Department noted that Lockheed and Northrop had both started research and development for advanced airborne early-warning radar systems and concluded that consolidation of the two R&D efforts would harm future military procurement.[109] The Justice Department also found evidence that competition is particularly important for technological advances in high-performance military aircraft and that important innovations have often been made by firms other than the incumbent suppliers of particular systems. Thus, it concluded that "competition is vital to maximize both the innovative ideas associated with each military aircraft program, as well as the quality of the processes used to turn innovative ideas into cost-effective, technically sound, and efficiently produced aircraft."[110]

The Justice Department's conclusion in the Lockheed/Northrop case (that preserving competition in the relevant markets would enhance innovation) was based principally on two factors that weighed against permitting the transaction: (1) evidence that Lockheed and Northrop were either actually conducting competing R&D on important products or were the leading contenders to conduct such R&D in the future, and (2) evidence that consolidation would lead to either monopoly or substantial dominance in relevant product markets, not just reducing but in large part eliminating competitive pressure. Thus, a combination of market structure and parallel innovation efforts pointed toward a likely reduction in both actual and potential innovative activity if the merger were consummated.

Thus, to a large extent, Lockheed/Northrop fits the parameters of Case 2 in Section II. Although a patent race was not necessarily at issue, what was at stake was the race to develop technology that would win a major government contract, another form of a winner-take-all (or winner-take-most) innovation contest. The Justice Department found, at least implicitly, that the benefits of faster innovation and a choice of alternative technologies offset possible costs of effort duplication in the aerospace/defense sector. In addition, it was possible that, if the two technologies that the competitors developed were truly substitutes, then the government would also get the benefit of conventional product-market competition between bidders for the contract. In other

words, mixed with the innovation concern central to the case was also a more conventional, static pricing concern.[111]

Biotechnology and Pharmaceuticals. In the mid-1990s, the FTC focused on innovation concerns in crafting a consent agreement with merging firms in the biotechnology and pharmaceuticals industry. Ciba-Geigy and Sandoz announced plans to merge into a new company now known as Novartis. The FTC raised several objections to the merger.[112] Along traditional antitrust lines, the FTC was concerned that the combination would give the merged entity power to reduce competition and raise prices in the markets for herbicides used in growing corn and for flea-control products for pets.[113] The FTC accordingly ordered one party to divest those businesses.[114] The more novel parts of the FTC's challenge, however, had to do with research and development and the prospects for future innovations in the market for gene therapy products—products that allow treatment of diseases and medical conditions by modifying genes in patients' cells.

At the time of the FTC's investigation in 1996 and 1997, no gene therapy products were on the market or even approved by the Food and Drug Administration (FDA).[115] Conventional merger analysis therefore did not apply because no product market existed in which to analyze the merger's effects on prices and output. The FTC instead adopted a dynamic perspective; looking to the future, it found long-run competitive concerns. The sales of gene therapy products were expected to grow rapidly, with projections for a $45 billion market by 2010.[116] Ciba and Sandoz were either among the few or the only firms with the technological capability and intellectual property rights necessary to develop gene therapy products commercially. The FTC stated in its complaint against the proposed merger that Ciba and Sandoz were "two of only a few" entities capable of the R&D necessary to enter the market. Together they would control essential patents, know-how, and proprietary commercial rights without which other firms, even if capable of developing gene therapy products, would be unable to commercialize them. The FTC was concerned that Novartis, the newly named post-merger company, might not adequately license its gene therapy intellectual property to ensure that other firms would be able to close the R&D gap. The FTC concluded that "preserving long-run innovation in these circumstances is critical."[117]

The FTC did not, however, block the merger. Instead, it crafted a consent decree designed to correct those aspects of the transaction that

raised concerns for current and future competition and innovation. As noted above, divestiture of certain overlapping herbicide and flea-control businesses occurred. More notable, however, was the fact that the FTC did not require divestiture of either firm's gene therapy division. Instead, Ciba and Sandoz agreed that they would license technology and patents sufficient for one of its major rivals to compete against the merged entity in the development of gene therapy products.[118]

The FTC's remedy steered between the potentially conflicting economic effects that a merger might have on research and development. On one hand, consolidating complementary capabilities can enhance innovation and allow a combination of firms to achieve what the firms individually could not do as easily. On the other hand, concentrating markets to near-monopoly levels can dampen the pressure to innovate and reduce the enhanced probability of success that comes from multiple R&D efforts. Both concerns are reflected in the FTC's enforcement action. The FTC declined to order either Ciba or Sandoz to divest its gene therapy subsidiary because it found that R&D efforts between the parent companies and their subsidiaries were closely coordinated, making divestiture disruptive and counterproductive for innovation. The decision instead to order compulsory licensing to a capable competitor was designed to preserve both competition and the benefits of the merging parties' relationships with each other and their respective gene therapy subsidiaries.

The market context in which the FTC's focus on innovation occurred is significant. The merger did not simply change the degree of competition within a middling range of market concentration. Rather, the combination of Ciba and Sandoz concentrated nearly all innovation efforts and essential inputs for commercialization of gene therapy under one corporate roof. Innovation concerns were sufficient to motivate enforcement because the facts showed a combination of monopoly market structure and reduction in the number of actual (as opposed to potential) innovation efforts. To some degree, this was a traditional potential-entry case with respect to product-market competition. But the action also broke important new ground: it expressly recognized that a current merger could be challenged on grounds of future innovation and competition in a product market that does not yet—but likely will—exist. Contrast this action with the ZF/Allison action. In the case of ZF/Allison, the issue was a product market with (as yet) nonexistent innovation; in Ciba/Sandoz, the issue was innovation for an (as yet) nonexistent product market.

Recent Case Developments: More Nuanced Analysis

The antitrust agencies' focus on innovation in merger review, which became evident in the 1990s, has continued to develop. Although most innovation cases involve advanced stages of innovation—so that the issue is more one of potential product-market competition than innovation for its own sake—the Department of Justice and FTC have both also expressed interest in protecting innovation for its own sake, as the following cases illustrate.

The proposed $16 billion merger of Hoechst and Rhône-Poulenc into the pharmaceutical company known as Aventis raised both potential and actual competition concerns for the FTC.[119] Innovation was central to the potential competition aspects of the merger. Hoechst had an existing anticlotting product and Rhône-Poulenc was close behind, with a product almost through the FDA review process. As in Ciba/Sandoz, the FTC was also concerned about a combination of patent portfolios, in this case, patents related to anticlotting agents. In December 1999, the FTC entered into a proposed consent agreement settling its charges that the merger would violate Section 7 of the Clayton Act. The parties were allowed to merge on the condition that they divest assets relating to Rhône-Poulenc's direct thrombin inhibitor drug Revasc to preserve competition and the opportunity for innovation in direct thrombin inhibition as a superior treatment for blood-clotting diseases. The merged entity was also required to divest its interest in a subsidiary that produced cellulose acetate to preserve competition in the market for cellulose acetate thermoplastics.[120]

The FTC again faced a mix of actual and innovation-based potential competition issues in its challenge to the Amgen/Immunex merger in 2002.[121] At the time Amgen and Immunex proposed to merge, Amgen had the only IL-1 inhibitor (which is used to treat rheumatoid arthritis) on the U.S. market. Immunex and one other firm, Regeneron, were the only other companies with IL-1 inhibitors in U.S. clinical trials. The FTC feared that the combination of the Amgen and Immunex patent portfolios might allow the merged firm to block entry by Regeneron. The FTC expressed concern not only about harm to potential competition from the merger but also about the possibility that the combination would reduce R&D competition for related new products. The FTC nonetheless allowed the merger to proceed based on a consent decree that required the licensing of certain patents to Regeneron. The

FTC reached a similar result in its review of the Glaxo/SmithKline Beecham merger in 2001.[122]

The cases discussed so far may leave the impression that innovation has been salient only in megamergers where billions of dollars are at stake in the transaction and/or in particular market sectors, notably pharmaceuticals and defense aerospace. But that is not the case. As noted in our earlier discussion of remedies in Section IV, the Department of Justice sued in 2001 to block 3D's proposed $45 million acquisition of DTM, alleging that the transaction, as originally structured, would have resulted in higher prices and less innovation for industrial RP systems in the United States.[123] The complaint alleged that "3D and DTM offered the most sophisticated systems in the industry and competed directly against each other in the development, manufacture, and sale of industrial rapid prototyping systems and materials."[124] The acquisition would have combined the two largest manufacturers of RP systems in the United States; reduced the number of competitors in the U.S. market for industrial RP systems from three to two; and resulted in the combined company having a U.S. market share, by revenue, of 80 percent.[125] The Department of Justice settled the case through a consent decree that requires 3D and DTM to license their RP-related patents to a firm that will compete against the merged enterprise in the U.S. market. The district court's decision entering the decree expressly discussed the merger's potential impact on innovation as well as price competition in the market for rapid prototyping systems.[126]

Taken together, the merger cases in which the U.S. antitrust agencies have made innovation a central issue fall mostly into the first of the abstract cases we set out in Section II: they have involved innovation efforts sufficiently well underway that one of the merging parties can convincingly be considered a potential competitor of the other. Review of those mergers has thus fit relatively comfortably into the existing framework for merger policy. But at least some cases have paid lip service, or even purported to base enforcement, on the preservation of innovation for its own sake in a particular industrial sector. In these cases—for example, GM/ZF and 3D/DTM—the agencies did not undertake a detailed analysis of the market structures in the relevant industries that would be most conducive to innovation, nor did they examine the welfare consequences of reduced innovation in the industries at issue. In the GM/ZF case, the Department of Justice appears implicitly to have assumed that one larger firm would be worse for innovation than two already quite large enterprises would be. In the 3D/

DTM case, the consolidation from three to two major U.S. firms raised concerns about innovation, although those concerns were deemed to have been allayed by the consent decree.

The cases to date therefore do not yet give a sense of how the agencies are likely to respond to transactions that fall into the second and third abstract cases that we discuss in Section II. Approaches to cases that raise questions about which market structures will be most conducive to efficient R&D, or that raise welfare trade-offs between price competition and innovation, are not as well developed as the review of cases in which innovation matters solely through existing projects' effects on potential product-market competition. The understanding in merger policy of the relationship between competition and innovation will have to be further developed, not only to identify objectionable transactions but also to craft effective remedies (to date, licensing of intellectual property rights has generally been assumed to cure both the reduction in R&D and the reduction in potential competition that some mergers portend).

VII. Conclusion: Towards Dynamic Merger Policy

When it comes to merger policy, innovation is tricky stuff. However, antitrust enforcers have the tools to treat innovation in merger analysis. The cases in which the Department of Justice and the FTC have already addressed innovation demonstrate that the agencies are sensitive to the ways that innovation can affect future competition in product markets. The use of information about innovation to support objections to a merger based on potential competition concerns does not require fundamental change to, or expansion of, the existing merger-policy framework. The harder issues for merger policy include four kinds of problems that transactions involving innovation raise: (1) the need to assess potential product-market competition from innovation efforts still far from completion, (2) the question of whether current product sales and production capabilities are relevant to the assessment of future competition, (3) a merger's effect on innovation, and (4) possible trade-offs between dynamic-innovation benefits and static-competition benefits.

The first issue is an evidentiary one. At what point is evidence of innovation sufficient for the agencies or courts to determine that the innovator is a predictable product-market competitor? Most of the cases to date have involved innovations that were essentially complete and

undergoing trials and/or regulatory approval. But some transactions will push enforcement authorities to take a more dynamic view of potential competition. The challenge for the agencies and courts in these cases will not involve changing the existing merger-review framework but instead will involve articulating the parameters of the factual inquiry from which the agencies and courts will infer potential competition from evidence of ongoing innovation.

The second issue, whether current market shares are relevant to predicting future product-market competition, can be addressed within the standard conceptual framework codified by the *Merger Guidelines*, and well-developed economic tools are available for addressing the issue. However, a movement away from a predominant focus on market shares and toward a more refined analysis of industry conditions and the nature of competition would represent a dramatic change in the practice of merger litigation.

The remaining problems listed above are more difficult and fundamental for the existing framework on both conceptual and practical levels. The issues of the efficient amount or timing of innovation, and of the comparative values of competition today versus improved products tomorrow, do not fit easily into the conventional merger review framework. Antitrust agencies could decide not to address these issues and could retain their focus instead on more conventional product-market concerns. But the impact of innovation on economic welfare and the impact of market structure on innovation will occur whether antitrust policy accounts for them or not. Hence, if the agencies choose this course, judgments about these impacts would be made implicitly and without reflection. To the extent antitrust policy makers wish to avoid the potential costs of ignoring innovation, the question becomes, How should antitrust agencies proceed in incorporating innovation concerns into their mission?

The overarching lesson from our analysis is that merger-policy enforcers should recognize that innovation will depend more heavily on factual inquiries specific to a given case and less on systematic presumptions of the kind merger policy has long applied to static, product-market competition. The analysis summarized above suggests several approaches that the agencies charged with developing and enforcing merger policy might use to address innovation and its potential effects in the merger-review process.

First, the agencies could develop and articulate guidelines for drawing inferences of potential product-market competition from evidence

of ongoing innovation. Doing so would extend the existing framework to cover several situations in which innovation does or many would say should play an important role in merger analysis.

Second, agencies might continue to expand their consideration of mergers' effects on innovation and consumer welfare to cases in which the concern is with potential R&D projects that are not already underway. So far, the agencies have been cautious in moving beyond concerns about potential product-market competition based on well-defined innovative efforts. The agencies also have not made explicit trade-offs between short-term product-market competition and innovation. The agencies could, however, consider broadening their inquiry to take these important effects into account.

Therefore, a third approach that the agencies might pursue would be to develop the expertise that would allow case-by-case, fact-intensive inquiries to assess the welfare effects and trade-offs posed by mergers where innovation is at stake. Academic researchers can make an important contribution to this effort by conducting industry-specific studies that provide a deeper understanding of the history and conditions for innovation in different economic sectors regularly at issue in mergers. As observed in Section V, empirical research demonstrates that industry-specific factors play important roles in mediating the relationship between concentration and firm size on the one hand and the pace of innovation on the other. Additional studies of the sort we recommend might lead to the identification of fact patterns that allow clearer understanding of how to treat innovation in the context of the different kinds of transactions that come up for review.

A fourth approach would be for the agencies to make use of the tools of decision theory to deal with uncertainty, particularly with respect to innovation. Under current practice, for example, the agencies often take an approach of considering a two-year horizon in assessing the effects of entry, with little or no discounting within the horizon and complete discounting of anything beyond.[127] Similarly, efficiency benefits that are realized only with a lag are "given less weight because they are less proximate and more difficult to predict."[128] Standard decision theory indicates, however, that these approaches are poor heuristics for calculating expected payoffs in the face of uncertainty. For example, these approaches to entry tend to underestimate the effects of potentially revolutionary innovations that have some probability of having large effects over a period of several years. The conventional decision-theoretic approach would be to estimate probability

distributions for alternative potential outcomes and then use those probabilities as weights in projecting an expected net present value of a merger's effects on consumer welfare.[129] More broadly, the effects of mergers on innovation are uncertain and occur over time, and the agencies and the courts have not made full use of established decision theory to structure their analyses of consumer-welfare effects.

In conclusion, although a coherent and effective approach to innovation in merger policy will be difficult, the analysis suggests that the goal is achievable.

Notes

1. An average of 131 other investigations were conducted per year (United States Department of Justice, Antitrust Division, Workload Statistics 1991–2002). Non-merger antitrust actions include criminal prosecutions of price-fixing cartels, as well as civil actions against individual companies found to have engaged in anticompetitive practices (e.g., the Microsoft case).

2. *See* Federal Trade Commission, Fiscal Year 2002 Congressional Budget Justification (April 9, 2001), available at http://www.ftc.gov/os/2001/04/2002budgetjustification.pdf, p. 46–60.

3. Innovation considerations were raised in some early non-merger cases. *United States v. Aluminum Co. of Amer.*, 148 F.2d 416, 427 (2d Cir. 1945) recognized the effects of market power on innovation, although innovation concerns did not play a significant role in the decision. Innovation played a more central role in *United States v. Automobile Manufacturers Ass'n*, 307 F. Supp. 617, 618 (C.D. Cal. 1969), in which the court found that the leading American automobile manufacturers had engaged in a conspiracy "to eliminate competition in the research, development, manufacture and installation of motor vehicle air pollution control equipment . . ." in violation of Section 1 of the Sherman Act (aff'd in part and appeal dismissed in part, 397 U.S. 248 [1970]).

4. See, e.g., *Economic Report of the President 2000*, p. 35.

5. *1999 Annual Report*, Antitrust Division, United States Department of Justice, p. 5.

6. "Antitrust Considerations in International Defense Mergers," address by Robert Kramer, Chief, Litigation II Section, Antitrust Division, United States Department of Justice (May 4, 1999), p. 3.

7. Of course, from a long-run perspective, promoting innovation and promoting low, quality-adjusted prices are largely the same objective. The distinction we draw in the text can be viewed as one between static pricing efficiency and dynamic pricing efficiency.

8. Admittedly, this case is somewhat artificial. Actual markets are likely to have ongoing waves of innovation.

9. Under the total welfare standard, efficiency gains benefit firms and, if they are passed on in lower prices or higher quality, their customers as well. Both are equally valued. See Williamson (1968). Under the alternative consumer welfare standard, the competition authority takes into account only those benefits passed on to consumers.

10. See, e.g., Neven and Roller (2000).

11. See, e.g., *Antitrust Enforcement and the Consumer*, available at http://www.usdoj.gov/atr/public/div_stats/9142.pdf (2001), Sections 1, 2, 4; *Antitrust Guidelines for Collaborations Among Competitors* on the FTC web site (04/2000), available at http://www.ftc.gov/os/2000/04/ftcdojguidelines.pdf, p. 1, 4, 6.

12. 15 U.S.C. Section 18. Mergers can also be challenged under Section 1 of the Sherman Act, 15 U.S.C. Section 1, which bars "[e]very contract, combination in the form of trust or otherwise, or conspiracy in restraint of trade or commerce among the several States, or with foreign nations."

13. In addition, private challenges can be made against mergers (although they face antitrust-injury and standing hurdles), which may be motivated by very different considerations than governmental challenges. Our focus here is on public policy.

14. United States Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines*, rev. April 8, 1997 (hereafter, *Merger Guidelines*).

15. *Merger Guidelines*, Section 0.1.

16. See, e.g., Baker (2003) and Scheffman, Coate, and Silvia (2003).

17. *Merger Guidelines*, Sections 1.0, 1.5. See also *FTC v. University Health, Inc.*, 938 F.2d 1206, 1211 n. 12 (11th Cir.1991); *FTC v. PPG Industries, Inc.*, 798 F.2d 1500, 1503 (D.C.Cir.1986); *FTC v. Staples, Inc.*, 970 F.Supp. 1066, 1081–82 (D.D.C.1997).

18. For the most part, economic theory and antitrust policy have long favored more competition over less for the purpose of lowering prices, expanding output, and making consumers better off. There are, however, limited exceptions to this view. For example, certain industries in which per-unit cost declines as output increases to the point that it is most efficient to have just one firm producing all output in a given market have come to be known as natural monopolies. Historically, telecommunications networks were a leading example, and public policy actually served to limit entry. That view has since changed. For instance, the Telecommunications Act of 1996, 47 U.S.C. Sections 151 et seq, seeks to promote competitive entry.

19. 374 U.S. 321 (1963).

20. Ibid.

21. *Brown Shoe Co. v. United States*, 370 U.S. 294 (1962).

22. See, e.g., *Merger Guidelines*, Section 1; Toys R Us v. FTC, 221 F.3d 928 (7th Cir. 2000).

23. See, e.g., Stocking and Mueller (1955, pp. 44–8).

24. *Merger Guidelines*, Section 1.0; *FTC v. Swedish Match*, 131 F. Supp. 2d 151, 160 (D.D.C. 2000); *California v. Sutter Health Systems*, 130 F. Supp. 2d 1109, 1120 (N.D. Cal. 2001). See, also, Katz and Shapiro (2003).

25. *Merger Guidelines*, Sections 1.0 and 1.11.

26. We are assuming that the baseline price is greater than or equal to incremental cost.

27. *FTC. v. Tenet Healthcare Corp.*, 186 F.3d 1045 (8th Cir. 1999).

28. Baker (1997).

29. Ordover and Wall (1989, pp. 20–1) [footnote omitted].

30. See, e.g., Parker (1998).

31. *United States v. Philadelphia National Bank*, 374 U.S. 321 (1963).

32. *See Merger Guidelines*, Section 1.5.

33. See, e.g., Schmalensee (1989).

34. *Merger Guidelines*, Section 2.0.

35. The *Merger Guidelines* describe the process as follows:

"The Agency will not challenge a merger if cognizable efficiencies are of a character and magnitude such that the merger is not likely to be anticompetitive in any relevant market. To make the requisite determination, the Agency considers whether cognizable efficiencies likely would be sufficient to reverse the merger's potential to harm consumers in the relevant market, e.g., by preventing price increases in that market." [Section 4, internal footnote omitted.]

36. *See, Merger Guidelines*, Section 4.0.

37. See, e.g., *SCM Corp. v. Xerox Corp.*, 645 F.2d 1195, 1203 (2nd Cir. 1981) ("While the antitrust laws proscribe unreasonable restraints of competition, the patent laws reward the inventor with a temporary monopoly that insulates him from competitive exploitation of his patented art").

38. See, e.g., *Atari Games Corp. v. Nintendo of America, Inc.*, 897 F.2d 1572, 1576 (Fed. Cir. 1990) ("[T]he aims and objectives of patent and antitrust laws may seem, at first glance, wholly at odds. However, the two bodies of law are actually complementary").

39. *Merger Guidelines*, Section 1.11 ("In attempting to determine objectively the effect of a 'small but significant and nontransitory' increase in price, the Agency, in most contexts, will use a price increase of five percent lasting for the foreseeable future."). European Commission, 1997, *Commission Notice of the Definition of the Relevant Market for the Purposes of Community Competition Law.* (http://europa.eu.int/comm/competition/antitrust/relevma_en.html) ("The question to be answered is whether the parties' customers would switch to readily available substitutes or to suppliers located elsewhere in response to an hypothetical small (in the range 5%–10%), permanent relative price increase in the products and areas being considered.").

For most mergers, pre-merger prices are taken at the benchmark. In cases where pre-merger prices reflect coordinated behavior, some measure of a competitive price is used instead. *Merger Guidelines*, Section 1.11.

40. In addition to the issues in the text, Hartman et al. offer another criticism of the standard hypothetical monopolist approach to market definition. Their criticism, however, appears to be based on a misunderstanding of the *Merger Guidelines.* Hartman et al. write that "During [the 1970s] a variety of [minicomputer] systems competed on price and performance while exhibiting price differences of several hundred percent. Strict interpretation of the Merger Guidelines suggests that such price differences imply that the products are in different markets." (Hartman, Teece, Mitchell, and Jorde 1993, p. 323.) The hypothetical monopolist test, however, is based on the effects of price *changes*, not existing price differentials.

41. See, e.g., Pleatsikas and Teece (2001, p. 671).

42. For the latter reason, Pleatsikas and Teece are incorrect when they assert that "defining markets from a static perspective when innovation is rapid will inevitably lead to

identification of markets that are too narrow." (Pleatsikas and Teece 2001, p. 687. [Footnote citing Teece and Coleman (1998), at 826–828, omitted.])

43. In this regard, some tension exists between a forward-looking approach and the *Merger Guidelines'* treatment of entry, which tends to take a limited perspective. (*Merger Guidelines*, Section 3.)

44. And, of course, the issues that innovation raises for the definition of relevant markets affect the resulting calculation of market shares.

45. Under the process described by the *Merger Guidelines*, "Market shares will be calculated using the best indicator of firms' future competitive significance." *Merger Guidelines*, Section 1.41.

46. As discussed in Section V of this paper, the flip side is that a merger may have substantial effects on competition even if the post-merger market share is permissible within the enforcement guidelines. If the merger brings together two imminent technologies that otherwise would have competed, then consumers lose out on rivalry that otherwise would have come to exist absent the merger.

47. *Merger Guidelines*, Section 1.521. The extent to which the agencies are willing to adopt forward-looking views of competition is the subject of some debate.

48. *United States v. 3D Systems Corporation and DTM Corporation*, Verified Complaint.

49. *United States v. 3D Systems Corporation and DTM Corporation*, Final Judgement (Proposed).

50. Intellectual property assets also were included in the divestitures required to settle *United States v. Premdor U.S. Holdings, Inc. International Paper Company, and Masonite Corporation*. Similarly, *United States v Miller Industries* involved acquisitions of tow truck companies holding important patents and led to a consent degree with mandatory licensing.

51. For a discussion of the application of Section 2 to high-technology markets, see Evans and Schmalensee (2002).

52. General principles of antitrust law require "clear proof" or at least a "reasonable probability" that entry into the new market would in fact have occurred in the near future and disallow speculation about "ephemeral possibilities." (*United States v. Marine Bancorp*, 418 U.S. 602, 617, 623 (1974); *Tenneco, Inc. v. FTC*, 689 F.2d 346, 352 (2d Cir. 1982); *In re B.A.T. Industries*, 104 F.T.C. 852, 919–928 (1984).)

53. Gilbert and Sunshine (1995).

54. We will return to this point in our review of selected innovation cases below.

55. See, e.g., Kamien and Schwartz (1975, p. 20), ("concentration reflects the current sellers of a product and may be quite unrelated to the extent of actual and potential rivalry in innovating new products".) See also, Evans and Schmalensee (2002, pp. 16–18) and Hartman, Teece, Mitchell, and Jorde (1993, pp. 322–3).

56. Under the theory of limit pricing, incumbent firms set low prices today to deter future entry. In many circumstances, however, the threat entry will have little effect on pre-entry prices, and potential competition plays a relatively small role in price setting.

57. There are some exceptions. Even in static settings, for instance, perfect competition does not attain the first best in the presence of externalities, and distortions from concentration may in some cases offset those from externalities.

58. For example, in their 1975 survey of work on innovation and market structure, Kamien and Schwartz stated that "Few, if any, economists maintain that perfect competition efficiently allocates resources for technical advance." (Kamien and Schwartz 1975, p. 2.) Today, economists have a deeper appreciation for licensing and other forms of innovation diffusion, so there might be less agreement with such a sweeping statement because multiple interpretations of what is meant by perfect competition are possible in this context.

59. Hicks (1935, p. 8).

60. Schumpeter (1942, p. 106).

61. Of course, the competitive ideal of antitrust policy has evolved over time. When Schumpeter was writing, the ideal was rivalry among small, atomized economic actors. Any cooperation or concentration deviating from that standard was inherently suspect. The Chicago School revolution did much to improve understanding of why different market structures might result in different contexts and thereby reduced rigid adherence to the perfectly competitive model. Because of its benefits for allocative efficiency, competition nonetheless remained the touchstone of antitrust policy.

62. Scherer (1992).

63. Fellner (1951) and Arrow (1962).

64. Scherer (1967), Kamien and Schwartz (1972), and Kamien and Schwartz (1976).

65. *See* Scherer (1992) and Reinganum (1989).

66. It should be observed that, in terms of efficiency, the social value of innovation is the *incremental* improvement that it represents over the existing technology. Hence, the fact that a monopolist is concerned with cannibalization is not entirely indicative of an efficiency problem.

67. See, e.g., Mansfield (1968).

68. Williamson (1965), Bozeman and Link (1983), and Mukhopadhyay (1985).

69. Scherer (1967).

70. Levin, Cohen, and Mowery (1985) and Scott (1984).

71. Cohen and Levin (1989), citing Cohen, Levin, and Mowery (1987).

72. *See* Kamien and Schwartz (1975, pp. 20–22). Kamien and Schwartz summarized their survey of the empirical literature as follows: "In reviewing the diverse findings on research efforts and concentration, we find little consensus" (p. 22), and "Our review of the impact of market structure on innovation has netted little more than reaffirmation of the early observation that both competitive pressures and market opportunity seem important." (p. 24). Somewhat surprisingly, they then concluded their survey with "A new empirically inspired hypothesis has emerged to the effect that a market structure intermediate between monopoly and perfect competition would promote the highest rate of innovative activity." (p. 32).

73. In terms of theory, a recent demonstration of this possibility is provided in a paper by Jan Boone, which finds that an increase in the intensity of competition can drive a leading firm to increase its innovation by relatively more than its rivals and thus increase future concentration. (Boone 2001.)

74. Geroski (1990).

75. Kamien and Schwartz (1975, p. 15), attribute this general idea to Galbraith.

76. For a survey, see Reinganum (1989).

77. Similar effects may arise when being first to market creates a durable advantage in terms of favorable consumer perceptions.

78. See, e.g., Griliches (1992) and Jones and Williams (1998).

79. Carlton and Gertner (2003) point out that empirical studies generally compare *average* private and social returns, while the privately and socially optimal R&D levels depend on *marginal* returns. In settings where R&D investment is driven by preemption incentives, the private marginal returns may deviate from the private average returns by more than the marginal social returns deviate from the average social returns, suggesting that perhaps excessive private incentives would be a problem. It is far from evident, however, that patent pre-emption incentives are of empirical significance in many industries.

80. The source of the socially excessive R&D is the fact that the innovating firm's rivals may see their profits fall as a result of the innovation, and the innovator does not count this reduction in total surplus as a cost.

81. *Merger Guidelines*, Section 4.

82. For a general comparison of alternative institutional arrangements, including merger, see Katz (1995).

83. For an overview of the ambiguous relationship between firm size and innovation, see Cohen and Klepper (1996).

84. Galbraith (1952) and Nordhaus (1969).

85. Kamien and Schwartz (1982) and Cohen and Levin (1989, p. 1067).

86. Scherer (1965).

87. Cohen and Levin (1989).

88. Cohen, Levin, and Mowery (1987) and Cohen and Levin (1989).

89. Fisher and Temin (1973), Kohn and Scott (1982), and Acs and Audretsch (1990 and 1991).

90. Acs and Audretsch (1991).

91. See, e.g., Baker (1995).

92. Kamien and Schwartz (1975, p. 26).

93. Gugler and Siebert (2004).

94. In this regard, the divestiture of intellectual property to preserve product-market competition (see Section 0 above), is more similar to the manufacturing/retailing paradigm than to the innovation paradigm.

95. For a discussion of antitrust policy toward single-firm conduct in markets characterized by Schumpeterian competition, see Evans and Schmalensee (2002).

96. Judge Posner (2000) has offered a different view of the problem. He argues that high-tech mergers can be dealt with well by existing institutions and policies, but that

high-tech unilateral conduct cases are problematical because the agencies and courts can neither bring sufficient technical expertise to bear on the issues nor move in a timely enough fashion given industry's rate of change.

97. *Roche Holdings, Ltd.*, FTC No. C3315 (filed November 18, 1990).

98. *See* Gilbert and Sunshine (1995, p. 580) for further discussion of this case.

99. *United States v. General Motors Corp.*, No. 93-530 (D. Del., filed November 16, 1993).

100. Ibid.

101. Ibid.

102. See, e.g., Gilbert and Sunshine (1995).

103. *See* Pitofsky, et al. (1997).

104. Ibid at 2.

105. *United States v. Lockheed Martin Corp. and Northrop Grumman Corp.*, Complaint (D.D.C., filed 3/23/98).

106. Ibid at 2.

107. Ibid at 3.

108. Ibid at 3.

109. Ibid at 7–8.

110. Ibid at 26.

111. Similar issues arose and conclusions were reached in the Department of Justice's challenge of a proposed merger of the only two companies that manufacture nuclear submarines for the United States. (*United States of America v. General Dynamics Corporation and Newport News Shipbuilding, Inc.*, Verified Complaint, United States District Court for the District of Columbia, October 23, 2001.)

112. *See In the Matter of Ciba-Geigy Ltd., et al.*, Decision and Order, FTC Docket No. C-3725, March 24, 1997.

113. Ibid.

114. Ibid.

115. See FTC, *In the Matter of Ciba-Geigy Ltd, et al.*, Analysis of Proposed Consent Order to Aid Public Comment, at 3.

116. Ibid.

117. Ibid.

118. Ibid at 9.

119. *Hoechst AG*, FTC Docket No. C-3939 (2000), available at http://www.ftc.gov/os/caselist/c3919.htm See, also, Arquit and Wolfram (2001, p. 453).

120. *Hoechst AG*, FTC Docket No. C-3939 (2000), available at www.ftc.gov/os/caselist/c3919.htm.

121. *Amgen Inc.*, FTC Docket No. C-4056 (2002), available at http://www.ftc.gov/os/caselist/c4056.htm.

122. *Glaxo Wellcome PLC*, FTC Docket No. C-3990 (2001), available at http://www.ftc.gov/os/caselist/c3990.htm. See, also, *Glaxo Wellcome plc & SmithKline Beecham plc.*, FTC Docket No. C-3990 (Dec. 18, 2000) (Analysis of Proposed Consent Order to Aid Public Comment), available at http://www.ftc.gov/os/2000/12/glaxoana.htm; Arquit and Wolfram (2001, pp. 337–9).

123. *United States v. 3D Systems Corp. and DTM Corp.*, C.V. No. 1:01CV01237 (D.D.C. filed June 6, 2001). See, at http://www.usdoj.gov/atr/cases/f8800/8896.htm (Complaint). See, also, *United States v. 3D Systems*, 2002-2 Trade Cas. (CCH) ¶ 73,738 (D.D.C. 2002) (Final judgment).

124. *United States v. 3D Systems Corp. and DTM Corp.*, Complaint, Section 21.

125. Ibid.

126. *United States v. 3D Systems Corp. and DTM Corp.*, Final judgment, at 11.

127. *Merger Guidelines*, Section 3.2. The agencies sometimes take a more sophisticated view, at least when deciding whether to file a case against a proposed merger, if not in court.

128. Ibid, footnote 37.

129. We observe in passing that there are difficult legal issues concerning whether the courts can appropriately aggregate welfare affects across different generations of consumers.

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