



The Patent-Antitrust Intersection: A Reappraisal

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THE PATENT-ANTITRUST INTERSECTION: A REAPPRAISAL

*Louis Kaplow**

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HARVARD LAW REVIEW

THE PATENT-ANTITRUST INTERSECTION: A REAPPRAISAL

Louis Kaplow*

The conflict between antitrust law and patent policy has incessantly perplexed courts and commentators. In this Article, Professor Kaplow develops and analyzes a conceptual solution to the patent-antitrust puzzle. This analysis is applied in a number of familiar contexts, and the resulting conclusions call into question much of the earlier analysis of these issues. Both the development of the model and the attempt to apply the theoretical framework in practice indicate that the problem is far more complex than has previously been realized. This Article is an attempt to clarify the issues, but in the end it may reinforce existing pessimism concerning the possibility of untangling the patent-antitrust intersection. The discussion also illustrates the difficulty of applying economic analysis to concrete problems in a manner that yields confident conclusions.

THE intersection of antitrust law and patent policy has proved to be a source of perpetual confusion and controversy since the passage of the Sherman Act nearly a century ago. In the courts, this confusion manifests itself in the continual flux of patent-antitrust doctrine, the apparent inconsistency among many segments of that doctrine, and the difficulty courts have in articulating rules and standards. Commentators have continued the debate for decades but generally have been unable to agree upon common bases for judgment or even to pinpoint the sources of disagreement.

Approaches to the patent-antitrust conflict fall into three general categories. The first sidesteps the conflict by pretending in one way or another that one half of the problem does not exist. Courts and commentators vary regarding which half they emphasize and generally do not explain why they effectively ignore the other half. The second approach resolves the conflict by invoking formalistic constructions that are indeterminate and only superficially address the issues at stake. The third approach focuses on the relationship between the reward a patentee receives and the value of the patent. This approach has much in common with the first in that it emphasizes patent policy

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at the expense of antitrust policy, and with the second in that it is often justified by appeals to many of the more popular formalisms. Part I of this Article describes the patent-antitrust conflict in a manner that indicates the weaknesses of the prevalent approaches, and shows that the conflict runs even deeper than has generally been recognized.

Part II develops and analyzes a conceptual solution to the patent-antitrust puzzle. The proposed test examines the ratio between the reward the patentee receives when permitted to use a particular restrictive practice and the monopoly loss that results from such exploitation of the patent. Because reward is assumed to induce inventive activity and thus to produce social benefits, this ratio indirectly reflects a relationship between social benefit and social cost (monopoly loss). Thus, generally speaking, the greater the ratio, the stronger is the case for permitting the practice. Part III evaluates the more prominent previous approaches to the conflict in light of the ratio test analysis presented in Part II. Parts IV through VII apply the analysis to the problems of price-restricted licensing, agreements involving competing patents, price discrimination, and patentee control of unpatented end products. Although each of these four Parts reaches conclusions with varying degrees of confidence, the conclusions nonetheless call into question much of the previous analysis of these issues.

The ratio test is conceptually simple, yet its practical application is quite complex for a number of reasons. First, coherent practical conclusions about patent-antitrust doctrine can be reached only if similar conclusions have already been made concerning patent policy as a whole, and it is well known that the empirical foundations for current patent policy are shaky at best. Second, even given a developed patent policy, one faces the difficult task of ascertaining the economic effects of a wide variety of patentee practices. This task not only raises most of the ongoing disputes concerning the appropriate contours of antitrust policy generally, but is also subject to several additional sources of uncertainty peculiar to the patent-antitrust context. This Article is an attempt to clarify the issues, but its revelation of the unavoidable complexity of the problem indicates that, in practice, the untangling of the myriad strands in the patent-antitrust conflict might prove impossibly difficult.

I. THE DIRECTNESS OF THE PATENT-ANTITRUST CONFLICT AND SOME IMPLICATIONS

Although the conflict between the patent statute¹ and the antitrust laws has long been thought troublesome, it is in fact even more deep-seated than is generally perceived. Consider a patentee² that intends

¹ 35 U.S.C. (1982).

² The same analysis is generally applicable for assignees, *but see infra* subsection II.B.2(b); in some instances, this analysis may also be applicable to practices of licensees.

to employ a particular restriction, practice, or strategy in exploiting its patent. Limiting the analysis to the antitrust issues, which is the intended scope of this Article,³ one might initially conclude that the practice should be held permissible only if it does not violate the antitrust laws.

Not long after the passage of the Sherman Act,⁴ however, courts realized that this approach is too facile.⁵ A practice is typically deemed to violate the antitrust laws because it is anticompetitive. But the very purpose of a patent grant is to reward the patentee by limiting competition, in full recognition that monopolistic evils are the price society will pay. Generalizing from this principle, one could reverse the initial conclusion, arguing that any action by a patentee in violation of the antitrust laws is privileged under the patent statute.

Courts subsequently recognized that this conclusion was also too simplistic, because the patent statute was plainly not intended to bestow upon each patentee *carte blanche* in all its endeavors. For example, a patentee who negotiates a favorable royalty by holding a prospective licensee at gunpoint clearly will not be relieved from the proscriptions of either criminal or contract law. The question is whether one should view antitrust law any differently.⁶ At a minimum, it seems clear that a firm having one otherwise insignificant patent may not freely engage in price-fixing, mergers, predatory pricing, or anything else it wishes solely on that account. The statutory limitation of the patent grant to seventeen years⁷ illustrates the position, now generally accepted by commentators,⁸ that the reward for

³ Of course, some other categories of patent abuse are not subsumed within antitrust, fraud, or other general laws.

⁴ Ch. 647, 26 Stat. 209 (1890) (codified as amended at 15 U.S.C. §§ 1-7 (1982)).

⁵ See, e.g., *Bement v. National Harrow Co.*, 186 U.S. 70 (1902).

⁶ It is fruitless to attempt to resolve the patent-antitrust conflict by examining the general purposes behind the statutes in the hope of establishing a simple hierarchy that would indicate which policy should always prevail; at this level of generality, arguments can readily be made to lead to either result. First, one could argue that patent policy naturally governs in the event of conflict with other laws setting competition policy, such as antitrust law. One could conclude that the patent statute is not intended to displace *all* fields of law upon which it implicitly relies; for example, patent exploitation requires the enforcement of a wide variety of contracts even if no licensing is involved. In the realm of competition policy, however, the patent statute presumably is intended to govern, because it is specifically designed to change the ordinary competitive environment.

Conversely, one could argue that patent law should naturally give way to other laws setting competition policy. One might contend that the argument for the supremacy of patent policy is *stronger* in fields of law outside competition policy and that the patent statute should govern in cases of direct conflict. For example, a seller's right to dispose of goods as it wishes should be overridden if production of the goods infringes on another's patent. But antitrust law is specifically designed to regulate the competitive environment, and one therefore cannot simply assume that its policies were meant to give way in cases of direct conflict. This argument appears particularly strong when one considers that none of the antitrust statutes contain exceptions for patent exploitation.

⁷ See 35 U.S.C. § 154 (1982).

⁸ See, e.g., sources cited *infra* note 36.

inventive activity should not be unbounded. This realization, however, does not indicate whether any or all practices in violation of the antitrust laws are out of bounds.

Most formulations that seek to mediate the patent-antitrust conflict begin by asking whether the restrictive practice in question results in excessive profits to the patentee or merely permits the patentee to realize part of the reward appropriate to the patent.⁹ Thus, although the premise has never been fully explicit, courts and commentators appear to have thought that patent-antitrust doctrine should be determined by reference to a specific level of aggregate reward. The following discussion demonstrates how even this slightly refined formulation leads to conclusions quite different from those that courts and commentators might expect. These conclusions motivate the alternative framework that is constructed in Part II.

In considering the implications of making a particular level of reward the policy goal of patent-antitrust doctrine, it is useful to consider two extreme doctrinal regimes:

1. *Antitrust laws reign supreme*: A patentee's practice is deemed illegal if it violates any aspect of antitrust law; no privilege is accorded to patentees.¹⁰

2. *Patent statute reigns supreme*: The antitrust laws cannot render the patentee's practice illegal; the patentee has an absolute privilege to violate the antitrust laws.¹¹

From the perspective of antitrust and patent policy, consider how these two regimes differ. Under regime 1, the patentee would not be allowed, for example, to use price-restricted licenses or to enter into certain patent pools, but would still be permitted to exploit the patent on its own, to sell all rights under the patent to another entity, or to enter into various intermediate arrangements that do not violate any provisions of the antitrust laws. Under regime 2, however, the patentee would be permitted to engage in all of the practices barred under regime 1. Assume that the typical expected reward to the patentee under regime 1 is x .¹² Presumably x is not trivial, though it

⁹ See *infra* subsection II.A.3 and Part III.

¹⁰ This hypothetical is offered for heuristic purposes only; I make no effort here to be rigorous. Indeed, the statement of the first regime is internally inconsistent: if antitrust law truly reigned supreme, with no privilege whatsoever accorded to patent exploitation, the patent system itself would be nullified because the very act of enforcing one's patent involves monopolization. This difficulty in articulating one of the extreme positions results from the attempt to specify the framework in formalistic terms, an issue discussed further in Section III.B.

¹¹ Problems of definition — including extremism — similar to those noted in the preceding footnote are fully applicable here. See, e.g., *supra* p. 1817 (insignificant patent should not justify wholesale exemption from antitrust prohibitions).

¹² The reward x can be conceived as an amount, a percentage of something, a multidimen-

is less than the reward under regime 2, which I will assume to be $x + 10$.¹³

Which regime is preferable depends upon how much reward is deemed appropriate. If patent policy dictated an outcome less than or equal to x we would prefer regime 1; if greater than or equal to $x + 10$, regime 2. (Outcomes between x and $x + 10$ will be considered momentarily.¹⁴) But one might ask why legislators would care which regime courts¹⁵ selected, because the legislature could simply adjust the underlying grant. For example, the legislature need only increase or decrease the patent life to compensate for the prohibition or authorization of anticompetitive practices. Therefore, one could argue that it is irrelevant which regime — or which point in between — is adopted by the courts.

There are at least two reservations one might have about such an argument. First, our patent policymaker, Congress, is noted for inaction and has not changed the patent life in over a century. This suggests that Congress is not making such ongoing adjustments.¹⁶ Second, perhaps Congress has chosen to set the patent life¹⁷ only approximately, leaving to the courts the task of fine-tuning the amount of reward in response to changes in technology and the structure of the nation's economy. Although this second point might not seem

sional vector, or anything else thought necessary to capture the relevant incentive aspects of the patent system.

¹³ The choice of "10" is arbitrary, and purely for illustrative purposes. Any number could be selected by simply making the appropriate redefinition of the units in which x is measured.

¹⁴ The likelihood that an intermediate value is desired depends upon the magnitudes involved. For example, if x were large, so that the range between x and $x + 10$ were relatively small — that is, if the choice of patent-antitrust doctrine had only a modest impact upon the aggregate expected reward — it seems most likely that the optimal scheme would be one of the two extreme regimes presented. Cf. *infra* pp. 1837–38 (discussing Turner's position); *infra* note 81 (showing that interaction between patent life and patent-antitrust doctrine is minimal if patent-antitrust doctrine has little impact on total reward).

¹⁵ To the extent that antitrust enforcement is largely determined by actions of government prosecutors rather than in suits by private parties, prosecutors' actions would presumably be viewed similarly to those of the courts.

¹⁶ This view may not be especially powerful, because Congress' inaction might be explained for other reasons. Among these other possible explanations are that courts have usually been right, that Congress considers the effect of antitrust law on patent policy insignificant, that the patent life has been changed previously, and that Congress has made other changes in the patent statute and has actively considered various modifications in light of decisions in this area, see, e.g., Stedman, *Patents and Antitrust — The Impact of Varying Legal Doctrines*, 1973 UTAH L. REV. 588, 614 n.61.

¹⁷ The patent life is not the only feature of patents and patentability established by the patent statute; it is selected for illustrative purposes because it is the most obvious and straightforward aspect of the patent grant to use as a device for calibrating the magnitude of the typical reward. A related policy instrument that has been studied far less is the breadth of the coverage of the patent laws. See Nordhaus, *The Optimum Life of a Patent: Reply*, 62 AM. ECON. REV. 428, 429–30 (1972).

very plausible,¹⁸ it is instructive to accept this view of the courts' role for a moment to see what conclusions it suggests.

Suppose, for example, that the courts were to determine that the appropriate reward is $x + 5$. The resulting patent-antitrust doctrine would thus be a compromise between regimes 1 and 2; neither the patentee nor the government would always be the victor. But how should a court decide any particular case? As is often true in the law, the decision in one case will depend upon the decisions in related cases. Yet in this context, the interdependence is extreme: in general, it is wholly indeterminate how any individual case or, similarly, any single component of patent-antitrust doctrine should be decided, because the question is whether the *totality* of the courts' patent-antitrust decisions leads to the appropriate reward of $x + 5$. A court could just as easily permit a prohibited restriction, as long as it prohibited some other previously permitted restriction (or group of restrictions) yielding the same aggregate reward. *Any* pattern of doctrine yielding a total reward of $x + 5$ would be acceptable. For example, reversing all the rules of a given pattern that yields $x + 5$ — that is, permitting what was previously prohibited and prohibiting what was previously permitted — might also yield the same total.¹⁹ Thus, a focus on aggregate reward produces the conclusion that patent-antitrust doctrine is indeterminate both in the context of individual cases and when one considers the area as a whole.

Given the startling implications of this indeterminacy, one might wonder why courts and commentators have not expressed greater concern in resolving patent-antitrust cases. This problem has never fully emerged because neither courts nor commentators have explicitly considered the consequences of tacitly relying on aggregate reward as a criterion for decision. Legal materials on this subject reveal that efforts have been directed only toward deciding each case on its own facts, in a manner that bears no resemblance to a policy approach focused on aggregate reward in the manner just described. Once one recognizes and understands this indeterminacy problem, however, one must undertake a deeper critique of legal discourse in this area and its relation to the questions and policies at stake.

¹⁸ Some possible reasons for skepticism are the incredible complexity of this area, which leads one to expect delegation to a regulatory agency; the inefficiency of relying on the courts for fine-tuning because of the substantial and otherwise unnecessary litigation that would be required; the lack of attention Congress has given the issue in passing antitrust laws; and the limited bounds of the apparatus and the difficulty of adjusting it. *See also infra* Section II.C (discussing interdependence of Congress and the courts).

¹⁹ It would not necessarily yield the same total, because the reward induced by a particular restriction in general will be affected by which other restrictions are permitted. For a more general discussion of this issue, see *infra* Section II.C.

II. A FRAMEWORK FOR APPROACHING THE PATENT-ANTITRUST CONFLICT

This Part offers partial relief from Part I's discouraging conclusion that patent-antitrust doctrine, although it addresses important concerns in the aggregate, has a largely indeterminate content in the context of individual cases. This relief derives in part from relaxing certain simplifying assumptions implicit in the preceding analysis — assumptions that have not been expressly articulated in prior attempts to address this issue. An analysis that moves beyond such simplifying assumptions yields a far more complicated perspective on the patent-antitrust conflict, but one that is unavoidable if there is to be any hope of clarifying the formidable problems that the conflict raises.

The indeterminacy problem described in Part I rests upon the unstated assumption that the various patentee practices that clash with the antitrust laws are fungible. Part I assumed that the only factor relevant in assessing various practices is the amount of reward to the patentee that results from permitting the practice — two practices providing the same reward were considered equivalent and thus interchangeable. But equal reward is not a sufficient condition for fungibility; for two practices to be equivalent, it is also necessary that they cause equal detriment. In other words, the result of Part I depended on the assumption that restrictive practices that are equally good as rewards to the patentee are also equally bad in terms of the monopolistic harms they cause. More precisely, as will be demonstrated implicitly in the derivation of the ratio test in Section B, it was assumed that the ratio of good to bad was the same for each practice.

On its face, this assumption may seem reasonable. The patentee's reward is made possible through monopolistic restrictions, and one might expect that the reward and the monopoly loss would each be roughly proportional to the extent of the restrictions and thus roughly proportional to each other. Although such a tendency will often be observed, it does not hold as a general proposition. It is simply not true that all activities generating equal profits impose equal damages upon society.

Although much of antitrust commentary (outside the patent-antitrust context) has consisted of debate over which practices should be prohibited by the antitrust laws and which should not, little attention has been given to the question of *how much profit* the antitrust defendant derives from a given practice *in proportion to the harm caused*. It is not surprising that this issue has been neglected, because antitrust intervention is predicated upon the mere existence of a net harm to society. The magnitude of the harm is irrelevant, except perhaps in determining enforcement priorities. The amount of the defendant's profit is likewise of no special concern, except to the extent

its profit is deemed to be a component in determining the total social cost of a practice.²⁰ But when patent policy is also implicated, profit plays a central role, because it serves as a reward — and, in turn, an incentive — for the inventive activity that produces the benefits of the patent system.

When monopoly loss is viewed as part of the price society pays to stimulate inventive activity, the natural economic question is how society can purchase a given level of inventive output — which requires a given level of incentive — for the least cost, or, equivalently, how much inventive output society can purchase per unit of monopoly loss that it must bear. This question is intimately related to two policy decisions: first, how society should determine which antitrust prohibitions to apply to patentees, and second, how society should determine the time period over which patentees may exploit their patents. These two decisions — articulating patent-antitrust doctrine and setting the patent life — are interrelated. Part I has already suggested that patent-antitrust doctrine is dependent on the length of the patent life. The opposite connection exists as well: the amount of reward provided and the monopoly loss arising in each additional year in which exploitation is permitted (and thus the appropriate length of the patent life) depend upon what practices patentees may employ during that time period.

To untangle this interrelationship and thus clarify the factors relevant to resolving the patent-antitrust conflict, it is necessary to return to first principles. Section A begins this process by analyzing how the optimal patent life should be determined, taking as given the existence of a set of rules defining the permissible means of exploiting the patent during that time period.²¹ Section B examines how a given set of rules governing exploitation should be adjusted — that is, how patent-antitrust doctrine should be articulated — taking as given the optimal

²⁰ For discussion of profit as a component of social cost, see Kaplow, *The Accuracy of Traditional Market Power Analysis and a Direct Adjustment Alternative*, 95 HARV. L. REV. 1817, 1822–23 (1982); Posner, *The Social Costs of Monopoly and Regulation*, 83 J. POL. ECON. 807 (1975); Scherer, *The Posnerian Harvest: Separating Wheat from Chaff* (Book Review), 86 YALE L.J. 974, 978–79 (1977). Profit is also a component of standard damage measures in private treble damage actions.

²¹ The derivation of the optimal patent life is familiar to economists. See generally SENATE SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, SENATE COMM. ON THE JUDICIARY, 85TH CONG., 2D SESS., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 66–73 (Study No. 15, Comm. Print 1958) (prepared by F. Machlup) (discussing derivation of optimal patent life) [hereinafter cited as ECONOMIC REVIEW]; W. NORDHAUS, INVENTION, GROWTH AND WELFARE 70–90 (1969) (same); Scherer, *Nordhaus' Theory of Optimal Patent Life: A Geometrical Reinterpretation*, 62 AM. ECON. REV. 422 (1972) (same). Often, however, the dependence of this derivation upon restrictive practices permitted to patentees is not made explicit. Scherer's treatise seems to be an exception. See F. SCHERER, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 442 (2d ed. 1980) (“[O]n a more sophisticated plane, the problem is to design a system — e.g., by adjusting the length or strength of patent grants — that will yield the maximum surplus of benefits over costs.” (emphasis added)).

patent life derived in Section A. But as previously suggested, adjustments to the patent-antitrust rules generally make it necessary to revise the length of the patent life. Section C explores this feedback effect and demonstrates the need in theory to solve simultaneously the problems of articulating patent-antitrust doctrine and of determining the optimal patent life. The analysis presents a number of considerations, including the derivation of the ratio test, that are directly relevant to the debate over the patent-antitrust conflict. These considerations are summarized briefly in Section D. Section E then sketches some difficulties in applying this analysis through judicial decisions.

A. Deriving the Optimal Patent Life

1. *The Costs and Benefits of Varying the Patent Life.* — Determining the optimal patent life²² from an economic point of view²³ is straightforward once one has defined the functional relationships between the patent life and the costs and benefits of the patent system. To perform this task, however, one must know the range of permissible means of patent exploitation, including the content of patent-antitrust doctrine. Therefore, for the remainder of this Section, I shall assume that some such legal regime is in place.

(a) *Benefits of the Patent System.* — There are three links in the logical chain connecting the patent life and the benefits of the patent system. A longer patent life increases reward to the patentee, which in turn encourages inventive activity, which in turn produces social benefits. Consider these links in sequence. First, lengthening the patent life presumably increases the reward to the patentee by enhancing the opportunity for monopolistic exploitation. The amount that the reward will increase depends upon a number of factors, including the market value of the invention, the structure of the market involving the patented process or product, and the attributes of the patentee (such as marketing and production capacities) that determine its range of options within that market.²⁴ Second, the

²² This discussion, like most of the analysis in this Part, assumes that a single patent life will be set for all patents. Thus, the relationships to be described refer to the aggregate of all inventive activity subject to the patent laws rather than to individual inventions, types of inventors, or particular industries. See generally *infra* subsection II.E.2 (discussing possibility of varying rules case by case).

²³ This Article explicitly confines its analysis to one based on an economic perspective; the economic point of view represented here is itself a narrow version. The reader should keep in mind the standard reservations concerning the use of cost-benefit analysis, including the failure to account for distributional effects, see, e.g., W. NORDHAUS, *supra* note 21, at 76 n.9. Moreover, this Article does not address the effects of inventive activity on the quality of life, whether through the speed of technological change, effects on preferences, externalities (such as pollution), or increased societal emphasis placed on military activities.

²⁴ For example, the productive capacity of a patentee might determine whether it can produce all of the patented product itself or instead must license the patent in order to supply the entire market. See *infra* note 33.

increase in reward is designed to stimulate inventive activity. Determining the extent and types of increased activity is a complex process whose outcome will vary substantially from case to case. Relevant factors include the potential return from further research and development, the risk involved in the undertaking, the nature of rivalry among firms, and the degree to which the enhanced reward to successful patentees is anticipated by inventors. Third, the increase in inventive activity may contribute to social welfare. To the extent that valuable new inventions are discovered that otherwise would have been developed more slowly or not at all, social welfare might be increased.²⁵

Although each of these three connections has received substantial attention in the past, our knowledge of the functional relationships between the separate links in the chain connecting patent life to social benefits remains quite limited.²⁶ I make no systematic attempt here to remedy that deficiency in understanding, although much of the rest of the Article does offer insights into the first connection — that between patent life and reward. Rather, I assume for the moment that we have already made our best attempt, in light of existing information, to define the functional relationship between patent life and the social benefits generated by the patent system.

(b) *Costs of the Patent System.* — The costs of the patent system go beyond the direct costs of research and development, because the patentee's reward for inventing the patented item arises from allowing monopoly. Like the magnitude of the reward, the magnitude of the loss arising from the legally authorized monopoly depends upon the particular invention, market structure, and attributes of the patentee, as well as the legal rules regulating patent exploitation. The longer the patent life, the greater these costs. Moreover, lengthening the

²⁵ Of course, any benefits of inventive activity must be evaluated net of their direct costs. In addition, some induced inventive activity might be duplicative; the net gain in welfare from the invention might thus be less than it otherwise would have been, and the net gain for some inventions might even be negative. See, e.g., ECONOMIC REVIEW, *supra* note 21, at 51; Loury, *Market Structure and Innovation*, 93 Q.J. ECON. 395, 406-07 (1979); Usher, *The Welfare Economics of Invention*, 31 ECONOMICA 279, 286 (1964); Wright, *The Economics of Invention Incentives: Patents, Prizes, and Research Contracts*, 73 AM. ECON. REV. 691, 691 (1983). Numerous other factors also affect the relationship between inventive activity and social welfare, such as whether inventions are developed too quickly and thus at greater cost, see Barzel, *Optimal Timing of Innovations*, 50 REV. ECON. & STATISTICS 348 (1968), or whether private actors are more or less prone to taking risks than seems socially optimal, see Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY* 609, 611-14 (National Bureau of Economic Research Report 1962).

²⁶ See, e.g., W. NORDHAUS, *supra* note 21, at 81-82 (discussing the sensitivity of optimal patent life to changes in parameters of the system, which implies that uncertainty over parameter estimates results in uncertainty about the optimal patent life); see also sources quoted *infra* note 52 (indicating limits in present knowledge of costs and benefits of the patent system). But see W. NORDHAUS, *supra* note 21, at 83-86 (arguing that, although determination of optimal life is extremely difficult, welfare effects of departing from the optimal life might be insignificant).

patent life in order to induce further inventive activity increases the period of monopolistic exploitation for those inventions that would have been created even without lengthening the patent life. In regard to these inventions, prolonging the patent life results in a social cost not offset by any social benefit.²⁷ For present purposes it is assumed that the functional relationship between patent life and the social costs generated by the patent system is known. Later analysis will address in greater detail how monopoly cost varies in different circumstances.

Finally, in defining social costs and benefits, this Article does not address the merits of transferring wealth from consumers to producers in general,²⁸ or to patentees in particular. These distributional considerations bear directly on the construction of the social cost and benefit functions, and would be taken into account in that process. Only after considering all such factors and deciding that some patentee reward is socially desirable does one undertake further analysis such as that offered in this Article.

2. *Determining the Optimum.* — The optimal patent life is that length of time at which the marginal social cost of lengthening or shortening the patent life equals the marginal social benefit.²⁹ If the

²⁷ See, e.g., F. SCHERER, *supra* note 21, at 443–44. It should be noted, however, that one possible source of social benefit might be greater incentives to invest in the development process. See *infra* p. 1839 & note 71.

²⁸ See generally Lande, *Wealth Transfers as the Original and Primary Concern of Antitrust: The Efficiency Interpretation Challenged*, 34 HASTINGS L.J. 65 (1982) (noting importance of distributional effects).

²⁹ See W. NORDHAUS, *supra* note 21, at 76–86; Markham, *Inventive Activity: Government Controls and the Legal Environment*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY, *supra* note 25, at 587, 597.

Whether such an interior solution exists depends upon the relative slopes of the marginal cost and marginal benefit functions. It seems plausible, although by no means certain, that the marginal cost function will rise and the marginal benefit function will fall as the patent life increases. The marginal benefit function can be expected to fall, because one can anticipate diminishing returns to society as increases in the patent life cause further resources to be devoted to inventive activity. For example, enhanced rivalry leading to duplicative investment, *see* sources cited *supra* note 25, might contribute to diminishing returns. In addition, risk effects relating to inventors' incentives might produce the same result. Inventive activity is risky, and private entities generally exhibit at least some risk aversion. Because the risk-deterrence effect increases as a function of the scope of the project, larger scale inventions — those that are more costly but have a prospect of greater returns — will require relatively more inducement. Inventive activity is a function of rewards, and, in the case of more costly projects, higher levels of reward will on average tend to be decisive — that is, higher levels of reward will be necessary to change a decision against the project to a decision in its favor. Combining these last two points yields the conclusion that as rewards rise, the marginal increase in incentive associated with a given increase in rewards will decline. This is the relationship that defines diminishing returns in the incentive function. Because benefits are a function of incentives, total benefits as a function of rewards will have a tendency to exhibit diminishing returns.

The basic reason one might expect the marginal cost of increasing the patent life to be an increasing function is that the greater the patent life, the greater is the number of patents already in existence at a given time. Thus, the greater the existing patent life, the greater is the social cost of any further increase in the patent life, because an ever-increasing number of

patent life were shorter than the optimum indicated by this rule, the marginal benefit of lengthening the patent life would presumably exceed the marginal cost; increasing such a patent life would induce further inventive activity that would produce benefits in excess of the accompanying social costs. Similarly, for patent lives longer than the optimum, the marginal cost presumably would exceed the marginal benefit; decreasing such a patent life would then reduce costs by more than the reduction in benefits.

Notice that equating costs and benefits *at the margin* does not result in equating *total* costs and benefits. In fact, equating total costs and benefits would be irrational because the result would be a patent

preexisting patents can be further exploited. This result, however, does not necessarily follow, because it depends upon the curvature of the relationship between the patent life and the level of inventive activity. Ignoring the effect on the cost function of inventive activity's responsiveness to patent life is equivalent to assuming, as a first approximation, that the cost function is linear. Finally, it should be noted that, because a number of inventions would still occur without the patent system, even the first year of permitted patent life imposes substantial costs; it is therefore possible that the optimal patent life would be zero. See F. SCHERER, *supra* note 21, at 443-44.

A number of qualifications are in order. First, because costs must be discounted to present value, future costs are less detrimental than current ones of the same nominal amount. This fact, however, will not affect the analysis that compares the marginal costs and benefits of changing the patent life, because the reward, which feeds into the benefit function, is similarly discounted by the patentee. See Nordhaus, *supra* note 17, at 429. If the discount rates used were not equal, however, there could be some effect in a direction that depends upon which discount rate was larger. In addition, the fact that the pattern of costs and benefits may not match from one year to the next has no direct impact on determining the optimal patent life, because the patent policy decision involves extending the patent life at the margin, which compares costs and benefits in the same year. Yet the marginal extension may change the patentee's exploitation decisions in earlier years; thus, the assumption that considerations of discounting will not affect the analysis is not completely accurate, although it seems reasonable as a first approximation.

Second, adding an additional year to the patent life does not simply replicate the previous year's experience. For example, the market structure after expiration of the patent might be affected by the patent's duration, especially if there are learning-curve effects over the life of the patent. Although such effects do vary with the life of the patent, there is no reason to believe that the relationship is strictly linear. Third, other inventive activity relevant to the initial patent might occur over the life of the patent and thus change the environment and affect both the cost and benefit functions. See, e.g., *infra* Part V. Finally, market structure might change over time for any number of other reasons.

It is instructive to compare the assumption that the cost function is roughly linear as a first approximation — ignoring that more patents exist when the patent life is longer — to the benefit function that was hypothesized to exhibit diminishing returns. In general, cost and *reward* (in contrast to benefit) to any individual patentee increase in approximately the same proportion as the patent life is increased. This view is consistent with the qualifications concerning the linearity of the cost function because those same qualifications will have roughly similar impacts upon profits (rewards). The relationship between reward and benefit — which operates through the connections between reward and inventive activity, and between inventive activity and benefit — presumably exhibits diminishing returns. Thus, it is reasonable to expect that equating marginal costs and benefits would yield a unique solution that would be a maximum, unless marginal costs exceed marginal benefits when patent life is zero, in which case the global optimum would be a patent life of zero.

system that yielded zero net gain in social welfare. The optimum is attained when the total social benefits exceed the total social costs by the greatest possible amount. Thus, all that can be known about the relationship between total benefits and costs at the optimal patent life is that total benefits exceed total costs; if this were not true, the optimization process would have indicated that there should be no patent system at all.

3. *Limitations of the Proportionality Test.* — A careful analysis of the steps for determining the optimal patent life reveals the fallacy underlying the common view that patent restrictions should reward the patentee in proportion to the value of its patent.³⁰ This view has superficial appeal in two respects. First, as between two patentees, the one with the more valuable patent generally should receive the greater reward, because the more valuable invention should be encouraged even if it entails greater cost. But this unrefined notion of proportionality provides no information about what the specific proportion between reward and value should be; rather, it merely suggests that this proportion should be roughly similar for all patents.³¹ Moreover, even given a particular proportion, this notion of proportionality does not help us to decide which restrictive practices to authorize or to prohibit.³² In some circumstances, one patentee might be unable to exploit its patent in the manner that others employ without resorting to a prohibited practice; permitting the practice would then promote this sort of proportionality.³³ In other instances, only some patentees would be able to obtain most of the rewards made possible by a particular restrictive practice; prohibiting the practice would then enhance this type of proportionality.

A more important reason one might favor linking the patentee's reward to the patent's social value is that such a link corrects the

³⁰ This view is discussed below in Sections III.C and III.D.

³¹ Even this limited claim is subject to numerous qualifications if factors distinguishing among various patents and patentees can be used to develop a more case-specific policy or if variations in any of the relevant factors, such as risk aversion, are systematically correlated with the value or cost of inventions. See *infra* subsection II.E.2.

³² This fact assists Bowman in regarding most restrictive practices to be indistinguishable. Thus, he has no difficulty moving from the generally accepted view that some patent exploitation should be permitted to the conclusion that virtually unlimited exploitation should be permitted. This analysis suggests that patent life should also be unlimited. Yet the inability to make distinctions on this ground leads to such conclusions only if no other distinctions are deemed relevant. The analysis in Section B shows that this is not the case. Bowman's views are discussed more completely in Section III.C.

³³ For example, a small patentee might need various restrictions to accomplish what a large or dominant entity could achieve through unilateral exploitation. See F. SCHERER, *supra* note 21, at 449. Of course, if restrictions were thought to be undesirable, a preferable response to this situation would be to limit the scope of permissible exploitation by a single firm. Although it might not always be possible to achieve equality through such an approach, it does not follow that equality achieved through permitting restrictive practices is preferable. Two wrongs, although perhaps more equitable, might not be more desirable.

market in a manner that induces private actors to develop the appropriate inventions. Absent patent protection, an inventor might capture only a small portion of the value of its inventive activity. As a result, the inventor in many cases could not expect to receive rewards sufficient to cover its costs, even if those costs did not exceed the social value of the invention. The appropriate policy would thus be to permit the patentee to receive reward equal to the full value of its patent. All reward up to that point induces inventive activity only as long as the inventor's expected reward, which equals the expected value of the invention, exceeds (or at least equals) the inventor's expected cost in developing the patented item.³⁴

This proportionality argument, however, has a simple but fatal flaw: it overlooks the costs of providing the reward. The argument suggests, for example, that the optimal policy is to permit an unlimited patent life with no restrictions upon practices of exploitation, as long as such practices do not result in reward that exceeds the total value of the patent.³⁵ Such a view incorrectly focuses on total social benefits, rather than *net* social benefits (the excess of total benefits over total costs). Taking into account the costs of the patent system leads to the more accurate intuitive view that the optimal patent life combined with the optimal set of antitrust restrictions would provide *less* reward than indicated by the full value of the patent.³⁶ Thus, the rule that the reward must not exceed the value of the patent is only a necessary condition for the desirability of a restrictive patentee practice.³⁷ It is not a sufficient condition not only for the reasons suggested in Section B, but also because the reward would still be excessive if it were not as much less than the full value of the patent as the optimization process suggests it should be.³⁸

³⁴ Any inventive activities induced by rewards beyond that point would be those for which the expected cost exceeded expected value. If inventors are risk averse, however, it might be necessary to offer an expected reward greater than the value of the patent.

³⁵ This statement is not fully accurate. For example, rivalry that led to duplicative research activity might justify reducing the reward. Moreover, private benefits might generally exceed social benefits even without patent protection. See Hirschleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 AM. ECON. REV. 561 (1971). The possibility of adverse effects from long-run changes in market structure occurring over the patent life adds another element to aggregate social cost and reinforces this conclusion about the relation of private to social benefits. One offsetting factor is that if spillovers from the patentee's research are not included in measuring the value of the patent, there would be a tendency for the reward based on this measure of value to be insufficient. This issue is relevant to determining the appropriate breadth of the patent grant. None of these qualifications affects the argument in text, which establishes that even further reductions in reward from the level suggested by the preceding factors will always be appropriate. Of course, it is possible that after taking all these effects into account, the patent system would be found unnecessary.

³⁶ See, e.g., ECONOMIC REVIEW, *supra* note 21, at 39, 62-66; W. NORDHAUS, *supra* note 21, at 88-89; F. SCHERER, *supra* note 21, at 442.

³⁷ A qualification would be necessary if spillovers from the inventive process were substantial enough to overwhelm all the contrary effects discussed *supra* note 35.

³⁸ Optimization through equating marginal cost and benefit will yield some average propor-

Once one realizes that the proper level of reward is determined not by simple deduction premised on the value of the patent, but implicitly from a process that seeks to maximize net social benefits, it becomes obvious that the legal system must regulate not only the total reward a patentee receives, but also the means by which that total is realized. This observation is generalized in Section B.

B. Patent-Antitrust Doctrine and the Ratio Test

1. *Derivation and Interpretation of the Ratio Test.* — In deriving the optimal patent life, Section A took as given the existence of a patent-antitrust doctrine³⁹ indicating the scope of permissible patent exploitation. This Section considers how to optimize that doctrinal configuration, taking as given the patent life derived in Section A.⁴⁰

(a) *Deriving the Ratio Test.* — One can assess the desirability of permitting a currently forbidden practice⁴¹ by comparing the costs it imposes upon society with the costs of adjusting the patent life to achieve an equivalent reward. The method proceeds in two steps. First, one determines whether permitting the practice would impose more cost per unit of incremental reward than would result from lengthening the patent life to provide the same reward. If so, the practice should remain prohibited because it would be costlier to provide additional reward by permitting the practice than by length-

tion between reward to the patentee and value of the patent. But that relationship, which refers to *average* rather than *marginal* conditions, is an informational by-product of the optimization process that has no direct relevance in determining the appropriateness of particular restrictive practices. The proportionality approach implicitly begins by picking a proportion between reward and value and then uses the proportion as a decision rule. This process is both conceptually backwards and — because the proportion is typically assumed to equal one — wrong in its outcome.

Moreover, using a proportion of less than one is of little help. Such an approach offers no answer to the conceptual question of how such a proportion should be chosen. See *infra* p. 1892 (indicating how far removed such a proportion is from the targets of the optimization process). In addition, the proportionality test is easy to apply only when the proportion equals one. The proportionality test is typically used by arguing that a licensee's or buyer's willingness to deal with the patentee implies that the reward is less than the value of the patent. See, e.g., *infra* subsection III.C.1. Such an observation demonstrates only that the proportion is less than one; it offers no basis for the inference that the proportion is less than some number smaller than one. The latter inference requires far more detailed information concerning not only the rewards, but also the value of the patent. The value of the patent could prove most difficult to determine. The problems posed by the lack of information are briefly discussed in subsection II.E.1.

³⁹ There are other doctrines, such as rules governing patent misuse and aspects of contract law, that regulate patent exploitation. Although they are taken as given in a literal sense for the purposes of this Article, the analysis here is fully applicable to those issues as well.

⁴⁰ This view of the problem corresponds to the situation facing the courts: although they have jurisdiction to articulate patent-antitrust doctrine, they must accept the patent life set by Congress. This view would, of course, no longer apply if the patent life were not taken as given. For a full analysis of these points, see Section II.C.

⁴¹ The analysis for assessing the desirability of retaining a currently permitted practice is directly analogous.

ening the patent life, and if one began with a patent life that was determined to be optimal, lengthening the patent life is itself necessarily undesirable.

For example, suppose that the optimal patent life has been calculated to be seventeen years. Next, suppose that the patent life would have to be lengthened to eighteen years in order to produce the same additional reward that the practice in question can offer for the given seventeen-year patent life.⁴² If permitting the practice would entail more loss than would lengthening the patent life to eighteen years, the practice should not be permitted — permitting the practice would be costlier than extending the patent life to eighteen years, and the conclusion that a seventeen-year patent life was optimal implies that extending the patent life to eighteen years is itself undesirable.

If the practice in question would produce the same incremental reward as would extending the patent life one year, but at a lower cost, one proceeds to step two. A second step is necessary because extending the patent life was itself found to be undesirable. In the second step, one must determine whether permitting the practice would impose less cost per unit of incremental reward than would be saved by *shortening* the patent life to diminish the total reward by an offsetting amount. If so, the practice should be permitted because it is a less costly way of providing reward than was adding the final increment in the patent life.⁴³ There is, however, a qualification: the

⁴² The implicit assumption in this analysis, and much to follow, is that reward is fungible. See *infra* subsection II.B.2(c). In other words, patentees do not care how they get their profits, but simply how much profit they receive. Divergences from this assumption are considered in subsection II.B.2(c) (ex ante versus ex post perspective, for example) and in Section IV.A (non-profit-maximizing behavior).

⁴³ The practice might not impose less cost per unit, in which case it would remain unclassified after both steps of the test. In this case no firm conclusion is possible without the analysis developed in Section II.C.

This complication is related to the need to make an adjustment in the patent life for practices that satisfy the second step of the test. Both concerns arise because — although marginal benefits and marginal costs are precisely equal at the optimum — a one-year change in the life of the patent is not a diminutive change, just as an all-or-nothing decision to permit a practice previously prohibited is not a diminutive change. If one could make infinitesimal increases in reward — for example, by allowing restrictive practices for only part of the patent life — it would be possible to edge slowly toward the exact optimum. Because all-or-nothing changes are not this precise, however, full adoption of a practice may in the end result in overshooting the optimum and thus may leave society worse off than it was previously. (A technical derivation of this analysis is offered in the Appendix on pp. 1891–92.) Thus, it may be that permitting the previously forbidden practice would be more desirable than extending the patent life by a full year, but still not low enough in cost to warrant implementation. Any increase in the amount of the reward reduces the marginal benefit of further increases, because of the diminishing returns assumption. See *supra* note 29. Hence an infinitesimal increase in reward from using a particular practice might be desirable (because the change has a favorable proportion of cost to benefit), whereas full adoption of the practice, which might be the only practical alternative to prohibition, need not be desirable. Because benefits do not increase proportionally with costs, the proportion of cost to benefit may no longer be favorable.

conclusion that the practice should be permitted rests on the assumption that the patent life will be correspondingly reduced. This reduction is necessary if we are to maintain the total reward at the level implicit in the original optimal patent life. It should be noted, however, that this result runs counter to a basic assumption of this Section: that the patent life was to be taken as given. Thus, the implications of this qualification require a separate and thorough examination — an examination provided in Section C.

The preceding analysis can be cast in terms of a ratio test, with the ratio defined as:

$$\frac{\text{Patentee Reward}}{\text{Monopoly Loss}}$$

In this ratio, “patentee reward” and “monopoly loss” refer, respectively, to the *incremental* reward and loss resulting from the practice in question. In general, the higher the ratio, the more desirable the practice. In addition, the ratio test may be used to determine the desirability not only of restrictive practices, which are the subject of patent-antitrust doctrine, but also of changes in the patent life itself. Every patent life implies a specific ratio. The ratio implicit in a given patent life simply refers to the ratio of incremental reward to incremental loss that results from a marginal adjustment in the patent life.

The components of the ratio test should be contrasted with the central factors used in Section A. The ratio here compares marginal patentee *reward* to marginal cost (marginal monopoly loss) rather than marginal social *benefit* to marginal cost. The latter pair of factors was used in Section A to determine the optimal patent life.⁴⁴ The focus in this Section is on patentee reward rather than social benefit primarily because the analysis here takes the optimal patent life as given and asks whether the total reward to the patentee implicit in the optimal patent life can be achieved at a lower cost.⁴⁵

(b) *Applying the Ratio Test.* — The technique for assessing the desirability of restrictive practices can be recast in terms of this simple ratio as follows. One first determines the ratio implicit in the optimal patent life derived in Section A. If that patent life were seventeen

⁴⁴ Of course, at the optimum, the ratio of marginal costs to benefits equals one because the two functions are equated. The difference between these ratios is most clearly seen using the notation in the Appendix. See *infra* p. 1891 & note 278.

The link between reward and benefit is partially reconsidered in subsection 2(c) of this Section.

⁴⁵ One could also ask whether additional reward can be produced at the same cost. These formulations are equivalent in most circumstances. They would diverge only if, after some point, additional reward caused social benefit to decline rather than increase. Yet because the costs of the patent system will cause the optimal patent life to be short of this point, see *supra* p. 1828, the alternative formulation would be valid, as long as the change in reward caused by permitting a previously prohibited restrictive practice was sufficiently small. For a comparison of discrete and infinitesimal changes, see *supra* note 43.

years, for example, one could determine the amounts of incremental patentee reward and monopoly loss that would result from extending the patent life to eighteen years and thus compute the ratio of reward to loss for the eighteenth year.⁴⁶ This patent-life ratio could then be compared to the ratio for any given restrictive practice.⁴⁷ Practices with ratios lower than that for the eighteenth year should be prohibited, and those with higher ratios should — subject to the requirements of the second step — be permitted.⁴⁸

This method of analysis is important for determining the desirability of various restrictive practices because the ratio will not be the same for all restrictions. Two examples, to be discussed at length later in this Article, illustrate this point. At one extreme, consider a patentee that, having invented a minor process improvement, arranges price-restricted licenses covering the entire industry and sets prices substantially above those prevailing before the licensing agreement. Assume further that, because the significance of the patent is rather limited, the royalty charged by the patentee is rather small. In this

⁴⁶ Instead, one could determine the ratio for the 17th year. The complexity addressed at pp. 1830–31 and in notes 43 and 45 arises precisely because these two ratios might differ. Practices that have a smaller impact on reward than a one-year change in the patent life can be unambiguously evaluated — subject to any necessary adjustment in the patent life — as long as their ratio exceeds or falls short of the ratios for both the 17th and 18th years of the patent life. Ambiguity arises if the ratio for the practice in question falls between the two patent-life ratios. Because the ratios for the two years are probably rather close, this problem is not likely to be very significant.

A further qualification arises with respect to the assumption that the impact of the practice on reward will be less than or equal to the impact of a one-year change in the patent life from the optimal life. If more than one practice is changed from the pattern assumed to have been in place when the optimal patent life was derived, the *total effects* of all the changes would have to fall within the necessary boundary. This issue is the topic of Section II.C.

⁴⁷ Cf. ECONOMIC REVIEW, *supra* note 21, at 73 (stating, in discussing compulsory licensing, that “both effects, the different incentive to search for patentable inventions and the different utilization of patented inventions, have to be analyzed and compared”).

⁴⁸ See *supra* pp. 1830–31.

It is also useful to ask what result should obtain in the case of a practice with a high ratio, but with a reward that exceeds the value of the patent. Because there is such a large effect upon the total reward, one must correspondingly reduce the patent life. The result is to permit massive reward, but only for a brief period of time. As long as the ratio for the practice exceeds the ratio implicit in the patent life, even as the patent life is shortened, this trade-off is beneficial. This analysis might appear to contradict the earlier point that a necessary condition for the desirability of permitting a practice is that the reward not exceed the value of the patent. See *supra* subsection II.A.3. The apparent paradox is resolved by noting that the value of the patent is typically viewed statically — when the reward is said to exceed the value of the patent, it is usually meant that the reward for a given time period (say one year) exceeds the value contributed by the patent *during that same time period*. But this relationship does not imply that the reward for the given time period exceeds the total contribution of the patent over the entire useful life of the invention. Hence rewards that seem excessive may be given for some time periods and no rewards may be given in others. The net result would be that the total reward over the readjusted patent life is *less* than the value of the invention over its useful life (which in this case would have to be longer than the patent life) even though, at any instant of time during the brief patent life, reward would exceed value.

case, the patentee's incremental reward will consist of the modest royalty payments and a share, in proportion to the patentee's share of the market, of the excess profit resulting from the cartel prices. Unless the patentee has a very high market share, its reward from being permitted to use this scheme will be moderate in comparison to the total loss imposed. Thus, the resulting ratio will be rather small.⁴⁹

In contrast, consider a patentee that charges higher royalties to firms in industries in which the patent is more valuable, rather than charging a uniform royalty at some average level. The use of such discriminatory royalties has two effects. First, it increases total reward by transferring surplus to the patentee from those industries in which the patent is valued more highly. Second, it decreases output in industries charged an above-average royalty and increases output in industries charged a below-average royalty. Even if the output effects produce a net monopoly loss, it might be quite small because the output effects tend to be offsetting. Thus, the denominator of the reward/cost ratio will be relatively small. But because all the reward goes to the patentee, the numerator will be undiluted. Therefore, the ratio in this example might well be substantially higher than that in the first.⁵⁰

(c) *Cost-Effectiveness Analysis: A Practical Restatement of the Ratio Test.* — One practical limitation in applying the preceding analysis is that even if one ascertains the ratios for all relevant practices — in itself a most formidable and controversial endeavor — there is still insufficient information to determine any component of patent-antitrust doctrine⁵¹ unless one also knows the ratio implicit in the optimal patent life. Yet our knowledge is inadequate to inspire great confidence even in the desirability of having a patent system at all,⁵² much less in the ability to make the subtle measurements of

⁴⁹ This example is discussed further in subsection II.B.2(b) and Part IV. To the extent that the patentee already enjoys a very high market share, its ability to increase price above the competitive level will often not be substantially enhanced by such a cartel arrangement. See generally Landes & Posner, *Market Power in Antitrust Cases*, 94 HARV. L. REV. 937, 951-52 (1981) (comparing market power measures for dominant firms and cartels).

⁵⁰ This example is elaborated in subsection II.B.2(a) and Part VI. If perfect price discrimination were possible, there would be no deadweight loss from the patent system (subject to the reservations indicated earlier in notes 25 and 35). This suggests that direct price discrimination should be viewed more favorably than other restrictive practices. Nevertheless, the reservation pertaining to the resulting increase in the total reward, see *supra* notes 43 and 45, is applicable.

⁵¹ The exception would arise when the denominator was zero or negative, in which case antitrust considerations alone would permit the restriction, or when the numerator was zero or negative, in which case permitting the restriction would impinge upon both patent policy and antitrust policy. In these exceptional cases, there is no direct conflict between patent and antitrust policy. Even this exception would have to be qualified if the marginal social benefits of increasing the patent reward were negative.

⁵² See generally J. JEWKES, D. SAWERS & R. STILLERMAN, *THE SOURCES OF INVENTION* 253 (1958) ("It is almost impossible to conceive of any existing social institution so faulty in so many ways. It survives only because there seems to be nothing better."); ECONOMIC REVIEW,

marginal effects that determine the ratio implicit in the optimal patent life.

Even if this patent-life ratio cannot be readily determined, however, some cost-effectiveness analysis is still possible. In principle, one could derive the ratio for all possible restrictions and order them from highest to lowest. Regardless of the implicit patent-life ratio, improvements clearly might be made possible by shuffling the extant pattern of restrictions. For example, a currently permitted practice with a low ratio might be exchanged for a currently prohibited practice with a high ratio. If the total reward remained approximately the same after such exchanges, one could unambiguously conclude that the changes as a whole were beneficial, even though it might be impossible to know whether any single change was desirable.⁵³ This process essentially amounts to cost-minimization — the changes in patent-antitrust doctrine would provide the given amount of reward at the least possible cost.⁵⁴

supra note 21, at 79–80 (“No economist, on the basis of present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or a net loss upon society. The best he can do is to state assumptions and make guesses about the extent to which reality corresponds to these assumptions.”); Markham, *supra* note 29, at 598–99 (“[T]he studies have developed relatively little information on the social costs at which these positive benefits of the patent system are obtained.”).

⁵³ In fact, if the ratios for two restrictions were sufficiently close to each other, and to the ratio implicit in the optimum patent life, it would be possible that both changes, if taken in isolation of the other, would be undesirable even though exchanging the two would be desirable. This is not surprising because taking either change alone changes the total reward, which can be demonstrated to produce this seemingly paradoxical result.

⁵⁴ It might be thought possible to go further *if* one knew the optimal *total* reward. In response to the question in Part I of how the courts should go about providing a reward of $x + 5$, there would be a determinate answer. Courts would move down the ordered list of ratios, permitting those practices with the highest ratios and stopping when they reached the point at which the aggregate reward was $x + 5$. (Of course, to the extent that the decision concerning the permissibility of each restrictive practice is an all-or-nothing choice, *see supra* note 43; *infra* subsection II.E.2, this process could not be done precisely, because the change that moves the total reward up to $x + 5$ may overshoot somewhat and thus require some shuffling of doctrine to get as close as possible at the least possible cost.) The conclusions that no restrictive practices are permitted if that regime still provides a reward above the target, whereas all practices are permitted if it still leaves a reward short of the target, would just be special cases of this approach.

It is, however, no easier to use the total reward than to use the ratio implicit in the optimal patent life. First, the total reward implicit in the optimal patent life was not itself the target of the optimization process, but rather one of its by-products. (The discussion of the proportion of reward to the value of the patent in subsection II.A.3 and on p. 1892 is similar.) For example, whether it is appropriate to permit the 17th year of exploitation was not determined by asking whether the target total for appropriate reward had already been reached by permitting a 16-year patent life, but rather by considering whether permitting a 17th year increased social benefits by more than it increased social costs. It was this determination that fixed the optimal patent life, and that patent life that implicitly determined the total reward. Recall that the social benefit function connects patent life to reward to inventive activity to ultimate benefit. The optimization process chooses a particular patent life, and the implicit total reward is determined simply by reexamining the functional relationship between patent life and reward.

2. *Factors in Determining the Ratios of Particular Practices.* — As will be demonstrated in Parts IV through VII, there is considerable disagreement over the economic effects of various restrictive practices. This Article makes only modest attempts to resolve such controversies. Instead, it focuses on how to evaluate the desirability of allowing a practice once one has determined its effects. This Section discusses three recurring issues germane to determining the ratio for particular practices.

(a) *How Much of the Reward Is Pure Transfer?* — Once one determines that a particular practice yields a reward that is deemed appropriate, one must consider the cost of providing that reward. Not all reward to the patentee need be generated by forcing society to bear the full costs of economic waste arising from monopolistic exploitation. In some instances, restrictive practices will in large part simply transfer economic surplus from consumers to patentees, with little resulting economic waste. For example, in the hypothetical in which discriminatory royalties were used to increase the patentee's profits,⁵⁵ we saw that the effects on output were at least partly offsetting; as a result, the reward was achieved through a transfer of surplus with little or no accompanying economic loss. To the extent that the reward is accomplished through a pure transfer — that is, with no accompanying misallocation of resources or inefficiency in production — monopoly cost is avoided. Thus, practices in which a greater share of the reward is pure transfer will have a lower denominator (monopoly loss) for a given numerator (patentee reward) and, accordingly, a higher ratio. Alternatively, assuming we know how much a given restraint costs society (that is, assuming the denominator is fixed), the more the restraint results in a pure transfer to the patentee, the greater is the numerator, and thus the higher the ratio.⁵⁶ From either viewpoint, restrictions that are closer to pure transfers are to be preferred to those that are not, all else being equal.

(b) *What Portion of the Reward Accrues to the Patentee?* — There are two components to the question of what share of the reward accrues to the patentee. The first focuses on what share of the reward accrues to entities other than the one that exploits the patent.⁵⁷ In

Second, the total reward implicitly generated by equating marginal costs with marginal benefits in Section II.A, and relied upon to determine the cutoff point in moving down the list of ratios in this hypothetical, is not the fully optimized total reward, but rather the optimal reward *given* preexisting patent-antitrust doctrine. Thus, the rearrangement of patent-antitrust doctrine achieved through this ordering process yields precisely the same result as the cost-effectiveness analysis described in text; both processes minimize costs by adjusting patent-antitrust doctrine in order that permitted practices have higher ratios than prohibited practices and that the total reward remains fixed.

⁵⁵ See *supra* p. 1833 & note 50.

⁵⁶ A qualification would again be necessary if the marginal benefits were to become negative.

⁵⁷ Even if a given practice results largely in a pure transfer with little economic loss, the beneficial effects discussed above in subsection (a) will be substantially reduced if only a portion of that reward is realized by the actual patentee.

the example in which price-restricted licenses are used to cartelize an industry, other firms in the industry share in the reward roughly in proportion to their share of the market.⁵⁸ To the extent that reward accrues to these other firms rather than to the patentee, the numerator is smaller for a given denominator and therefore the ratio is lower.⁵⁹

The second component, which has been largely overlooked by courts and commentators alike, focuses on what portion of the reward accrues to the patentee in those instances in which the patentee is not the entity exploiting the patent.⁶⁰ For example, if some patentees must assign (sell) their patents at prices that do not reflect the true value of their inventions, permitting the assignees to reap a greater harvest might do little to stimulate innovative activity.⁶¹ This issue also arises to some extent when a patentee licenses its invention, because the return to the licensee may not all be transmitted to the licensor.

One might argue that it does not matter whether reward to the patentee or reward to the assignee is used in the ratio because the two measures typically will be equivalent. This would be true if patentees who assigned their rights anticipated, at the time they made their decisions to invest in inventive activity, that they would receive a price equal to the value the buyer expected to receive in exploiting the patent. Yet imperfections in the market for the sale of inventions can prevent the full reward from being passed on to the patentee.⁶² For many inventions, there might not be a large number of buyers.⁶³

⁵⁸ See *supra* pp. 1832-33. This will not be true to the extent of any royalties paid to the patentee by other firms in the industry.

⁵⁹ The relevance of this simple principle has been noted by others, although the analysis of why the principle is important generally has been inaccurate or incomplete. See, e.g., sources cited *infra* note 155. The problem is that commentators generally do not understand precisely how this principle is relevant because they rely on proportionality notions rather than on the ratio test. These tests are distinguished in this context in Section IV.B.

⁶⁰ This component perhaps has not come to the fore in our legal system because it implies that a restriction that is permitted when practiced by the original inventor could be prohibited when practiced by a purchaser. Such a distinction apparently violates the command to treat like cases alike by providing different treatment for similarly situated defendants. This formalistic objection, however, has little force because the phrase "similarly situated" begs the question. Nonetheless, one can imagine that the argument might have inhibited the inquisitiveness of many courts and commentators.

⁶¹ The desirability of allowing reward to the assignee for the exploitation itself must also be addressed. See *infra* p. 1839.

⁶² Cf. Caves, Crookell & Killing, *The Imperfect Market for Technology Licenses*, 45 OXFORD BULL. ECON. & STATISTICS 249, 257-58 (1983) (noting that only 40% of surplus accrued to licensors).

⁶³ Cf. *id.* at 250 (referring to often limited numbers of competent licensees). This can arise for a number of reasons. First, a patent might advance the frontiers of an industry in which only a few firms are yet capable of successful production or distribution. Second, patentees will profit more if they can reach most markets quickly. This may encourage or compel a patentee to deal with a limited number of firms. Third, a patent might be quite valuable, but only to a few buyers. This would be the case with a product serving a select group, or if a patent

In addition, there might be insufficient information for a seller to evaluate the potential for exploitation or for a buyer to evaluate the operational value of the patent. This problem will be compounded if the patentee or prospective buyers fear that extensive discussion with other prospective buyers that do not ultimately acquire the patent may give those other buyers advance information on the patent's exploitation, and thereby give them a head start in efforts to invent around the patent or otherwise diminish its competitive benefit.⁶⁴

It is quite difficult to determine the significance of such market imperfections, either in any given case or in a broad category of cases susceptible to more general rules. For this reason, and because the information relevant to making the inquiry is typically not available, I will not pursue the point here. These issues do, however, have much in common with the factor to be considered next, as well as with the issue raised in subsection II.E.2.

(c) *To What Degree Is this Source of Reward an Incentive?* — Although much commentary over the years has addressed the extent to which patent rewards actually stimulate inventive activity, few conclusions have been drawn.⁶⁵ The question of incentive differs in kind from the factors discussed in the preceding two subsections in that it moves beyond the terms of the ratio test itself. Recall that the numerator of the ratio focuses on *reward* — as distinguished from social *benefit*, which is relevant in determining the optimal patent life. This subsection examines the connection between reward and incentive — one of the links in the chain that connects reward to social benefit. The examination of this link calls into question the proposition that all reward is fungible and concludes that certain sources of reward might, for various reasons, act as more or less of an incentive than others.⁶⁶

Turner has advocated the position that, because researchers, be they individual or corporate, “can make only the grossest calculation of whether the prospective rewards are likely to exceed the costs,” the incremental reward produced by patent exploitation dependent upon

improved on a process used by only a few entities. Fourth, it might simply be the case that the relevant market is highly concentrated, leaving the patentee with few potential buyers. Finally, the antitrust laws might further limit the number of potential buyers. See, e.g., *infra* Part V.

A scarcity of buyers is problematic only if the patentee cannot itself exploit the invention, either directly, as is often true for individual or small-scale inventors, or by licensing. But licensing might frequently be unprofitable because of transaction costs or limited because of antitrust concerns. Moreover, if there were few buyers, there would also likely be few licensees. In either case, all of the problems that arise in negotiating a sale would also arise in negotiating a license.

⁶⁴ Cf. Caves, Crookell & Killing, *supra* note 62, at 250, 257 (discussing this problem in the context of licensing).

⁶⁵ See, e.g., sources quoted *supra* note 52.

⁶⁶ See *supra* note 42.

restrictive practices is unlikely to have a substantial effect on inventive activity.⁶⁷ From this perspective, it is not irrational for Turner to tend to focus solely on the denominator of the ratio — an antitrust-oriented approach that concentrates on whether a given practice produces monopoly loss.⁶⁸ As a result, however, Turner does not discuss the possibility that different kinds of restrictions will yield different rewards, nor does he explore the distinction between the reward produced by permitting a restrictive practice and the equivalent amount of reward that could be produced by lengthening the patent life. Thus, his analysis suggests not that reward is irrelevant, but only that the connection between reward and incentive might be more complex and varied than was implied by the brief discussion in Section A.⁶⁹

Although the relationship between reward and incentive is complex, it would nonetheless be relevant in comparing restrictive practices if the rewards from some practices had a greater incentive effect than did the rewards from others. One simple, although largely unexplored, reason this might be so is that inventors' decisions to undertake inventive activity are based on their perceptions of potential rewards *before* they undertake the activity, not on the reward they in fact receive afterward. Thus, for example, the wholesale abolition of patent rights would likely have a greater negative influence on expectations of reward, and hence on innovative activity, than would a severe cutback in the range of permissible licensing practices, because, in addition to the greater effect on ultimate reward, many inventors are much less likely to be aware of the latter development, or might never have realized the potential benefit from such practices in the first place.⁷⁰ If not all reward has the same incentive effect, ratios cannot be applied blindly. Preferences among restrictive practices must be adjusted to reflect the differential impact of the incremental rewards that each such practice provides.

⁶⁷ Turner, *The Patent System and Competitive Policy*, 44 N.Y.U. L. REV. 450, 459 (1969); *see id.* at 463. Turner states that "[i]t is doubtful that anyone who would be induced to invest in research in hopes of a thousand-to-one payoff would be deterred if the potential payoff were reduced to eight hundred-to-one." *Id.* at 459. Of course, depending upon the expected cost of the project and the probability of receiving the payoff, this might or might not be the case. Moreover, Turner offers no support for the representativeness of his hypothetical numerical estimates. But given that I do not believe that anyone else has been able to demonstrate the contrary convincingly, I cannot say that his hunches are necessarily off track.

⁶⁸ *See id.* at 461 (basing analysis solely on antitrust policy); *id.* at 463 (suggesting that his analysis to follow derives solely from antitrust policy). Turner is not alone in taking this approach. *See infra* pp. 1846-47 & notes 100-03.

⁶⁹ *See supra* pp. 1823-24.

⁷⁰ Cf. ECONOMIC REVIEW, *supra* note 21, at 75 ("To be sure, restrictive license agreements can increase considerably the profits of a patentee. But, much as this might affect the value of his patents, it would hardly be taken into account at the stage when he plans his investment outlays for industrial research and development work.").

It is difficult to derive useful conclusions from the analysis of the link between reward and incentive, yet a few generalizations are possible. First, some restrictive practices might be most relevant in the later stages of the development of an innovation, at which time investment or development decisions are being made based upon practices already in effect or due to be implemented soon.⁷¹ Second, inventors who are regularly involved in the inventive process might appreciate the value of some practices better than inventors who have little experience with patent exploitation. On the other hand, experienced inventors might realize that antitrust limitations in fact only minimally limit their reward, whereas the less initiated, who are aware merely that various antitrust restrictions exist, might have exaggerated fears. To account for this factor, it seems necessary to formulate rules that vary with the identity of the patentee, as was necessary in the case of patentees who sell their inventions to others for eventual exploitation.⁷² The prospect of acquiring the relevant information seems equally unpromising in the present context. In the end, therefore, fruitful analysis of the patent-antitrust problem may require the simplifying assumption that all reward has the same incentive effect.⁷³

C. Simultaneous Determination of Patent-Antitrust Doctrine and the Patent Life

The technique described in subsection B.1 for determining the appropriate structure of patent-antitrust doctrine through comparisons to the ratio implicit in the optimal patent life is incomplete. The optimal patent life was determined in Section A *by taking patent-antitrust doctrine as given*. If Section B's approach for determining patent-antitrust doctrine were implemented, the patent life derived in Section A might no longer be optimal. For example, if the adjustment in patent-antitrust doctrine resulted in a larger scope for patent exploitation and thus produced greater reward for any given patent life, it would be appropriate to reduce the patent life from the level set in Section A.

That adjustment, however, does not end the problem. The adjustment in the patent life might change some of the conclusions about the optimal patent-antitrust doctrine formulated in Section B, because that doctrine was determined by reference to the reward/loss ratio

⁷¹ See generally F. SCHERER, *supra* note 21, at 440-441 (encouraging development as a purpose of patents); Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977) (same). Even after an innovation is patented and licensed, the availability of an exclusive license might encourage the licensee to develop nonpatentable know-how that would enhance the value of the patent.

⁷² See *supra* pp. 1836-37.

⁷³ See generally *infra* subsections II.E.1 & II.E.2 (discussing problems of information and individual application).

implicit in the original optimal patent life. If the optimal patent life changes, so might this ratio. The new ratio would then require a further revision of patent-antitrust doctrine, which in turn would require readjustment of the patent life, and so on. In general, setting the patent life and determining patent-antitrust doctrine are interdependent endeavors; in other words, the system of equations that defines the optimization process must be solved simultaneously.⁷⁴

One might derive this simultaneous solution through the following heuristic process. First, instead of defining the set of practices to be analyzed as only those subject to patent-antitrust doctrine, consider a broader definition under which each separate year of patent exploitation is conceived as a "practice."⁷⁵ Next, order the ratios for all the practices in this more broadly defined set from highest to lowest. There is the complication that the ratio for each practice depends upon which other practices are assumed to be permitted, but this problem can be addressed to a substantial degree by the following sequential approach.⁷⁶ Begin with no exploitation allowed.⁷⁷ The first practice to be permitted presumably⁷⁸ is the first year of exploitation.⁷⁹ Then, given the first year, determine which practice, be it another year of exploitation or any one of the possible restrictive practices subject to patent-antitrust doctrine, offers the highest ratio. Add that practice to the list and similarly select the next, this time assuming that the first year of exploitation and the practice just selected are taken as given in determining the ratios of the remaining possibilities.⁸⁰ Continuance of this process yields an ordering of all the practices. It is essential to determine the social benefits and costs at each step along the way in order to find the point after which the marginal benefit of permitting further practices no longer exceeds the marginal cost. The combination of practices reached at that point is the solution, which embodies both an optimal patent life and a corresponding formulation of patent-antitrust doctrine.

⁷⁴ The formal solution to this problem is presented in the Appendix.

⁷⁵ For various reasons, it seems unlikely that one would permit the fifth year of patent exploitation and not the fourth. This need not be of concern to the derivation, because if there are indeed good reasons for this conjecture, the earlier years will always have higher ratios than the later years, with the result that later years would simply never be selected before earlier years.

⁷⁶ There still might be reversals in such a process resulting from synergistic effects among various practices. This complicates the process but does not alter the ability to derive determinate results. This issue is discussed in the formal derivation in the Appendix at note 282.

⁷⁷ Allowing no exploitation is equivalent to adopting the "antitrust laws reign supreme" regime discussed on p. 1818, with the addition that the patent life is set equal to zero.

⁷⁸ None would be permitted if the patent system, for any formulation of patent-antitrust doctrine, were undesirable.

⁷⁹ See *supra* note 75 (concerning the ordering of the years).

⁸⁰ As more practices are added, the ratios of the remaining practices will be continually changing. The Appendix describes how this would be taken into account. See *infra* pp. 1891-92 & note 282.

The need for a simultaneous solution has complex implications for the courts. Because the optimal patent life and the content of patent-antitrust doctrine can be determined only simultaneously, the ideal institutional arrangement would involve a single entity with control over both policy instruments. From this point of view, the current separation of functions between Congress and the courts makes little sense in this context. But in view of the fact that no major institutional rearrangement appears imminent, it is useful to consider how the existing structure might best be able to confront the issues posed by the intersection of patent and antitrust policy.

A second-best arrangement might involve careful coordination between Congress and the courts, although this Section indicates how intimate such coordination would have to be. Moreover, even this compromise seems a rather far cry from the current state of affairs. Congress set the patent life over a century ago and has not changed it since it passed the antitrust laws. Thus, courts probably could not count on Congress to perform its half of the feedback loop.⁸¹ The simplifying notion that Congress has in fact set the general contours by defining the patent life and has left the details to be worked out by the courts is therefore problematic. Because the optimal patent life depends upon how the “details” are worked out, there can be no presumption that the courts will arrive at sensible overall results by relying upon the method outlined in Section B, although the cost-effectiveness analysis developed there is nevertheless still valid.⁸² Instead, only a third-best strategy may be available. If courts believe — based on the analysis performed in evaluating patent-antitrust restrictions — that the patent life set by Congress is too short or too long, they may find it appropriate to allow more or fewer restrictive practices, respectively, than a strict application of the ratio implicit in the current patent life would suggest.⁸³

⁸¹ If courts had articulated the doctrine in the manner Congress predicted, it is conceivable that feedback might not have been necessary. This is a highly unconvincing view, however, because Congress could not have considered patent-antitrust doctrine before it enacted the antitrust laws. Moreover, the courts have reversed their position on restrictive practices over time, and this presumably would have sparked congressional action. More plausibly, if Congress had perceived the impact of patent-antitrust doctrine on the total reward to patentees to be very small relative to the total reward typically received from exploitation over the optimal patent life, there would have been little need to adjust the patent life in light of the courts' modifications of patent-antitrust doctrine. There has been no attempt to determine whether this is the case, and at least in the instance of price discrimination, *see infra* Part VI, it seems unlikely. If this were generally true, however, it would suggest that patent-antitrust doctrine is quite unimportant to the general scheme of patent policy, apart from its proscription of practices resulting in massive monopoly losses.

⁸² *See supra* subsection II.B.1(c).

⁸³ This strategy is implicit in the discussion at the conclusion of Part I. *See supra* pp. 1818–20.

D. Summary of Guidelines

The conclusions that derive from the analysis in Sections A through C are as follows:

1. The ratio test, which compares the patentee's reward to the monopoly loss imposed on society, should guide the evaluation of restrictive practices. Practices with higher ratios generally should be preferred. Factors aiding in the application of this test to specific practices include the extent to which the reward is pure transfer, the portion of the reward that accrues to the patentee, and the degree to which the reward serves as an incentive.

2. The common view that restrictive practices should be evaluated by determining whether the resulting reward exceeds the value of the patent is misguided. In general, the reward should be less than the value of the patent, and even this requirement is not a sufficient condition for the desirability of permitting a given practice. Rather, the determinative inquiry is that indicated by the ratio test — whether the resulting marginal increase in reward is substantial by comparison to the marginal increase in monopoly loss, and how that ratio compares to the ratios for other restrictive practices and for the existing patent life.

3. Knowledge of the ratios for each practice is alone an insufficient basis for formulating a comprehensive structure of patent-antitrust doctrine, because these ratios must be compared to the ratio implicit in the optimal patent life. There are two problems in making this comparison. First, the ratio implicit in the optimal patent life may be very difficult or even impossible to determine. Second, that ratio is based upon a patent life that was derived by taking patent-antitrust doctrine as given. Thus, there is an inevitable and problematic interdependence between the decision concerning the optimal patent life and the decision concerning the proper structure of patent-antitrust doctrine.

E. Limitations on Practical Application of the Analysis

As is often the case when one examines a problem in detail, asking the right questions begets more questions. Although the analysis described thus far is complicated, the following discussion indicates three respects in which the inquiry is even more intricate. These difficulties go beyond the previously noted problem of working out the appropriate role for the courts in their interaction with Congress.

1. *Lack of Information.* — The most obvious difficulty in applying the analysis developed in this Article is that the various kinds of information needed for the analysis will not generally be available;⁸⁴

⁸⁴ See, e.g., Markham, *The Joint Effect of Antitrust and Patent Laws Upon Innovation*, AM. ECON. REV., May 1966, at 291, 292 ("[T]he linkage between technological change and the

thus, courts' decisions must inevitably be speculative. To determine ratios for particular practices — the subject of the applications in Parts IV through VII — a number of complicated phenomena must be measured and compared. And if more than a minor reshuffling through cost-effectiveness analysis is desired, it is also necessary to have information concerning the ratio implicit in the existing patent life, which in turn requires detailed knowledge about all the links in the relationship between the patent life and the costs and benefits of the patent system.⁸⁵ Moreover, even if the total benefits and total costs could be easily approximated, these approximate values would be virtually useless. It is necessary to know the *marginal* costs and benefits and the degree of reward that can be inferred from them, and these marginal effects will be much harder to estimate. Finally, a coherent approach to the interdependency problem discussed in Section C requires not merely being able to evaluate such information in the present system, in which the patent life is given, but also being able to gauge how such measures vary as the aggregate total reward is varied. In the end, therefore, only the most limited improvements may be possible.

2. *Further Case-by-Case Variations in the Applicability of the Analysis.* — The applicability of some of the previous analysis was shown to vary case by case, depending not only upon the restriction employed, but also upon the nature of the patent, the structure of the market, and the attributes of the patentee. To make the analysis tractable, therefore, all of the preceding discussion referred, either explicitly or implicitly, to the reward expected by the "typical patentee" or to the cost imposed in the "typical situation" in which a restrictive practice is employed. Clearly, however, a regime that provides a reward of x to the typical patentee may provide far more than x to some and far less than x to others; as a result, some activities will be rewarded too generously and others not generously enough. Moreover, the ratio test implicitly refers to some typical ratio for a given restriction; this ratio may in fact be much greater in some instances than in others. How much difficulty this variance causes depends substantially upon the *ex ante* perceptions of potential patentees. To the extent that prospective inventors are unable to determine whether they will benefit more or less than is typical for the relevant practice, the average tendencies will be the most relevant indicators of the patentee's reward (subject to the qualifications noted previously⁸⁶). On the other hand, prospective inventors who know

patent system and antitrust policy — only two of the several environmental factors affecting it — would still have to be determined. Again, the prospects of establishing these linkages in precise terms seem remote.").

⁸⁵ See *supra* pp. 1833–34 & notes 52, 54.

⁸⁶ See *supra* note 29 (risk); *supra* pp. 1836–37 (when patentee is not the one exploiting the patent); *supra* subsection II.B.2(c) (extent to which reward is an incentive).

that they will benefit more or less than the average would presumably take that information into account. It would therefore be desirable if the rules could be adjusted accordingly.

In a parallel fashion, it was assumed in the previous analysis that the policy instruments available to the courts and Congress are quite limited. Congress was assumed to choose a single optimal patent life, rather than a different life for different industries, different sorts of inventions, and different classes of inventors.⁸⁷ Courts were implicitly assumed to permit or prohibit practices according to what essentially amounts to a pattern of per se rules. Of course, the rules could be further refined to account for market conditions, the nature of the invention, and the like.⁸⁸

One could consider any degree of refinement of any of these assumptions, and the same analysis would apply. But any attempt to apply more case-specific rules would further complicate the already difficult problem facing the courts.⁸⁹ In addition, the more one attempts to vary the patent life and the rules of exploitation industry by industry and case by case, the less compelling becomes the justification for rewarding invention through a patent system at all. In theory, direct reward systems are preferable because they avoid the monopoly costs associated with a general patent system.⁹⁰ A central reason for reliance on a patent system is that it is thought to be too difficult to determine the appropriate level of reward fairly and accurately on a case-by-case basis.⁹¹ It should also be noted that this justification for the patent system results in an unavoidable tension because the typical or average measures of marginal costs and benefits that are essential in designing both patent policy and patent-antitrust doctrine would likewise be difficult to determine.

3. *Interdependency Among Cases.* — Even if all the uncertainties, complexities, and coordination problems could be overcome, there would remain the problem that courts cannot hope to articulate a coherent patent-antitrust doctrine by proceeding on a case-by-case basis. Part I indicated that the appropriate outcomes in different cases might be interdependent in ways that transcend the simple desire for

⁸⁷ Cf. Markham, *supra* note 29, at 602 (proposing dual patent system that distinguishes between major breakthroughs and incremental changes).

⁸⁸ Moreover, regarding the problem of discrete versus infinitesimal changes, *see supra* notes 43, 45, 46 & 54, courts could in theory — although it seems incredibly unlikely — rely upon a lottery-like strategy in which they chose different outcomes with predetermined probabilities. This would make all of the previous complications vanish because the functions would now be continuous. Of course, in the process, additional risk would be imposed on patentees, in addition to the increased administrative costs.

⁸⁹ *See, e.g.,* Stedman, *The Patent-Antitrust Interface*, 58 J. PAT. OFF. SOC'Y 316, 325 (1976) (observing that courts, on the whole, "have avoided [a case-specific] approach like the plague").

⁹⁰ *See, e.g.,* E. MANSFIELD, *MICROECONOMICS* 492-93 (2d ed. 1975).

⁹¹ *See, e.g.,* F. SCHERER, *supra* note 21, at 458.

consistency in doctrine.⁹² The discussion in this Part has demonstrated that the most plausible approach that might be practicable — the cost-effectiveness analysis presented in subsection B.1(c) — is itself plagued by this problem of interdependency; even if it might be possible to reach decisions in two areas of the doctrine taken together, it would be uncertain whether either change alone were an improvement.⁹³ Courts thus could not confidently determine that any given decision produced a net gain unless the determination entailed reconsideration and revision of other components of patent-antitrust doctrine not presented by the particular case at hand.

III. PREVIOUS SOLUTIONS TO THE PATENT-ANTITRUST CONFLICT

This Part discusses approaches to the patent-antitrust conflict that courts and commentators have offered in the past. Section A shows that many of the earliest reactions to this conflict involved simply avoiding it altogether, a tendency that continues to the present. Although such avoidance has been a frequent response, other approaches have also been suggested. The most popular, particularly with the courts, has been to invoke formalistic tests that purport to indicate which practices are desirable. Section B demonstrates that all such tests are question-begging and thus indeterminate. Sections C and D then consider the tests proposed by Bowman and Baxter, respectively. Their work is to date the most extensive and thoughtful; both attempt to develop a consistent framework and to apply it in a variety of contexts in which the patent-antitrust conflict arises. The discussion in these Sections indicates the shortcomings of each of their proposals. Some particular manifestations of these shortcomings will be illustrated in the later Parts that deal with specific applications.

A. Common Confusion Among Courts and Commentators: Evading the Conflict

The earliest judicial decisions on patent-antitrust issues — decisions that addressed license provisions requiring, for example, that the licensee adhere to prices set by the patentee, or purchase various supplies only from the patentee (tying clauses) — uniformly favored the patentee, largely on the theory that the greater power includes the lesser.⁹⁴ Because patentees were legally entitled to refuse to license their patent at all, the less restrictive practice of licensing the patent subject to certain conditions was deemed unimpeachable. This type

⁹² See *supra* p. 1820.

⁹³ Each taken alone could be undesirable. See *supra* p. 1834 & note 53.

⁹⁴ See, e.g., *Henry v. A.B. Dick Co.*, 224 U.S. 1, 32, 35 (1912) (patent misuse challenge to tying arrangement).

of argument has been rejected in many contexts, typically because the lesser can indeed be more of an evil than the greater or because regulation of the lesser restriction can lead to substantial improvement in light of the unwillingness of the regulated entity to resort to the greater restriction.⁹⁵ This position has gradually fallen into disfavor in the patent-antitrust context as well.

Even after the notion of an antitrust immunity for patentees fell into disrepute in the second decade of this century,⁹⁶ the purpose of the patent statute — providing reward to encourage inventive activity — continued to be blindly invoked in support of restrictive practices by patentees. The most famous example is *United States v. General Electric Co.*, in which the Supreme Court, upholding the patentee's right to issue price-restricted licenses, cited as a sufficient argument the contention that the patentee's reward was enhanced.⁹⁷ This tendency to resolve the conflict by ignoring the antitrust component — which amounts to a preoccupation with the numerator (patentee reward) and a corresponding disregard of the denominator — has proved durable among courts⁹⁸ and commentators⁹⁹ alike.

As criticism of some of the Supreme Court's permissive rulings on restrictive patentee practices has mounted, so has the tendency for commentators to make the opposite mistake of resolving the patent-antitrust conflict by invoking antitrust analysis as though patent policy were irrelevant to the issue. Sullivan often exhibits this tendency,¹⁰⁰

⁹⁵ Early criticism of this argument in the context of patent law can be found in Powell, *The Nature of a Patent Right*, 17 COLUM. L. REV. 663, 678–79, 684 (1917). The equal protection and due process clauses of the Constitution have accounted for perhaps the most notable, but by no means the only additional examples. Virtually all government regulation, whether of employment conditions or sales of consumer products, takes place in a context in which firms have the option of resorting to the greater restriction by going out of business and thus not hiring or selling at all.

⁹⁶ See *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917) (disallowing tying contracts); *Bauer & Cie v. O'Donnell*, 229 U.S. 1 (1913) (rejecting resale price maintenance).

⁹⁷ 272 U.S. 476 (1926). The Court stated that a price-restricted license was permissible, "provided the conditions of sale are normally and reasonably adapted to secure pecuniary reward for the patentee's monopoly." *Id.* at 490. This formulation ignores antitrust policy altogether, unless one gives a broad reading to "normally and reasonably adapted." Such a reading renders the Court's test question-begging. See *infra* Section III.B. In any event, however, the Court gave no indication of any such intent.

⁹⁸ See, e.g., *SCM Corp. v. Xerox Corp.*, 645 F.2d 1195, 1206 (2d Cir. 1981) ("[W]here a patent has been lawfully acquired, subsequent conduct permissible under the patent laws cannot trigger any liability under the antitrust laws." (citations omitted), *cert. denied*, 455 U.S. 1016 (1982)).

⁹⁹ For example, although Sullivan makes a similar criticism of *General Electric*, see L. SULLIVAN, ANTITRUST 542 (1977), and explicitly notes the failure of such easy solutions to the conflict, see *id.* at 505, 527, he makes the same mistake in commenting on field restrictions that reserve exclusive fields to the patent holder. See *id.* at 560 ("[T]hese are all advantages the patent holder is plainly entitled to under the patent if it excludes licensees entirely.").

¹⁰⁰ Sullivan explicitly states that the conduct element of § 2 of the Sherman Act is met

and Baxter,¹⁰¹ Gibbons,¹⁰² and others¹⁰³ have on occasion done likewise. This approach, which concentrates on the denominator — monopoly cost — to the exclusion of the numerator, is as flawed as the previous error of focusing exclusively on the numerator, the patentee's reward.

B. Formalistic Conceptions Invoked by Courts and Commentators

Not all analyses of the patent-antitrust conflict have been marked by the sort of evasion just noted. The Supreme Court has made several attempts to formulate a rule to indicate which practices are permissible. The first such attempt was a reference in *Bement v. National Harrow Co.* to "conditions which are not *in their very nature* illegal."¹⁰⁴ Next, the Court expressed the view in *Motion Picture*

"under circumstances where it meets the basic test for exclusionary conduct laid down in nonpatent cases." *Id.* at 509. Under this test

[a] patent acquisition policy is exclusionary when it is not an 'honestly industrial' expression of 'superior skill or industry,' but represents a deliberate effort to preempt others, in the sense that the defendant could have avoided following the policy without acting in an economically irrational manner, or in a way inconsistent with its own self-interest.

Id. (footnote omitted). A more clear-cut example arises in Sullivan's discussion of territorial restrictions, in which he states that "[t]he higher return to the patent holder [made possible by the opportunity to discriminate in price] is, from the vantage point of the public, unnecessary to the stimulation of any socially desired conduct." *Id.* at 540. This statement is quite remarkable, for it directly assumes that there exists no social policy favoring increased reward to patentees. See also *id.* at 551 (stating, in discussing *General Electric*, that "permitting the patentee to fix prices would be gratuitously to allow an unnecessary competitive restriction").

¹⁰¹ See Baxter, *Legal Restrictions on Exploitation of the Patent Monopoly: An Economic Analysis*, 76 YALE L.J. 267, 297 (1966) (arguing that "legality of the seller's monopoly is irrelevant to . . . purpose" of Robinson-Patman Act). But see *infra* Part VI.

¹⁰² See Gibbons, *Price Fixing in Patent Licenses and the Antitrust Laws*, 51 VA. L. REV. 273, 296 (1965) ("Where the patents block each other, restrictive licensing can be prohibited with impunity because neither patentee is likely to refuse to license the other in reaction to the rule.") [hereinafter cited as Gibbons, *Price Restrictions*]. To state that price restrictions can be prohibited with impunity ignores the fact that restrictions may promote patent policy by increasing the reward to the patentee. See also Gibbons, *Field Restrictions in Patent Transactions: Economic Discrimination and Restraint of Competition*, 66 COLUM. L. REV. 423, 441-42 (1966) (discussing field restrictions) [hereinafter cited as Gibbons, *Field Restrictions*]; Gibbons, *Price Restrictions, supra* at 297-98 (discussing grant-back provisions).

¹⁰³ See, e.g., Burstein, *A Theory of Full-Line Forcing*, 55 NW. U.L. REV. 62, 93 (1960). Burstein is fairly criticized in W. BOWMAN, *PATENT AND ANTITRUST LAW* 118 (1973), for finding sufficient support for the proscription against tying in the argument that "it limits the potential gains of monopoly power," which directly translates into a limitation of the patentee's reward.

¹⁰⁴ 186 U.S. 70, 91 (1902) (emphasis added). After the Court's decisions in *Addyston Pipe & Steel Co. v. United States*, 175 U.S. 211 (1899), and *United States v. Trans-Missouri Freight Ass'n*, 166 U.S. 290 (1897), one would have thought that price restrictions were "in their very nature illegal," but the Court concluded otherwise. See *National Harrow*, 186 U.S. at 93-94. This result is hard to understand unless a metaphysical inquiry into the difference between the naturally and unnaturally illegal is thought possible. See, e.g., Cohen, *Transcendental Nonsense and the Functional Approach*, 35 COLUM. L. REV. 809 (1935).

Patents Co. v. Universal Film Manufacturing Co. that the "scope of every patent is limited to the invention described in the claims contained in it."¹⁰⁵ Subsequent formulations have included the focus in the *General Electric* case on "the reward which the patentee by the grant of the patent is entitled to secure"¹⁰⁶ and the Court's statement in *Zenith Radio Corp. v. Hazeltine Research, Inc.* that "the patentee [may not] extend the monopoly of his patent to derive a benefit not attributable to use of the patent's teachings."¹⁰⁷

In framing each of these tests, the Court seems to assume that there exists some transcendent notion of what constitutes "normal" or "proper" patent exploitation. If there were such a well-established conception, courts might have little difficulty reaching consistent and relatively uncontroversial decisions on these issues. In light of the analysis developed in Parts I and II, however, it is plain that the basis for any such conception would be extraordinarily complex. Moreover, patent-antitrust doctrine is noted for its indeterminacy and its frequent shifts in direction.¹⁰⁸ These circumstances suggest that, in reality, courts lack any such uniform conception of the appropriate scope of a patent.

Commentators have often invoked formalistic tests no more informative than those employed by the courts. Sullivan, for example, suggests inquiry into whether the "power to fix the prices charged by the licensee or to divide territories among licensees [is] part of the patentee's grant."¹⁰⁹ This inquiry seems similar to the version of the "scope of the patent" test that focuses on the patent itself.¹¹⁰ Buxbaum has discussed the EEC's use of a test upholding practices "inherent in the patent monopoly."¹¹¹ Baxter at one point similarly

¹⁰⁵ 243 U.S. 502, 510 (1917) (emphasis added) (considering patent misuse challenge). This approach continues to be followed by courts. See *Ethyl Gasoline Corp. v. United States*, 309 U.S. 436, 456 (1940) ("The extent of that right is limited by the definition of his invention, as its boundaries are marked by the specifications and claims of the patent."); *United States v. Studiengesellschaft Kohle, m.b.H.*, 670 F.2d 1122, 1135 (D.C. Cir. 1981) ("None of the anti-competitive effects of the challenged restriction . . . exceed the anticompetitive effects which the patent authorized."); *SCM Corp. v. Xerox Corp.*, 463 F. Supp. 983, 1014 (D. Conn. 1978) ("The exercise of [the] prerogative [of unilaterally refusing to license a patent] is a corollary of the explicit statutory grant of the right to exclude others from making, using, or selling the patented invention."), *aff'd*, 645 F.2d 1195 (2d Cir. 1981), *cert. denied*, 455 U.S. 1016 (1982). It is difficult to understand how careful study of the papers describing a patent can resolve the patent-antitrust conflict.

¹⁰⁶ *United States v. General Elec. Co.*, 272 U.S. 476, 489 (1926) (emphasis added); see also *id.* (referring to "scope of the patentee's rights").

¹⁰⁷ 395 U.S. 100, 136 (1969) (emphasis added).

¹⁰⁸ For example, note the overruling of *Henry v. A.B. Dick Co.*, 224 U.S. 1 (1912), by *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 518 (1917), and the rocky history of *General Electric*, see, e.g., L. SULLIVAN, *supra* note 99, at 541, 543.

¹⁰⁹ L. SULLIVAN, *supra* note 99, at 531.

¹¹⁰ See *supra* pp. 1847-48.

¹¹¹ Buxbaum, *Restrictions Inherent in the Patent Monopoly: A Comparative Critique*, 113 U. PA. L. REV. 633, 641-45 (1965).

phrases the issue as whether "the premium . . . constitute[s] income of the kind contemplated by the patent system."¹¹² Perhaps the most sweeping recent use of such formalistic tests appears in Stedman's description of the various legal approaches that he claims are available for resolving the patent-antitrust conflict. His typology relies upon such tests as "full monopoly power of the patentee" and "scope of his patent."¹¹³ Clearly, the tests advocated by these commentators suffer from the same weakness that the courts' tests do. By assuming the existence of a background standard of the appropriate scope of patent exploitation, they simply beg the question of determining which practices should be allowed.¹¹⁴

C. Bowman's "Competitive Superiority" Test

1. *Understanding Bowman's Test.* — Bowman states that his test "assumes the propriety of allowing a patentee to use any method of charging what the traffic will bear if, but only if, the reward to the patentee arising from the conditional use measures the patented product's competitive superiority over substitutes."¹¹⁵ This competitive superiority approach has two components. Primarily, Bowman relies on an objective test that takes as affirmative evidence of legitimacy a licensee's or buyer's willingness to accept a restriction as a condition

¹¹² Baxter, *supra* note 101, at 343.

¹¹³ Stedman, *supra* note 16, at 595; see also Note, *An Economic Analysis of Royalty Terms in Patent Licenses*, 67 MINN. L. REV. 1198, 1221 (1983) (patentee "simply . . . extract[s] the full monopoly return to which he is entitled"). Stedman's attempt to apply the scope-of-the-patent test proves difficult, see Stedman, *supra* note 16, at 599 (text at note 25), which he later acknowledges to some degree, see *id.* at 600 (text at note 29).

¹¹⁴ It might also be possible to characterize some of these tests not as empty formalisms, but as variations on the theme of "antitrust law reigns supreme" discussed in Part I. In other words, the phrase "inherent in the patent monopoly" could be read to allow the patentee to extract monopoly profits but not to engage in any restrictive practices that violate the antitrust laws in furtherance of that monopoly. Such an interpretation seems inconsistent with the intention of courts and commentators employing formalistic tests. Yet to the extent that any such notion does underlie any of these tests, it would be subject to the same criticism noted *supra* pp. 1846-47 — that it involves applying antitrust policy as though patent policy were irrelevant.

¹¹⁵ W. BOWMAN, *supra* note 103, at x; see *id.* at 88. Years earlier, Furth had offered a similar test in the context of evaluating price-restricted licenses. See Furth, *Price-Restrictive Patent Licenses Under the Sherman Act*, 71 HARV. L. REV. 815, 817 (1958) ("The patent's competitive superiority should set the bounds of the reward afforded its users regardless of the way the patentee chooses to exploit the patent."). Nevertheless, I choose to associate the test with Bowman because he and his book have become far more prominent and this analysis is more typically associated with him. Moreover, Bowman applies the test in a far wider variety of contexts and thus presents it as a truly general approach. Others have since used similar formulations. See, e.g., R. BORK, *THE ANTITRUST PARADOX* at x (1978) ("Bowman's own book, *Patent and Antitrust Law*, is so good and so definitive that I have not even attempted in this book to comment upon that branch of the law. There is nothing more to say." (footnote omitted)); Bowes, *The Misapplication of Antitrust Theory and Patent License Conditions*, 10 AKRON L. REV. 39 (1976).

to the deal.¹¹⁶ Bowman does not completely limit himself to this objective component, because it would potentially immunize any restrictive practice by a patentee, even a blatant cartel.¹¹⁷ Instead, Bowman sometimes proceeds beyond the objective test of what the market will bear.¹¹⁸ Therefore, he must be considering some additional limitation when he refers to "competitive superiority." Moreover, this second principle must be addressed in every case, even if the principle is rarely dispositive. In giving content to this second component, Bowman seems to rely upon formalistic conceptions such as those discussed previously,¹¹⁹ for he often resorts to arguments for or formulations of his test that fall within the formalistic genre. In his first chapter, for example, he reasons that "evaluating whether certain patent licensing practices should be sanctioned will involve the proper *scope of the legal monopoly*. Is more being monopolized than *what the patent grants*, or is the practice merely maximizing the reward *attributable* to the competitive advantage afforded by a patent?"¹²⁰ One reason the indeterminacy of the second component of Bowman's test may not readily present itself upon first reading is that pure horizontal cartelization is virtually the only behavior he would prohibit. Because almost everyone today agrees with that element of his position,¹²¹ the reader might be lulled into accepting it uncritically.

In addition to Bowman's ambiguous language, there is a further obstacle to understanding and analyzing his test. In most contexts, he finds his test to be satisfied a fortiori, because he believes that most allegedly restrictive practices should not be held to violate the antitrust laws even in the absence of patent policy considerations.¹²² These beliefs, which Bowman shares with others in the "Chicago School,"¹²³ derive from criticisms of arguments based upon leverage, foreclosure, and exclusionary practices¹²⁴ — arguments that have generated considerable controversy.¹²⁵ To the extent that Bowman's argument rests

¹¹⁶ Bowman also refers to this objective test as profit maximization, see W. BOWMAN, *supra* note 103, at x, and applies it to numerous situations, see, e.g., *id.* at 55-56 (territorial, use, quantity, and price restrictions).

¹¹⁷ See *infra* pp. 1867-68 (discussing Bowman's position on price-fixing cartels).

¹¹⁸ For an example of an apparent departure from his test, see the discussion in Priest, *Cartels and Patent License Arrangements*, 20 J.L. & ECON. 309, 337 n.101 (1977), in which he addresses Bowman's analysis of *Standard Sanitary Mfg. Co. v. United States*, 226 U.S. 20 (1912).

¹¹⁹ See W. BOWMAN, *supra* note 103, at 226 (characterizing the pure cartel as a "scope extension").

¹²⁰ *Id.* at 8-9 (emphasis added); see also *id.* at 54 (referring to "the 'scope' problem," "monopoly beyond the patent's proper scope," and the "advantage properly ascribable to the invention"); *supra* note 119.

¹²¹ See sources cited *infra* notes 187, 188.

¹²² See W. BOWMAN, *supra* note 103, at ix-x, 64.

¹²³ See generally, e.g., R. BORK, *supra* note 115 (applying the Chicago School approach).

¹²⁴ See, e.g., W. BOWMAN, *supra* note 103, at 54-61.

¹²⁵ See, e.g., R. POSNER, *ANTITRUST LAW* 177-211 (1976); Blake & Jones, *In Defense of*

upon such beliefs, his book adds nothing to the resolution of the patent-antitrust conflict. This Article devotes little attention to these issues and instead concentrates on how the patent-antitrust conflict should be resolved when some conflict is found to exist. Because Bowman so rarely finds anything worthy of concern from the antitrust side of the conflict, most of his discussion of the conflict is only tangentially relevant if one regards the antitrust issues to be of central concern. Nonetheless, his previously quoted statement of the competitive superiority test, combined with his frequent passing references to and applications of the test, seem sufficient to allow an understanding of the rule he intends.

2. *Criticism of Bowman's Test.* — Bowman's competitive superiority test fails to resolve the patent-antitrust conflict satisfactorily. The second, formalistic component of his test is subject to the critique developed in Section B. Even if one leaves aside the problems of defining "competitive superiority," one can readily perceive the shortcomings of his objective test, upon which he normally relies, by comparing it with the ratio test proposed in Part II.¹²⁶ Bowman's test seems to focus solely on the numerator of the ratio — the patentee's reward. From this perspective, the test permits any reward to the patentee that does not exceed the bound set by "competitive superiority."¹²⁷ The test is flawed because it ignores the denominator.¹²⁸ Although it was noted previously that the numerator and

Antitrust, 65 COLUM. L. REV. 377 (1965); Blake & Jones, *Toward a Three-Dimensional Antitrust Policy*, 65 COLUM. L. REV. 422 (1965); Bork, *Contrasts in Antitrust Theory* (pt. 1), 65 COLUM. L. REV. 401 (1965); L. Kaplow, *Extension of Monopoly Power Through Leverage* (Harvard Law School Program in Law and Economics Discussion Paper No. 4, May 1984) (unpublished manuscript on file in Harvard Law School Library).

¹²⁶ Bowman also misunderstands the connection between setting the optimal patent life and determining patent-antitrust doctrine. He states that "[l]engthening or shortening the patent period seems a far better solution to the rewarding problem than is manipulating patent exploitation standards." W. BOWMAN, *supra* note 103, at 52; *see also id.* at 115 (remarking on "a political problem of 'just rewards,' which . . . is . . . an extremely skewed and most inappropriate function of antitrust or patent law"). Of course, any given set of patent-antitrust doctrines can be termed a "manipulation" only by reference to some unbiased starting point. Bowman's reference point is, in fact, quite biased in that it is derived from a one-sided analysis, as this subsection indicates. More fundamentally, Part II demonstrated that the problem of rewarding patentees inevitably combines analysis of the patent period and patent-antitrust doctrine in a manner that undercuts Bowman's position.

¹²⁷ Bowman's test, by permitting any restrictive practice that the licensee or buyer is willing to endure, implicitly compares the situation in which the practice is permitted to that in which the invention had never existed, or, equivalently, to the situation in which the patentee refuses to practice the patent. *See* W. BOWMAN, *supra* note 103, at 88; *infra* p. 1885. From this perspective, Bowman's test can be seen as another version of the argument that the greater includes the lesser, which was seen to ignore the antitrust side of the conflict. *See supra* p. 1845.

¹²⁸ Bowman presents the conclusion that various restrictions "are all means not of creating monopoly, but rather of maximizing the return the patent affords." W. BOWMAN, *supra* note 103, at 55-56. He is correct that the restrictions probably help maximize the patentee's reward

denominator — patentee reward and monopoly loss — tend to vary together, it was established that the connection is quite loose.¹²⁹ Moreover, it was noted that even if the connection were perfect, there would be no basis for determinately resolving any component of patent-antitrust doctrine.¹³⁰ Merely knowing that the numerator is not too large in any given instance does not allow one to decide whether the restriction at issue is better or worse than most others. At best, such knowledge has some bearing on the notion that reward should be proportional to the value of the patent; this information would be sufficient for an application of the proportionality test, but that test was shown in subsection II.A.3 to be inadequate.

Of course, the limit imposed by the competitive superiority test — what the market will bear — is not *totally* unrelated to the magnitude of the denominator. If the denominator is sufficiently large, the traffic may not bear the restriction. Even with this refinement, however, the competitive superiority test is inadequate. The buyer's or licensee's decision to accept a deal depends simply upon whether it expects to derive a net profit. That decision tells us neither how much of the buyer's or licensee's cost accrues to the patentee as reward nor how much detriment results — for example, in terms of monopoly loss.¹³¹ The purpose of the ratio test is to incorporate precisely these questions.

— the numerator — but the reference to “creating monopoly” seems more germane to the magnitude of the denominator — monopoly loss. Bowman thus appears in this instance to assert a conclusion concerning the magnitude of the denominator based solely upon the magnitude of the numerator — in effect treating them as if they were mutually exclusive categories. This is clearly incorrect, because the numerator and denominator generally tend to move together. See *supra* p. 1821.

When discussing the economics of the patent system more generally, Bowman takes notice of both the system's costs and its benefits. “The problem should thus be recognized as involving a trade-off between the short-run disadvantages of monopoly on already granted patents and the possibly greater advantages of having new or better products not otherwise available.” W. BOWMAN, *supra* note 103, at 17. But Bowman's test does not take account of this trade-off. As a result, he does not compare the costs of various practices with an eye toward providing incentive at the lowest cost possible. In essence, his approach implicitly (and erroneously) assumes that, but for the reward provided by each restrictive practice he advocates, none of the inventions that the patentees exploit would have been forthcoming. The cost component thus is ignored when he examines the patent-antitrust conflict.

¹²⁹ See *supra* pp. 1821, 1832–33.

¹³⁰ See *supra* p. 1821.

¹³¹ For example, individuals may accept the conditions knowing that, if they do not, others will. If the conditions are outlawed, however, the patentee may come forward with a better offer. This is not to say that under such circumstances the result is always preferable, for the patentee no doubt receives less benefit. The point instead is that one would have to consider all these effects in order to determine the ratio, which in turn would guide the decision concerning whether the conditions should be permitted.

D. Baxter's "Comparability" Test

Baxter's test is that

a patentee is entitled to extract monopoly income by restricting utilization of his invention, notwithstanding that utilization of other goods and services are consequently restricted, provided that in each case he confines the restriction to his invention as narrowly and specifically as the technology of his situation and the practicalities of administration permit.¹³²

This test seems remarkably similar to the formalistic tests that inquire into the "scope of the patent."¹³³ One possible interpretation of Baxter's test is that it is concerned primarily with limiting the reward to the patentee. In fact, Baxter states that his formulation is desirable because it provides "a stream of benefits to the patentee . . . roughly *comparable to the ultimate value of the invention*."¹³⁴ This "comparability" test thus has much in common with Bowman's "competitive superiority" test. To the extent that this similarity holds true, the central criticism of the latter approach developed in subsection II.A.3 — that it ignores the cost of providing the reward — is likewise applicable here. This apparent congruence is not too surprising, because Bowman's test could also be characterized as simply restating the "scope of the patent" formulation.

Bowman and Baxter, however, reach strikingly different conclusions from their similar points of departure. Baxter's language seems more restrictive in terms of the limits it would place on patent exploitation. Unlike Bowman's test, Baxter's does not permit the patentee all that the traffic will bear, but rather requires that restrictions be confined as narrowly as possible. The basis for this further limitation is never clear, although arguably it reflects a bias toward minimizing the infringement upon antitrust policy.¹³⁵ Even if one assumes that Baxter's test is more restrictive than Bowman's, the criticism leveled against Bowman's test remains applicable.¹³⁶ At best, each commentator offers a test regulating the maximum reward without offering any analysis that bears on whether the level selected is any-

¹³² Baxter, *supra* note 101, at 313. Gibbons frequently takes a similar approach, *see, e.g.*, Gibbons, *Field Restrictions*, *supra* note 102, at 465-66, as does Buxbaum, *see* Buxbaum, *supra* note 111, at 649.

¹³³ *See supra* Section III.B.

¹³⁴ Baxter, *supra* note 101, at 313 (emphasis added).

¹³⁵ Of course, one could just as easily take Baxter's test as the starting point and characterize Bowman's test as one that is biased against antitrust policy. This dual possibility highlights the emptiness of formalistic attempts to resolve the patent-antitrust conflict.

¹³⁶ *See supra* subsection III.C.2; *see also supra* note 38 (discussing proportionality test when the proportion is less than one).

where near the appropriate amount or whether that reward is achieved in the least costly manner possible.¹³⁷

Because Baxter's focus is on minimizing restriction to the greatest extent possible, his test could also be seen as an approach directed at minimizing monopoly loss, the denominator of the ratio. Baxter's analysis of many specific applications supports this interpretation.¹³⁸ From this perspective, Baxter's approach can be characterized as one that tends toward results favoring the antitrust side of the conflict (which involves only the denominator), whereas Bowman's tends to favor the patent side (which is the basis for the numerator). Baxter's test is therefore subject to essentially the same criticism as that lodged against Bowman's test: concentrating exclusively on the denominator is a priori no better than concentrating only on the numerator.

In sum, the concept underlying Baxter's approach is one of limitation or minimization. Yet he never makes clear whether he seeks to limit reward, or monopoly loss, or both. At only one point does Baxter seem to concern himself — at least implicitly — with the relationship between reward and loss. His concern can be inferred from the following warning:

The value to the patentee of licensee conduct may far exceed its detriment to the licensee; indeed, the conduct may be as beneficial to the licensee as to the patentee, in which case the licensee has no incentive to resist the demands, and any expectation of comparability is foolish. ¹³⁹

This refinement seems to be a crude version of the factor discussed in subsection II.B.2(b) concerning what portion of the reward accrues to the patentee. In the context of this statement, however, Baxter seems more concerned with ensuring that the reward ("[t]he value to the patentee") not exceed the value of the patent (which Baxter equates with the "detriments to the licensee").¹⁴⁰ Unlike Baxter's primary formulation, this consideration does bear directly on the magnitudes of the ratio's numerator *and* denominator. But Baxter fails here — as he does throughout his analysis — to examine in any systematic way the *relationship* between patentee reward and monopoly loss. Baxter simply asserts that his formulation "gives appropriate scope to both antitrust and patent policy."¹⁴¹ Yet he offers no reason whatsoever demonstrating that his test yields the correct balance between the total reward patentees receive and the total monopoly loss incurred

¹³⁷ Moreover, even if the total reward were approximately correct, it might be achieved in an inefficient fashion because no attention is given to whether those restrictions that are permitted have the best ratios and thus result in the least cost.

¹³⁸ See, e.g., *infra* Section VII.B.

¹³⁹ Baxter, *supra* note 101, at 314.

¹⁴⁰ See *id.* at 313.

¹⁴¹ *Id.*

by society, nor does he demonstrate why his test reliably assesses the desirability of particular restrictions.

* * *

Thus, analysis under the ratio test shows that past approaches to the patent-antitrust conflict have been misguided. By ignoring the conflict, by appealing to empty formalisms, or by concentrating on only one component of the ratio, each attempt has failed to address fully the concerns relevant to a determination of proper patent-antitrust policy. In the following four Parts, the ratio test is applied to several prevalent patent-antitrust problems. These applications demonstrate how the ratio test can bring such complex issues into sharper focus.

IV. APPLICATIONS: PRICE-RESTRICTED LICENSES

The desirability of price-restricted licenses¹⁴² — licenses under which the patentee sets the price at which licensees must sell the patented item — depends substantially upon what one believes to be their purpose. Sections A through C explore three possible motivations for price-restricted licensing: protecting the patentee's market, disguising cartelization, and promoting efficiency through resale price maintenance. Application of the ratio test demonstrates that price restrictions should be prohibited whenever the patentee seeks to use such restrictions to facilitate cartelization. The issue becomes complicated, however, to the extent that salutary motivations unrelated to cartelization are also plausible. In that event, the appropriate approach depends upon whether it is possible to distinguish good purposes from bad. If this is not possible, one must focus on the significance of the contrary effects and the likelihood that each will occur even if the restrictive practice is prohibited. These aspects of the decisionmaking process are included in the discussion in Section C.

A. Protecting the Patentee's Market

Perhaps the earliest and now one of the most enduring explanations advanced for price-restricted licensing was articulated by the Supreme Court in *United States v. General Electric Co.*¹⁴³ In holding that such restrictions were permissible, the Court relied upon the following rationale:

When the patentee licenses another to make and vend, and retains the right to continue to make and vend on his own account, the price

¹⁴² Most of the analysis in this Part applies equally to output restrictions.

¹⁴³ 272 U.S. 476 (1926).

at which his licensee will sell will necessarily affect the price at which he can sell his own patented goods. It would seem entirely reasonable that he should say to the licensee, "Yes, you may make and sell articles under my patent, but not so as to destroy the profit that I wish to obtain by making them and selling them myself."¹⁴⁴

This argument could be extended to attempt to justify price restrictions on the ground that they protect the numerator by preventing licensees from siphoning off the patentee's reward. Such an argument, however, is unconvincing. Although the market-protection explanation finds favor with a number of commentators,¹⁴⁵ others have demonstrated its superficiality.¹⁴⁶ As long as the patentee charges a royalty that at least equals the difference between what is believed to be the best price and the patentee's own costs, the patentee has no obvious economic interest in protecting its own sales — it will receive at least as much profit from the royalty income attributable to sales by licensees. Moreover, if the patentee believes that it is less efficient than some of its licensees, it might profit even more by charging a royalty greater than the profit it could make per unit, and licensees would in any event be able to make more sales at a given profit margin than could the patentee. Price restriction motivated by a desire to protect the market for a patented item is therefore not profit-maximizing, and to that extent, market protection might not appear to be a plausible motivation for the licensing practice.¹⁴⁷ This would suggest that the

¹⁴⁴ *Id.* at 490.

¹⁴⁵ Furth, after quoting this language from *General Electric*, finds that it "aptly summarizes the principle that the proper measure of the patentee's reward is his patent's competitive superiority." Furth, *supra* note 115, at 819-20. He affirmatively advances the market-protection rationale later in his discussion. *Id.* at 830. Gibbons asserts that "the purpose of the [price] restriction is protection of the patentee from competition." Gibbons, *Price Restrictions*, *supra* note 102, at 286. He advances the same explanation for field restrictions, see Gibbons, *Field Restrictions*, *supra* note 102, at 458, and this theory seems implicit in his analysis of territorial restraints as well, see Gibbons, *Domestic Territorial Restrictions in Patent Transactions and the Antitrust Laws*, 34 GEO. WASH. L. REV. 893, 911-12 (1966) [hereinafter cited as Gibbons, *Territorial Restrictions*].

¹⁴⁶ See, e.g., W. BOWMAN, *supra* note 103, at 128; Baxter, *supra* note 101, at 316, 332-35.

¹⁴⁷ It is possible that market protection would be consistent with profit maximization if the licensor were seeking to maintain its position in the industry. Maintaining its position might enhance the licensor's bargaining power in any necessary renegotiation of agreements with licensees, particularly when licensees are limited in number and may thus have countervailing power. Alternatively, the licensor may hope to retain a strong market position when the license expires. Two reservations, however, should be noted. First, to the extent that such motives operate, the restriction would be costly to the licensor because licensees who would receive less would not be willing to pay as much for the privilege offered by the license. Second, both objectives can probably be achieved equally well through royalty arrangements, which can protect the licensor's sales while extracting profits from the licensees. Price or output restrictions therefore seem redundant.

Posner and Easterbrook argue that if the patentee has a rising marginal cost for its own production and is insufficiently informed about licensees' costs of production, it might be

alternative theories discussed below in Sections B and C are more relevant for determining antitrust policy for this issue.

The market-protection theory's inconsistency with profit maximization, however, does not completely rule it out as an explanation for price-restricted licensing. The patentee's decision to protect its own sales might be based "on a misconception of his economic interest or on a non-economic consideration."¹⁴⁸ The former explanation is quite plausible, for if the market-protection theory persuaded all members of the Supreme Court in 1926 and is still advocated by some commentators today, it might well remain a motivating force behind the actions of some patentees. Alternatively, patentees might be motivated by noneconomic concerns, such as maintaining the level of their own production and sales as an end in itself.¹⁴⁹

If either of these explanations were valid, the question would be whether these theories cut in favor of permitting price-restricted licensing or prohibiting it. Baxter does not find any support for prohibition:

If the explanation is a misconception of economic interest or a non-economic factor, the royalty structure may do economic harm; but no justification occurs to me for the general subordination of unidentified non-economic objectives to economic goals or for using the antitrust laws to assure that private economic interests are correctly perceived.¹⁵⁰

profitable to set a price floor in addition to a royalty rate. See R. POSNER & F. EASTERBROOK, *ANTITRUST* 269 (2d ed. 1981). Although this factual configuration is possible, it hardly seems likely. The argument assumes that patentees cannot renegotiate the royalty rate and that the output effect for the industry as a whole is less than the rising marginal cost effect for the patentee. Moreover, this argument implies two somewhat inconsistent premises: first, that the patentee's information concerning the comparison of the output effect and marginal cost effect is sufficiently precise to reach the hypothesized conclusion, and second, that the patentee's information concerning these effects is insufficiently precise to serve as the basis for setting the royalty rate.

¹⁴⁸ Baxter, *supra* note 101, at 318; see Priest, *supra* note 118, at 312 ("There is no reason to believe that company officials understand the mechanism by which any particular practice or policy affects profits."). See generally L. Kaplow, *supra* note 125, at 54-62.

¹⁴⁹ See generally W. BAUMOL, *BUSINESS BEHAVIOR, VALUE AND GROWTH* (rev. ed. 1967) (arguing that sales and growth maximization may better explain the motivations of many oligopolists than does profit maximization); R. MARRIS, *THE ECONOMIC THEORY OF 'MANAGERIAL' CAPITALISM* 46-61 (1964) (discussing noneconomic motives beyond profit maximization); O. WILLIAMSON, *THE ECONOMICS OF DISCRETIONARY BEHAVIOR* 79-81 (1967) (discussing Baumol's sales-maximization model); Bailey & Boyle, *Sales Revenue Maximization: An Empirical Vindication*, 5 *INDUS. ORG. REV.* 46 (1977) (finding sales maximization to be a serious motivation for corporate managers in 70% of the firms analyzed); Hirschey & Werden, *An Empirical Analysis of Managerial Incentives*, 7 *INDUS. ORG. REV.* 66 (1980) (presenting empirical evidence of dual profit and sales incentives for managers of large industrial corporations). This theory is controversial, see, e.g., F. SCHERER, *supra* note 21, at 37-41, and its merits will not be considered further here.

¹⁵⁰ Baxter, *supra* note 101, at 318.

The rationale for this position is unclear in light of Baxter's concession that economic harm might result. Although it might be true that the antitrust laws were not enacted for this purpose, there seems little sense in avoiding their application in circumstances in which such application would be beneficial. This argument becomes even more forceful if one concludes, based on the analysis to follow in Sections B and C, that the most plausible alternative explanation for price-restricted licensing in many instances is that it disguises cartelization. In that event, the fact that the practices *might* not be causing the targeted harms, but other harms instead, is not a sufficient reason for withholding the antitrust proscription.

It is not obvious, however, that the net effect of antitrust proscription will always be beneficial. To the extent that firms pursue noneconomic objectives or misperceive their interests, allowing firms to act on these motivations can be considered to be as much of a reward as additional profits would be to a profit-maximizing firm. Permitting price-restricted licensing would therefore serve the purpose of rewarding patentees and thus encouraging inventive activity, although measuring the incentive induced would be even more difficult than it proved to be in the profit-maximization scenario discussed previously.¹⁵¹ If one believes that non-profit-maximizing behavior frequently explains price-restricted licensing, and that price-restricted licensing can have a sufficiently high ratio of reward to loss from this perspective, one must consider the feasibility of determining whether this theory, rather than that of disguised cartelization, explains the behavior observed in any given case. The analysis relevant to this question is undertaken in Section C.

B. Disguised Cartelization

1. *Price Restrictions in Direct Licensing Arrangements.* — If there were no limits on price-restricted licensing, even the most trivial patent could become the centerpiece of a price-fixing cartel. Consider the following example, which is simply a more detailed version of the one discussed previously.¹⁵² Before the licensing arrangement, marginal costs and prices in the industry are \$100. The new patented process reduces production costs by \$0.01. The patentee licenses each firm in the industry to use its new process for a royalty of \$0.01 per unit, subject to the restriction that the firms must sell at prices established by the patentee, which also produces the product. After all firms in the industry have accepted such licenses, the patentee sets a price of \$150, which is its best guess of the profit-maximizing price for the industry. The result is essentially a price-fixing cartel that can

¹⁵¹ See *supra* subsection II.B.2(c).

¹⁵² See *supra* pp. 1832–33, 1836.

both openly set a price and enforce its agreement.¹⁵³ Note that this result could follow even if the patent had substantial value, or no value at all.¹⁵⁴

The conclusion that such practices should not be permitted is slightly less obvious than it may first appear. After all, the patentee does benefit from the scheme, and prospective inventors would no doubt be encouraged if they knew that their invention could be rewarded not only by a royalty payment covering its value, but also by a slice of the potential monopoly profits for the entire market to which the patent is relevant. The typical response is that this reward might be totally out of proportion to the value of the patent, as the illustration suggests.¹⁵⁵ As demonstrated in subsection II.A.3, disproportionate reward may well be a sufficient condition for prohibiting a practice.¹⁵⁶ But if courts deemed it a necessary condition, they would be obliged to undertake the monumental task of establishing the value of the patent in every such case. Such determinations may be unnecessary, however, because it seems fairly clear that the grossly disproportionate reward typically generated by a cartel will provide incentive far above the optimal level and thus result in a misallocation of inventive resources.

Moreover, even if the reward were not that substantial because the potential for monopoly profit in the industry were limited, or if

¹⁵³ The enforcement aspect is perhaps the less important of the two because individual firms can upset the scheme simply by refusing to join in the first place, or perhaps by cancelling their licenses (to the extent that this is permitted or would be a possible remedy in an enforcement suit). The degree to which an individual firm would be able to engage in such practices would depend upon its market share, production costs at different levels of output, and other market conditions. See generally Landes & Posner, *supra* note 49 (discussing the factors relevant to market power, including factors determining the strength of competing firms). This fact does not rob this aspect of the agreement of all its force, however, for cheating on the cartel would at least be much easier for the firms to detect and thus less effective.

¹⁵⁴ The price could be set equally high, even if the new process were no more efficient or a new product were deemed no more desirable by consumers, as long as end-product prices were controlled or there was an implicit agreement to confine production to the new process or product. Such an agreement might be easy to monitor, especially because the patentee could inspect operations under the guise of ensuring royalty compliance.

¹⁵⁵ See, e.g., W. BOWMAN, *supra* note 103, at 63 (stating, in discussing collusion through combination, that the "output restriction . . . is unrelated to the reward attributable to the patent"); L. SULLIVAN, *supra* note 99, at 554 (profit from the arrangement "cannot be said to be 'reasonably' within the patentee's reward"); Baxter, *supra* note 101, at 339 ("[S]haring the monopoly profits . . . suggests restraint unwarranted by the value of the invention."); cf. McGee, *Patent Exploitation: Some Economic and Legal Problems*, 9 J.L. & ECON. 135, 136-37 (1966) (arguing that a patent system, by sanctifying collusive pricing, might "increase expected values of private return from patents without increasing social value" and thereby lead to overinvestment in inventive activity).

Bowman's objective test for determining whether reward is in excess of the value of the patent, a test that simply looks to whether licensees or buyers have accepted the condition, fails to prohibit the restrictive practice even in this case. See *supra* subsection III.C.1.

¹⁵⁶ See *supra* p. 1828.

there were uncertainty or disagreement over how much reward is too much, one would probably still want to disallow this practice for the reasons suggested by the ratio test. Only a portion of the resulting profit accrues to the patentee.¹⁵⁷ Unless the patentee's market share is very large,¹⁵⁸ the numerator is likely to be small in relation to the denominator. The ratio test would therefore indicate that the practice is relatively undesirable regardless of the magnitude of the effect upon market price.¹⁵⁹

2. *Price Restrictions in Cross-Licensing Arrangements.* — When the parties have entered into arrangements providing for the cross-licensing of patents, there is an especially acute danger that patentees are actually motivated by a desire to create a disguised cartel. This danger suggests that such price restrictions should be prohibited unless alternative justifications are both important and readily identifiable by courts. The problem is most straightforward when prices are restricted among firms that cross-license competing patents.¹⁶⁰ In this situation, courts face greater difficulty in determining whether an arrangement involving cross-licensing is a disguised cartel, because the royalties paid will not reflect the actual values of the patents, but only the differences among the values. Two firms could, for example, cross-license patents of similar value with little or no transfer of royalties. If, however, nonmembers of the cross-licensing group are licensed, the royalties paid by such nonmembers can be analyzed in the same way that one draws inferences from the payment of royalties to a single patentee.¹⁶¹

With complementary patents, just as with competing patents, there is a significant danger that cross-licensing schemes will mask price-

¹⁵⁷ See *supra* subsection II.B.2(b).

¹⁵⁸ If the patentee does have a very large market share, it probably has almost as much market power even without resorting to the restrictive license or even without the patent itself. See *supra* note 49.

¹⁵⁹ This conclusion would have somewhat less force to the extent that, in such a cartel arrangement, the patentee imposed a royalty substantially in excess of the value of the patent and kept the proceeds, rather than redistributing them to the licensees. The greater the excess royalty, the greater the slice of the reward that would go to the patentee, and the higher the ratio. Of course, the problem of proportionality between reward and the value of the patent could become quite severe at this point. Essentially, there would be great incentives to encourage even the most trivial of inventions — resulting in great social costs. One might doubt that such a degree of excessive royalties would occur frequently or that it would be significant. It arises from granting to one member of the cartel — the patentee — a disproportionately large share of the profits, even after accounting for the value, if any, of the patent — a condition unlikely to be tolerated by other members of the cartel.

¹⁶⁰ When competing patents are cross-licensed, the dangers discussed in Part V also arise.

¹⁶¹ See Priest, *supra* note 118, at 329–30; *id.* at 347–49 (using such analysis to interpret the arrangement in *United States v. General Elec. Co.*, 272 U.S. 476 (1926), under the assumption that Westinghouse also held valuable patents); *id.* at 357.

fixing conspiracies.¹⁶² In this context, Priest advances the contention that

[w]here firms have cross-licensed complementary patents . . . some form of price restriction is essential for the firms to take advantage of licensing efficiencies and still gain the full monopoly return for their inventions. . . . But since the cross-licensing makes each firm a competitor of the other, the two must agree to restrain sales to avoid competing away the patent rents.¹⁶³

It seems, however, that if each licensor charges the other a royalty that reflects the value of the licensed patent,¹⁶⁴ profits will be preserved without resort to price restrictions. An example is offered in the margin.¹⁶⁵

Firms can nevertheless accomplish price-fixing indirectly through such royalty schemes. As the example in the footnote demonstrates, the price resulting from such a system will be the producers' cost plus the total of their per-unit royalty obligations. One might therefore argue that prohibiting price restrictions would be futile because the same results could be achieved through royalty arrangements.¹⁶⁶

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Some of the most egregious price-fixing schemes in American economic history were erected on a foundation of agreements to cross-license complementary and competing patents. . . . Typically, such arrangements have been implemented by adding to the patent exchange agreement provisions specifying prices, market quotas, membership in the industry, and other aspects of conduct and structure.

F. SCHERER, *supra* note 21, at 452.

¹⁶³ Priest, *supra* note 118, at 357.

¹⁶⁴ There is, of course, a conceptual problem in placing values on each patent independently when some or all of the benefit can be achieved only when both patents are used together.

¹⁶⁵ Consider the following example: The cost of production for firms *A* and *B* is \$6 when both patents are exploited. *A*'s patent is worth \$2 per unit, and *B*'s is worth \$1. *A* charges a royalty of \$2, and *B* charges \$1. Thus, *A*'s cost is \$7 (\$6 plus the \$1 royalty owed to *B*). *B*'s cost is \$8 (\$6 plus the \$2 royalty owed to *A*). Under these circumstances, a price of \$9 would prevail, and *A* and *B* would each earn a profit equal to the value of its invention on every unit sold, either directly in the case of its own production or through royalty payments in the case of production by its competitor. To see that this price results, consider the result if, for example, the price were to equal \$8. At that price, *B* can make no profit on its own production, because its costs are \$8, and *B* makes \$1 on *A*'s production from royalties; hence *B* would not produce at that price. Similarly, *A* makes only \$1 per unit on its own production (its costs are \$7), but \$2 on *B*'s through royalties; hence *A* would also prefer not to produce at this price and, in any event, would be able to charge more. One would thus expect prices to rise. Alternatively, if the price were \$10, *B* would make \$2 on its own production and only \$1 on *A*'s, whereas *A* would make \$3 on its own production and only \$2 on *B*'s. Thus, each would try to sell more, which would compete the price downward. Equilibrium is achieved at \$9, because at that price each firm makes the same profit regardless of which firm produces the output, and there is therefore no further upward or downward pressure on the price.

¹⁶⁶ One limit on such schemes is that other firms could undercut the conspirators' price if the patents were not worth the royalty payments. Of course, the same can be said for a price-restriction scheme unless it includes most firms in the industry.

This argument fails, however, because royalty schemes used to facilitate collusion can easily be detected. If the cross-payments are not of the same magnitude, firms receiving larger per-unit payments will benefit by a correspondingly greater amount, and one might expect firms, especially if the numbers are not very small, to be unable to agree on such a disparate sharing of the spoils. Attempts at equalization¹⁶⁷ should be detectable because substantial rebates will be difficult to hide.¹⁶⁸ The only alternative would be to set all the cross-royalty obligations at the same levels. But such an arrangement, particularly if it involves more than a very few firms, would most likely take on the appearance of a sham — the firms' defense would have to be that every firm in the group possesses one or more patents that, if each firm's patent holdings are taken as a unit, have the same value. Moreover, the firms would have to find patents that could plausibly support such claims,¹⁶⁹ that are all valid, and that include among them no patent due to expire during the course of the agreement. Thus, the justification for tolerating price restrictions among patentees that hold complementary patents seems unpersuasive, and attempts to circumvent a prohibition on such restrictions would be relatively easy to detect.¹⁷⁰

*C. Alleged Justification for Price Restrictions:
Resale Price Maintenance*

If price restrictions can be justified on grounds other than disguised cartelization, further analysis is required. This Section will focus on the most common alternative justification — that such restrictions entail resale price maintenance. The structure of the argument, however, is also applicable to other areas.

Price restrictions are often defended on the ground that, in essence, they permit the patentee to practice resale price maintenance. Proponents of this explanation claim that resale price maintenance is both a generally beneficial arrangement and a necessary condition to the patentee's securing an appropriate reward.¹⁷¹ From this perspective,

¹⁶⁷ In this context, "equalization" might mean, for example, reward in proportion to market share.

¹⁶⁸ See *infra* note 182.

¹⁶⁹ Another necessary condition for the claims to be plausible is that the value of each firm's patent(s) is also equal to the group royalty rate that is chosen.

¹⁷⁰ An additional difficulty with permitting price restrictions in licensing complementary patents is that it may be difficult to distinguish competing from complementary patents. See Priest, *supra* note 118, at 358. Thus, a more relaxed approach toward the latter may have to be abandoned to prevent abuse in cases involving the former.

¹⁷¹ See, e.g., W. BOWMAN, *supra* note 103, at 132-35; Priest, *supra* note 118, at 324-25. See generally R. BORK, *supra* note 115, at 280-98 (defending resale price maintenance); W. BOWMAN, *supra* note 103, at 120-39 (same); R. POSNER, *supra* note 125, at 147-66 (same). But see F. SCHERER, *supra* note 21, at 591-93 (arguing that resale price maintenance is overly restrictive).

one could conclude that this practice not only produces no net monopoly loss, but that it might actually produce some gain. Three problems must be overcome, however, before the resale price maintenance justification can be accepted in this context. First, it is debatable whether the alleged effects of resale price maintenance are desirable. But because that issue has no unique application in the patent-antitrust context, it will not be the focus of analysis here.¹⁷² Second, proponents of the resale price maintenance justification improperly dismiss the possibility that traditional horizontal conspiracy might better explain the observed behavior. Finally, once both possibilities are recognized, it is necessary to consider whether courts can

¹⁷² In presenting the typical justifications for resale price maintenance, insufficient attention is generally given to whether alternatives exist that could achieve the benefits attributed to this practice. One example in which alternative practices might be possible is the need to maintain the quality of repair and service after purchase. Presumably such activities would or could be limited to purchases from the outlet offering the service; alternatively, there could be separate charges, either directly to the customer or to the dealer that originally sold the product. If no such arrangements were possible, there would still be a free-rider problem even with resale price maintenance because retailers providing repairs and service bear all of those costs whereas retailers providing nothing share in the benefits. When the free-rider problem is serious, as in the case of advertising the manufacturer's or patentee's product, alternatives such as direct provision of advertising, targeted subsidies, sales quotas, or direct advertising requirements are possible. See, e.g., Priest, *supra* note 118, at 325 n.56. But see White, *Vertical Restraints in Antitrust Law: A Coherent Model*, 26 ANTITRUST BULL. 327, 333, 338 (1981).

In addition, in the patent-antitrust context, restrictions on the number of licensees may be equally effective and far less dangerous. Restricting the number of licensees will drive up margins in much the same manner as will resale price maintenance or territorial restrictions. The key difference is that this technique can be successful only to the extent that the patent is valuable. Licensing a patent of little or no value to a limited number of licensees will not increase prices because other firms, operating without a patent license, can still compete. This analysis draws on the fact that proportionality — reward's being less than total value — is a necessary condition for a given practice to be desirable. See *supra* subsection II.A.3 and Section IV.B. The ratio test could in principle dictate that patentees should not be permitted even to limit the number of licensees. Cf. *infra* p. 1879 (territorial and field restrictions limiting the number of licensees in each territory or field). This question will not be considered further here.

To the extent that these alternatives were not fully adequate, the loss would be limited to the degree to which they fell short of creating the incentives provided by resale price maintenance. How much they might fall short, if at all, is unclear because resale price maintenance alone is not an absolute cure for the free-rider problem. See, e.g., *Advising Clients on Vertical Restraints: Panel Discussion*, 51 ANTITRUST L.J. 50, 52 (1982) (remarks of Robert Pitofsky). The mechanism can be circumvented if discounters can, for example, tie to the sale of the product in question a good or service sold below cost. Moreover, in the case of advertising, substantial free riding is still possible. There is also no guarantee that promotional efforts will be directed primarily at other brands, rather than at other distributors of the same brand — a circumstance that is of little help to the manufacturer or patentee. See Caves, Crookell & Killing, *supra* note 62, at 263 (observing that licensors granting exclusive licenses often request performance clauses, minimum royalty payments, and sometimes downpayments for protection). In sum, the argument that resale price maintenance is justified because it eliminates free riders is frequently advanced but rarely analyzed in much detail.

reasonably be expected to determine which theory best explains the behavior in a particular case.

The theory of resale price maintenance might not accurately reflect the circumstances surrounding many price-restricted licenses. For example, although price-restricted licensing is often characterized as a vertical rather than a horizontal restraint, the accuracy of this characterization is not obvious. If one assumes that the patentee is in competition with its licensees, as has been the case in most of the leading Supreme Court decisions on the subject,¹⁷³ it is quite clear that the patentee's self-interest is hardly inconsistent with its propagation of a cartel. Despite this fact, Bowman, a leading promoter of the resale price maintenance justification, repeatedly characterizes price-restricted licensing as a vertical arrangement.¹⁷⁴ Although he admits the possibility that a collusion theory might conceivably explain the arrangement in *General Electric*, he emphasizes that such a theory "was *not* the basis for the decision in the case."¹⁷⁵ This, of course, is hardly surprising, considering that *General Electric* was decided in favor of the patentee.¹⁷⁶

But simply recognizing that price-restricted licensing is horizontal as well as vertical in all cases in which the patentee competes with its licensees does not dispose of the resale price maintenance rationale, because the arrangement might still have vertical effects that should be taken into account. To the degree that the patentee derives some of its profit through royalties, it does have an incentive for its licensees to maximize sales. Licensees can be both distributors of the patentee's invention and competitors with the patentee's production. Thus, it is

¹⁷³ See, e.g., *United States v. New Wrinkle, Inc.*, 342 U.S. 371 (1952); *United States v. United States Gypsum Co.*, 333 U.S. 364 (1948); *United States v. General Elec. Co.*, 272 U.S. 476 (1926).

¹⁷⁴ See, e.g., W. BOWMAN, *supra* note 103, at 121; *id.* at 129 (referring to Furth's suspicions of collusion in *General Electric*); *id.* at 130, 138.

¹⁷⁵ *Id.* at 138 n.38 (emphasis in original).

¹⁷⁶ As noted previously, Bowman himself criticized the rationale offered by the *General Electric* Court to explain the arrangement. See *supra* p. 1856 & note 146. The Court did not address the collusion theory.

Bowman further suggests that the evidence required for determining, for example, whether collusive behavior is present "is not different from that required in the usual cartel case." W. BOWMAN, *supra* note 103, at 138. At first glance, it might appear that Bowman has just reversed his position on price-restricted licenses, for proof of a written price-fixing agreement — a price-restricted licensing scheme being such an agreement — would typically be more than sufficient. The reversal, however, is only apparent; Bowman goes on to suggest that "the appropriate restriction to look for is restriction of the *nonpatented*, or the competing *other patent*." *Id.* If that were the test, the simple cartelization scheme described in Section B would be legal. But Bowman does not seem to go this far, for when reviewing cases decided prior to the passage of the Clayton Act, he notes that the Court in *Bement v. National Harrow Co.*, 186 U.S. 70 (1902), may have overlooked an "industrywide horizontal price agreement" lurking beneath the patent arrangement. W. BOWMAN, *supra* note 103, at 150-51. For a discussion of Bowman's approach in the context of collusion, see subsection III.C.1.

not clear, a priori, whether the vertical or horizontal characterization best captures the primary motivations for and effects of a given arrangement of this type and thus whether a high or low ratio should be ascribed to this restrictive practice.¹⁷⁷

Because the resale price maintenance explanation can be asserted in defense of virtually any price restriction scheme,¹⁷⁸ and because the dangers of disguised cartelization in wholly unregulated price-restricted licensing are substantial, it is desirable to permit such restrictions only under those circumstances in which cartelization can readily be detected if present.¹⁷⁹ Priest, who has examined this problem extensively, has reached the conclusion that detection is generally feasible.¹⁸⁰ His analysis represents a substantial advance. Nonetheless, it is still difficult to know whether courts in most cases can be sufficiently certain whether a cartel exists. The problem will be greatest when agreements are of short duration and thus provide little opportunity for observation of their effects, as would be the case when a proposed licensing scheme is challenged before or immediately after it takes effect. The evidence presented by Priest appears unambiguous in many instances precisely because the offenses had been egregious and there had been ample time to observe their effects.¹⁸¹ In other

¹⁷⁷ In the case in which there is a patent with nontrivial value coupled with a price-fixing scheme, both motives could conceivably be at work.

¹⁷⁸ As suggested by the discussion in note 179, this is true even in the case of traditional horizontal price-fixing. The parties can argue that, because of free-rider problems, the industry's product cannot best be promoted in the absence of restrictions; hence it is necessary for the industry to fix a price above that yielded by unfettered competition in order to give each firm an incentive to advertise the product and provide pre-sale information.

¹⁷⁹ An analogy to the relationship between the rules in *United States v. Topco Assocs.*, 405 U.S. 596 (1972), and *Continental T.V., Inc. v. GTE Sylvania, Inc.*, 433 U.S. 36 (1977), is instructive. *Sylvania* dealt with vertical territorial restrictions, which are similar in effect to vertical price restrictions, and *Topco* dealt with horizontal territorial restrictions, which are similar in effect to horizontal price restrictions in that market division is one way of cartelizing an industry. Part of the justification offered as a defense in *Topco* — the encouragement of local advertising — was essentially the same as the free-rider argument offered in justification of resale price maintenance. Had the Court accepted the defense, it would either have had to permit all territorial agreements or be faced with the task of determining the effects of the arrangement in every case (and if *Topco* had been decided the other way, there may have been many such cases). Without resolving whether *Sylvania* or *Topco* were correctly decided, one can well understand why the Court reached opposite results in the two cases. See *Sylvania*, 433 U.S. at 57 n.27, 58 n.28 (discussing horizontal-vertical distinction and applying it to *Topco*). Similarly, one could imagine the Court's overruling its decision in *Dr. Miles Medical Co. v. John D. Park & Sons Co.*, 220 U.S. 373 (1911), which held that resale price maintenance is per se unlawful, much more readily than one could imagine the Court's changing its mind about *United States v. Socony-Vacuum Oil Co.*, 310 U.S. 150 (1940), which held that horizontal price-fixing is per se unlawful. Although the Court usually does not find it impossible to distinguish horizontal and vertical arrangements, but see *supra* note 178, the option of simply maintaining different rules for each is far more problematic in the patent context described in text, because the arrangement is both horizontal and vertical, see *supra* p. 1864.

¹⁸⁰ See Priest, *supra* note 118.

¹⁸¹ See, e.g., *id.* at 332 (discussing *Rubber Tire Wheel Co. v. Milwaukee Rubber Works*

cases, his conclusions are based upon an analysis of the agreements themselves. This approach is somewhat different from the general tests he proposes and may lose its utility if firms begin to write their agreements with particular legal tests in mind.¹⁸² Moreover, Priest's conclusion that in some cases there was no cartelization rests on evidence that seems more ambiguous than he admits.¹⁸³ Thus, even

Co., 142 F. 531 (C.C.E.D. Wis. 1906), *rev'd*, 154 F. 358 (7th Cir. 1907), *cert. denied*, 210 U.S. 439 (1908), in which the royalty was 4% and prices increased 30 to 37.5%); *id.* at 346-47 (noting, in discussing *General Electric*, that General Electric set only a 2% royalty and that Westinghouse had the ability to survive massive price drops).

¹⁸² See *id.* at 331 (in discussing *Bement v. National Harrow Co.*, 186 U.S. 7 (1902), noting that the holding company admitted that its royalty was merely an administrative fee); *id.* at 334-40 (in discussing *Standard Sanitary Mfg. Co. v. United States*, 226 U.S. 20 (1912), emphasizing evidence that the firms agreed to restrict the production of seconds).

Priest apparently suggests that courts should consider market data *to the exclusion* of other evidence. See *id.* at 326-30. Such an approach is unwise. For example, internal documents might aid in the discovery of royalty rebates. Such documents might also help in the determination of whether such rebates constitute payments for promotional services or the distribution of cartel proceeds. In general, the analysis a firm would undertake before instituting resale price maintenance would differ substantially from that necessary for gauging the feasibility of a cartelization scheme, and the process of determining what price should be set for each of the two purposes would be based upon very different factors. Thus, an examination of internal documents could prove very useful in determining a patentee's true motives.

¹⁸³ For instance, in discussing *United States v. Masonite Corp.*, 316 U.S. 265 (1942), Priest notes the decline in market share of the largest licensee from 20% in 1935 to less than 12% in 1940, see *id.* at 353, yet this hardly seems conclusive of lack of conspiracy. Priest also argues that the failure of one licensee during a time of stiff competition from firms selling other building materials disproves the cartel hypothesis. See *id.* at 354. But a licensee's failure does not negate market power altogether, because, under any theory, the licensee must have had higher costs than others. Priest is critical of the government's approach in *Ethyl Gasoline Corp. v. United States*, 309 U.S. 436 (1940), see Priest, *supra* note 118, at 349-50, but his inference that cartelization was unlikely is not based upon market data — which he properly criticizes the Justice Department for not gathering — but rather derives from his belief that the government's theory was simply implausible.

Priest also argues that there is no choice but to undertake the sort of inquiry he proposes in every case because a *per se* prohibition on price restrictions could readily be circumvented by resort to territorial restrictions, which are protected by the patent statute. See *id.* at 315. This position is flawed for a number of reasons. First, the language of the patent statute, see 35 U.S.C. § 261 (1982), is hardly an unambiguous endorsement of the legality of territorial restrictions. See, e.g., L. SULLIVAN, *supra* note 99, at 535-38; Baxter, *supra* note 101, at 348-52 ("Only by amateurish literalism or cynical distortion can it be argued that § 261 places a general imprimatur of legality on territorial restrictions."); Gibbons, *Territorial Restrictions*, *supra* note 145, at 895-900. In any event, if the statute does so require, it seems Priest should be arguing at least in part that Congress should amend the statute. Second, Priest's argument assumes that territorial restrictions are fully effective substitutes for cartelizing an industry. This is surely not the case. Absent a patent that revolutionizes an industry, territorial division of sufficient scope to isolate each producer may substantially disrupt well-established capital investments, customer relations, and the like. Such is not the case with a direct price-fixing arrangement. Finally, if territorial restraints were in fact both impervious to antitrust attack and perfect substitutes for price restrictions, Priest's efforts would have been in vain. In the long run, it would do no good to apply Priest's analysis and detect those price restrictions that were disguises for cartelization, for patentees would know in advance that territorial restrictions represented a safe harbor.

if courts were to find that resale price maintenance offers a compelling justification for price restrictions, it is not clear whether courts could adequately distinguish situations in which price restrictions were being used for resale price maintenance from those in which price restrictions merely masked the monopoly loss due to cartelization.¹⁸⁴

In sum, although legitimate justifications for price-restricted licensing might exist, it seems likely that the motive behind such schemes is often to disguise cartelization. The ratio test clearly indicates that cartelization should be prohibited. As a result, courts should think twice before allowing exceptions to an otherwise flat prohibition on price-restricted licensing, because the resulting case-by-case inquiry might simply have the effect of insulating cartelization from detection.

V. APPLICATIONS: ACQUISITIONS, CROSS-LICENSING, AND SETTLEMENTS INVOLVING COMPETING PATENTS

Acquisitions, cross-licensing, and settlements involving competing patents all raise the problem of combining patents that otherwise might have been licensed or exploited in competition with one another.¹⁸⁵ Bowman analyzes this problem as follows:

The problem of patent accumulation, the aggregation of several or numerous patents under single ownership or control, is conceptually indistinguishable from the merger problem under antitrust law. . . .

. . . A pool of competing patents can be more readily analogized to a loose association than to a horizontal merger. This, of course, depends upon one's evaluation of the pool's efficiency-creating poten-

¹⁸⁴ In addition to offering ways to detect disguised cartelization, Priest's article examines two additional reasons that patentees might justifiably employ price restrictions. First, he argues, patentees might regulate price to "prevent[] licensees from disassembling the product to reduce royalty payments." Priest, *supra* note 118, at 323 (footnote omitted). "[I]f the royalty charge is set as some function of the licensee's sales revenues, the licensee may gain by disassembling the product to reduce royalties, notwithstanding some consequent diminution in product sales." *Id.* Priest also offers a far more intricate justification based upon the desire of the patentee to take advantage of future cost reductions by licensees. *Id.* at 318-23.

Both of Priest's arguments fail to consider fully the effects of alternative arrangements that might mitigate these problems. In addition, neither argument clearly applies in a significant manner to a broad range of cases. This latter weakness is suggested by the failure of defendants to advance such claims in numerous prior antitrust challenges in which it would have been to their advantage to do so even if the arguments did not clearly apply. For a more detailed explanation of these arguments, see L. Kaplow, *The Patent-Antitrust Intersection: A Reappraisal* 91-96 (Harvard Law School Program in Law and Economics Discussion Paper No. 2, Dec. 1983) (unpublished manuscript on file in Harvard Law School Library). Of course, to the extent that these or other justifications are deemed important, the decisionmaking framework applied to resale price maintenance would be applicable, and the complexity of case-by-case inquiry would be increased.

¹⁸⁵ Difficulties that might arise when complementary patents are combined or cross-licensed are examined in subsection IV.B.2 and in note 170, which discusses the problem of distinguishing complementary and competing patents.

tial. A pool of competing patents is difficult to distinguish from the cartel in this respect.¹⁸⁶

The courts,¹⁸⁷ as well as most other commentators,¹⁸⁸ take essentially the same approach. They reason that, if competing patents were held separately, competition would drive royalty rates down to the point at which each patentee could hope to charge a royalty that merely reflected the degree to which its patent was more valuable than any of the others. Combination or collusion eliminates this competition.

Although this consensus approach may reach the appropriate result, the explanation typically offered is incomplete. This approach fails to appreciate the significance of the diminution in reward to the patentee that results from prohibiting these arrangements and thus essentially ignores the question whether patent policy might dictate a different result. In terms of the ratio test, the denominator is the focus and the numerator is ignored.

Application of the ratio test does not by itself automatically resolve this problem because the numerator, which measures reward to the patentee, is quite substantial. One suspects, however, that the ratio test would indicate that these practices are undesirable because, as in the case of price-fixing, the reward to the patentee is only a fraction of the aggregate reward generated by the arrangement. In addition, the reward arising from such combinations seems to exceed greatly the reward required to provide the amount of incentive appropriate under the circumstances.¹⁸⁹

The true social worth of any one of the competing patents, given that the others exist, appears to be limited to the degree to which the patent exceeds the others in value.¹⁹⁰ Thus, in the simple situation in which each patent is essentially a perfect substitute for the others, any one patent has no economic value — if the invention it protects had never been created, the same cost reduction or product improvement could have been achieved equally well by one of the other patented inventions.¹⁹¹ The reward of zero and the accompanying

¹⁸⁶ W. BOWMAN, *supra* note 103, at 200–01. Bowman argues that the combination of two competing patents raises costs to licensees “above that measured by the ‘competitive superiority’ of either of the patents.” *Id.* at 201. This contention is inconsistent with his general use of the competitive superiority test, under which he infers from licensees’ willingness to accept the terms of the agreement that monopoly has not been extended. *See supra* subsection III.C.1.

¹⁸⁷ *See, e.g.*, *United States v. New Wrinkle, Inc.*, 342 U.S. 371 (1952).

¹⁸⁸ *See, e.g.*, 3 P. AREEDA & D. TURNER, *ANTITRUST LAW* ¶ 705a, at 117 (1978); R. POSNER, *supra* note 125, at 91–92; L. SULLIVAN, *supra* note 99, at 566–68.

¹⁸⁹ *Cf. supra* subsection IV.B (discussing excessive rewards in the context of collusion).

¹⁹⁰ A good discussion concerning the appropriate reward for partially and completely redundant inventions is provided in Beck, *Patents and Over-Investment in Process Inventions: Reply*, 45 S. ECON. J. 289 (1978). For a discussion of the resources consumed by inventing around, *see* F. SCHERER, *supra* note 21, at 446.

¹⁹¹ *See, e.g.*, Wright, *supra* note 25, at 694.

absence of incentive provided by the competitive process would therefore be appropriate.¹⁹²

This analysis, unfortunately, is incomplete. Even though each competing patent is of no incremental value relative to the others, it is still true that without any of the patents the situation would be worse. If combination is precluded and the competitive environment accordingly eliminates all reward to the competing patents, one might ask whether there remains any incentive to come up with the first patent. Moreover, given a situation in which one patent already exists and the patentee accordingly reaps due reward for its monopoly, one should also consider what the proscription on combination does to the incentives for others to enter into competition with the initial patentee by "inventing around" the initial patent. Both inquiries look to the future, when the competing patents do not yet exist, and ask whether the result arising from a competitive regime — in which combinations are prohibited — will be more socially beneficial than the result from a regime that allows unrestricted combination.

The less difficult of the two issues concerns the incentive for the patentee's rivals to invent around the initial patent.¹⁹³ Such invention provides no social benefit if the new invention is no better than the first¹⁹⁴ *and if the two patentees are permitted to combine in order to recover as though they were one*. In fact, the only effect of inventing around in such circumstances is to redistribute the reward from the original patentee to others.¹⁹⁵ Because inventing around does not contribute to welfare when combinations are permitted, the resources devoted to the task are entirely wasted. Such waste would be avoided to the extent that inventing around were discouraged by requiring

¹⁹² This is arguably Bowman's point, *see supra* note 186, if one emphasizes in his language the reference to "the 'competitive superiority' of *either* of the patents," *id.* (emphasis added). The criticism in text is still valid, however, for if the patents are pooled, licensees will in fact be willing to pay the premium as though only one of the patents existed. In this instance, Bowman essentially is requiring that one analyze the situation that would prevail in the absence of the restrictive practice as a basis for comparison, rather than make decisive the licensees' choice when the restriction is present.

¹⁹³ "[I]n the new product category, few positions impregnable to the imitation of rivals are attainable; it is possible to 'invent around' all but the most basic patents." Scherer, *Research and Development Resource Allocation Under Rivalry*, 81 Q.J. ECON. 359, 364 (1967).

¹⁹⁴ To the extent that the second patent is better than the first, that increment of value will be rewarded even with competition. Allowing for such cases does not affect the analysis that follows.

¹⁹⁵ *See* Priest, *supra* note 118, at 362, 373. Priest concludes from this that "[a] cross-license in this context unambiguously diminishes welfare." *Id.* at 362. He fails, however, to consider the effect upon incentives for future inventive activity. *See id.* at 373 (stating that expenditures on inventing around "can increase social welfare if they lead to erosion of the monopoly rent and reduction of the deadweight loss").

It is possible that, even if patentees are not allowed to combine, they will still be able to collude. Usually, however, the remaining aggregate reward tends to decrease as the number of patents increases. *See infra* note 199.

competition. And to the extent that requiring competition does not completely eliminate the incentive to invent around, there would be an additional social benefit because competition among patentees would lower prices and thus reduce the loss in social welfare.¹⁹⁶

The more difficult issue concerns the incentive for the patentee to come up with the initial invention. But for the possibility of potential competition (inventing around), the initial inventor faces the prospect of securing the full monopoly reward under either regime. Yet if competitors do invent around, and if combination follows, this reward will be diluted.¹⁹⁷ The issue thus becomes whether preventing combination would result in a greater or lesser dilution of the reward to the patentee. The important point to note is that, whether combination is prevented or not, no one will have an incentive to invent around unless the anticipated profit is sufficiently large.¹⁹⁸ Thus, in a competitive regime, to the extent that a second patent would prompt the rival patentees to compete away much of the total reward,¹⁹⁹ there would be only a modest incentive to develop the competing patent. The incentive would nevertheless suffice in cases in which the cost of inventing around is sufficiently small. It is quite true that if the initial patentee anticipated that the incentive to its rival would be sufficient to induce inventing around, there might be a serious diminution in incentive to come up with the invention in the first place. The crucial point, however, is that the same diminution in incentive would occur if combination were permitted. Under a regime allowing combination, if the cost of inventing around is relatively low, more and more firms will procure their own patents — a development that will force the

¹⁹⁶ Kitch advocates permitting firms to pool "as a way to stop what will otherwise be a wasteful and continuing investment process." Kitch, *supra* note 71, at 279 n.37. His analysis is deficient in two respects. First, Kitch relies on the questionable assumption that firms would be admitted to a pool before most of the resources necessary to complete the inventing-around process have been spent. Second, and more decisively, he overlooks the fact that firms will have a greater incentive to begin the inventing-around process if they know that pooling will be permitted. Applied to the example in note 200, Kitch's implicit model simply envisions a lower cost of inventing around (because the process need not be completed for the subsequent inventors to be admitted into the pool), which in general does not decrease the total resources wasted as a result of permitting pooling. If Kitch's theory were right, there generally would be less waste per duplicative invention but a proportionately greater amount of duplication.

¹⁹⁷ This general connection was noted by Priest. See Priest, *supra* note 118, at 360-61. Priest claims, however, that such a reduction "is unlikely [because] . . . the return to the innovation is a function solely of the time-lag between the first commercial use of the process and its duplication." *Id.* at 363. The flaw in this argument is that the time lag is not exogenous, but might depend upon the rules adopted. By ignoring this connection, Priest fails to consider the potentially ruinous effects of inventing around upon incentives to invent in the first instance.

¹⁹⁸ See *supra* subsection II.B.2(c).

¹⁹⁹ It is difficult to predict how much competition might generally result from the existence of just two patents. As the number of patents increases, however, the remaining amount of aggregate reward will tend to be less. The analysis in text holds regardless of the precise relationship between the number of patents and the degree of competitiveness.

existing combination either to sacrifice its profits or to admit the new patentees. In general, this process would continue until the original patentee suffered the same diminution of profit that it would have suffered under a competitive system.²⁰⁰

²⁰⁰ The following example illustrates the analysis in the text. Let C be the cost of inventing around — that is, the cost of developing an equivalent invention for all later inventors after the first invention has been made. Consider the effects under two regimes:

(1) *Invent and Combine*: It is assumed for this illustration that the share of reward going to a later inventor is simply its market share divided by the total market shares of all firms that are in the pool — that is, all firms that have come up with the invention. To further simplify the example, assume that all firms are the same size and thus have the same market share. Additional firms will develop the invention if their share of the profits is greater than or equal to the cost. Thus, the equilibrium condition is

$$(1/N) \times P = C.$$

N denotes the number of firms in the pool (that have developed the invention) and P denotes the maximum total profits that can be achieved with the invention. This implies

$$N = P/C.$$

Of course, the total expenditure of resources in this regime is simply $N \times C$, which equals P .

(2) *Invent and Compete*: Here it is necessary to specify how industry profits decrease as the number of firms with the invention increases. Any formulation will have the same qualitative result. For illustrative purposes, assume that industry profits equal $(1/N) \times P$ (where P denotes the maximum profits that could be achieved *without* competition) and that each firm with the invention realizes the same share of the industry profits as any other firm with the invention. Then the equilibrium condition is

$$[(1/N) \times P]/N = C,$$

which implies that

$$N = (P/C)^{1/2}.$$

The total expenditure of resources under this regime is $N \times C$, which equals $(P \times C)^{1/2}$. This is less than the total cost of P under the first regime unless C is greater than or equal to P , but in that case no firm would have an incentive to invent around under either regime, and the issue addressed here would never arise.

The basic difference between the two systems is that, under the competitive regime, profits erode faster than under the regime allowing combination; therefore, equilibrium is reached with fewer firms having invented around and thus with less waste of resources. There is, moreover, an additional benefit under the competitive regime. Because profits are eroded through competition, the monopoly cost of the patent system is also less. This savings has no cost in terms of the total reward to the initial invention by comparison to the regime that allows later copiers to combine. Under both regimes, the share of the remaining reward that accrues to the initial inventor is simply C . It should be noted that these results are not dependent upon the particular formulation of the example presented. Essentially, this is an example of how potential excess profits are translated into social costs when no barriers prevent competitors from eroding the profits. Cf. Dasgupta & Stiglitz, *Uncertainty, Industrial Structure, and the Speed of R & D*, 11 BELL J. ECON. 1, 13 (1980) (noting dissipation of monopoly profits in race to arrive at patent first). See generally Posner, *supra* note 20 (noting general tendency of monopoly profits to be converted into social costs).

This erosion of profits under either regime may result in insufficient incentive for anyone to develop the initial patent. Cf. F. SCHERER, *THE ECONOMIC EFFECTS OF COMPULSORY PATENT LICENSING* 24 (Center for the Study of Fin. Inst., New York Univ. Graduate School of Business Admin., Monograph Series in Finance and Economics No. 1977-2, 1977) ("If small potential innovators come to expect that their innovative thrusts will be promptly countered by established firm defensive moves, they may be discouraged from trying."). In this example, the problem would exist whenever the cost to the initial inventor was greater than the cost of inventing around, and it seems plausible that this condition would often be satisfied. There are, of course,

The preceding analysis suggests a preference for requiring competition. Although forcing competition diminishes the reward and thus the incentive for invention in the first instance, permitting combination has been shown to entail a similar result. Thus, the net

other benefits that go to the first inventor, such as receiving the full industry profit until others begin to invent around and retaining various benefits that often accrue to the first to offer a new product, such as an advantage in building a reputation. *See, e.g., id.* at 21, 23. The potentially ruinous effects of inventing around upon incentives for the initial invention are here demonstrated to plague the patent system generally. Indeed, inventing around is just a more involved type of copying, which it was the very purpose of the patent system to prevent. The issue arises because of the difficulty in defining the appropriate scope of the patent grant. (Here, by "scope" I do intend to refer to the description of the patent found in the documents constituting the patent grant.)

One cannot be certain of the result described here in view of the simplicity of the example. Delays in the time it takes to invent around a patent might affect the expected profits for the first inventor more under one regime than under the other. Also, the simultaneity of competitors' research and development activities, combined with technological uncertainty concerning the likelihood of success from any given endeavor, complicates the story. Moreover, if the costs of inventing around rise as the number of imitating patents increases, the regime permitting combination would offer a greater expected reward to the initial patentee, and the comparison of regimes would thus become more uncertain. (The opposite relationship — decreasing costs — would seem to favor the competitive regime.) At present, I see no *a priori* grounds for assuming that such complications bias the result in one direction or another. Yet the very complexity of the problem warns against overconfidence in drawing conclusions at this stage in the development of the analysis.

There is one technical qualification to the results described in both regimes. Because reward declines more rapidly under the competitive system, requiring competition might sometimes fare better than the results indicate. An extreme example illustrates the point. If prospective second patentees anticipated that competition would reduce rewards so much that there would be insufficient reward left for them to recover their research and development costs, no one would have a sufficient incentive to develop the second invention. The original patentee would then be left with a more substantial reward than it would have gained under a combination that involved sharing of the aggregate profit; the resources that would have been consumed by the duplicative invention would also be saved.

Finally, it is worth noting that, under either regime, the largest firms in any industry will have the greatest incentive to invent around. This is because the larger the firm's market share, the greater its share of the reward, as long as aggregate rewards (as opposed to rewards per unit of output) are positively correlated to the firm's market share — an assumption that seems plausible. One might thus expect the resulting pattern of development to be one in which the largest firms are the ones with the patents. In addition, for similar reasons, they may be the most likely to invent in the first place.

This point does not support the view that larger firm size is most conducive to innovation, which is a highly controversial issue. *See generally* F. SCHERER, *supra* note 21, at 407-38 (discussing the literature); Kamien & Schwartz, *Market Structure and Innovation: A Survey*, 13 J. ECON. LIT. 1 (1975) (same). The analysis instead seems to indicate that, in any given industry, it will be the firms with the greatest *relative* size that will be more likely to innovate, and to duplicate others' inventions, when the costs of inventing around are low relative to the value of the invention. This perhaps suggests that the empirical literature on the relationship among market structure, firm size, and innovation, discussed in the sources cited *supra*, is biased toward the conclusion that larger market shares tend to produce more innovation in an industry. (In this regard, it should be noted that, beyond intermediate levels of size and concentration, the studies do not generally find a positive relationship between innovation and size or concentration.) I call this a bias because a positive correlation is likely to be found even though it

difference between the two regimes is that forcing firms that invent around to compete will tend both to decrease the resources wasted on duplicative research and development and to diminish the monopoly loss incurred in providing the original inventor with a given level of reward. In terms of the ratio test, the competitive regime results in a similar numerator but a lower denominator than does the regime permitting combination and thus is a relatively more desirable approach. This conclusion, however, is subject to substantial uncertainty in light of the present deficiencies in knowledge of the subject; in some circumstances, the first inventor might indeed have less incentive to develop a patent under a competitive regime than under a regime permitting combination.²⁰¹

This Part has not compared the various contexts in which patent combinations arise. Nor has it attempted to address many of the issues that might prove relevant in determining the rules appropriate in each of those contexts. The application of the ratio test, however, has demonstrated that the prevalent distrust of patent combinations is probably justified, notwithstanding the shortcomings in the current analysis of these practices.

VI. APPLICATIONS: PRICE DISCRIMINATION

A. The Desirability of Permitting Price Discrimination by Patentees

The analysis of the benefits of allowing price discrimination by patentees, as noted in subsection II.B.2(a),²⁰² focuses primarily on how much of the patentee reward is pure transfer. For a given numerator (patentee reward), the denominator (monopoly loss) decreases as the extent to which the patentee achieves its reward through transfers of economic surplus increases.²⁰³ Price discrimination was

does not indicate that higher concentration or larger firm size will increase innovative activity. The only sense in which higher concentration or larger firm size might in fact result in an increase is that the equilibrium level of copying activity would be higher for larger firms. For the reasons suggested in the text, however, this effect is socially undesirable and thus adds a further reason to question whether any observed positive relationship between firm size and innovation gives appropriate guidance for policy formation.

²⁰¹ See *supra* note 200.

²⁰² See also *supra* p. 1833 & note 50 (further discussion of price discrimination).

²⁰³ Outside the patent context, conferral of reward through transfers might be undesirable for a number of reasons. One reason, explored by Posner, see Posner, *supra* note 20, is that added rents induce rent-seeking behavior that eventually competes away the rents while wasting resources along the way. It is precisely this process that the patent system attempts to convert to an advantage, for it is the holding out of the patent reward that induces the "rent-seeking" behavior that in this context constitutes inventive activity. Unfortunately, it also leads to wasteful duplication, see, e.g., *supra* Part V, litigation costs, and other losses as well.

Outside the antitrust context, the principle that price discrimination can be used to raise needed revenues from consumers with different elasticities of demand while keeping losses to a

offered as the typical situation in which reward might be achieved primarily through transfers.

Although many commentators have favored permitting patentees to engage in restrictive practices that facilitate price discrimination, their analyses often fail to recognize the need for simultaneous examination of the numerator and the denominator of the ratio. Bowman, for example, who typically concentrates solely on the ratio's numerator, finds price discrimination acceptable largely because it increases the patentee's reward.²⁰⁴ To bolster his position, he protests the unfairness that results when some patentees cannot engage in price discrimination because certain restrictive practices have been prohibited, whereas other patentees are in a position to discriminate without resorting to such practices.²⁰⁵ Bowman correctly observes that this situation induces inefficiency by encouraging the further integration of some firms to the detriment of more efficient smaller firms; to alleviate this problem, he advocates permitting price discrimination by all patentees.²⁰⁶ His argument, however, would fail to justify his conclusion if the practices of the larger firms were themselves undesirable, particularly if those practices could be regulated.²⁰⁷

Other observers overemphasize the denominator of the ratio in assessing the desirability of price discrimination. Many patent-antitrust commentators tend to assume that the desirability of allowing patentees to practice price discrimination depends upon what the effect on output will be in various circumstances.²⁰⁸ Indeed, price discrim-

minimum has arisen in a number of settings. See, e.g., A. ATKINSON & J. STIGLITZ, LECTURES ON PUBLIC ECONOMICS 366-93 (1980) (taxation); Bailey & White, *Reversals in Peak and Offpeak Prices*, 5 BELL J. ECON. & MGMT. SCI. 75 (1974) (utility rate-setting); Baumol & Bradford, *Optimal Departures From Marginal Cost Pricing*, 60 AM. ECON. REV. 265 (1970) (price regulation of monopoly).

²⁰⁴ See W. BOWMAN, *supra* note 103, at 56. Elsewhere, he refers to the effect of price discrimination as "maximiz[ing] the return ascribable to the differential advantage the patent affords." *Id.* at 101.

²⁰⁵ See *id.* at 56.

²⁰⁶ See *id.*

²⁰⁷ Cf. *supra* note 33 (making same argument in proportionality context).

²⁰⁸ See, e.g., L. SULLIVAN, *supra* note 99, at 540-41 (in discussing territorial restrictions, noting that "[t]he higher return to the patent holder is, from the vantage point of the public, unnecessary to the stimulation of any socially desired conduct"); *id.* at 557 (taking a similar position regarding use of field restrictions to facilitate price discrimination). Williamson's criticism of Bowman (whose statement is quoted later in this footnote) also relies heavily on the efficiency consequences — although Williamson considers transaction costs in addition to the output effect — while attributing little significance to the effect on the patentee's reward. See Williamson, Book Review, 83 YALE L.J. 647, 660 (1974).

Bowman avoids the error of focusing on output effects (although he makes a similar mistake in a related context, see *infra* Section VII.C) precisely because of his focus on only the numerator:

[I]t has been suggested that price discrimination deserves proscription when it results in output contraction. But evaluating this contention, especially in the patent context, merely raises the question whether a patentee should receive the "full reward" provided by the superiority of his patent in some circumstances but not in others.

ination will sometimes result in increased output and thus in a more efficient allocation of resources. But contraction of output is also possible, although commentators occasionally argue (without much foundation) that expansion is more likely.²⁰⁹

The effect on output is certainly relevant to the denominator of the ratio insofar as it increases or decreases monopoly loss. But this effect is not the only factor — and indeed may not even be the major factor — that bears upon the overall ratio. For example, if there is no effect on output, or even a moderately adverse effect, there will often still be a substantial increase in patentee reward. Thus, it is plausible that the net effect of discrimination will frequently be a high ratio: the relatively large transfer effect produces a large numerator, whereas the effect on output, at worst, involves a modest loss and thus yields a small denominator. Because the transfer effect might often dominate even an adverse effect on output — and thus increase the ratio despite an increase in the denominator — general conclusions concerning the benefits of price discrimination by patentees in many contexts are possible even if the specific effect on output is uncertain.

Beyond its effects on the ratio, price discrimination also raises the problem of disproportionately high rewards to patentees, which, as discussed in subsection II.A.3, can make for bad patent policy independent of how such discrimination fares under antitrust analysis.²¹⁰ If patentees, but not others, are permitted to engage in discriminatory practices, price discrimination might enable patentees to recover even more than the total economic surplus generated by their invention without resorting to any disguised cartelization. A patentee would reap this benefit if its price discrimination enabled it to capture not only the surplus generated by its invention, but also the surplus that would have gone to consumers or other producers in the absence of the patentee's invention. For example, a firm that had substantial market power before developing an invention may have been forbidden from engaging in price discrimination. With the patent, however,

Why, it needs to be asked, if temporary monopoly (by nature restrictive) is what a patent monopoly necessarily involves, should it be more reprehensible to achieve it from several demand curves than from just one?

W. BOWMAN, *supra* note 103, at 112.

²⁰⁹ See, e.g., F. SCHERER, *supra* note 21, at 320–22 (noting that, despite the tendency to expect increased output, “we really do not know, and so it is impossible to determine whether on balance third-degree discrimination increases output and improves the allocation of resources”).

²¹⁰ The connection between the possible need for limiting the patentee's total reward and the argument that transfers are an efficient way to reward licensees can be seen by reviewing the analysis of the latter. The claim was that for a given numerator, the denominator will be less when the reward is achieved through, for example, price discrimination. But the decision to permit restrictions or actions that facilitate price discrimination is not made in a world in which the numerator is fixed — permitting price discrimination also increases the numerator. This fact does not of course imply that the result will be undesirable, but one must weigh the impact of this effect when reaching a decision.

this firm may be able to discriminate in a manner that allows it to capture the preexisting consumer surplus. Thus, because price discrimination is one of the most efficient means of patent exploitation — it has a high ratio — a good way to reward patentees appropriately might be to permit price discrimination and to adjust the patent life accordingly.²¹¹

In evaluating the desirability of price discrimination, one should also consider the distributional and equitable implications of this practice as well as its effects on efficiency.²¹² The possible concerns are varied and complex. These issues, however, will not be considered here, because the relevant analysis is little affected by this discussion of patent policy, even if the possible positive effects of price discrimination noted in this Part influence one's ultimate conclusions.

Finally, price discrimination presents the usual antitrust concerns of potentially adverse primary- or secondary-line effects. These effects are important because they bear on the denominator of the ratio.²¹³ To begin with, consider primary-line effects.²¹⁴ Price discrimination will not permit predatory behavior unless others hold competing patents²¹⁵ or the predation has no connection to the patent. If one believes that antitrust law's general proscription of price discrimination is an important deterrent to such predation, and that actual instances of predation are difficult to detect, then permitting price discrimination would be problematic because it would be very difficult to determine whether a patentee in any particular case was in fact engaging in predatory pricing. Yet because the usual classifications that form the bases for economic discrimination are fields of use and customer groupings, predation should in fact be easy to detect, unless

²¹¹ Of course, even if more price discrimination were allowed, the patent life should not necessarily be shortened, because it might already be too short. See generally *supra* Section II.C (describing the simultaneous process for determining optimal patent life and patent-antitrust doctrine).

²¹² To the extent that price discrimination is deemed inappropriate, principles of the Robinson-Patman Act, 15 U.S.C. § 13 (1982) (§ 2 of the Clayton Act, amended by the Robinson-Patman Act of 1936, ch. 592, 49 Stat. 1526), and similar proscriptions deriving from other antitrust statutes presumably would be applied to royalty structures, in which case one must face the problems Baxter raises concerning the difficulty of defining when royalties are discriminatory. His analysis, see Baxter, *supra* note 101, at 281-87, is a significant contribution to the resolution of this problem.

²¹³ Many commentators have been hostile to the Robinson-Patman Act's proscriptions against price discrimination. See, e.g., R. BORK, *supra* note 115, at 382-401 (calling the enactment of the proscriptions "antitrust's least glorious hour"); F. SCHERER, *supra* note 21, at 580-82 ("The . . . Act is an extremely imperfect instrument. It is questionable whether the circle of its beneficiaries extends much wider than the attorneys who earn sizeable fees interpreting its complex provisions."). As a result, many commentators might not be greatly influenced by the primary and secondary effects regardless of how the effects might arise in the patent context.

²¹⁴ See generally Gibbons, *Field Restrictions*, *supra* note 102, at 433-35 (discussing primary-line effects of field restrictions).

²¹⁵ See generally *supra* Part V (discussing competing patents).

competitors' businesses are divided along the same lines separating users that value the patent differently. For example, if the patentee's competitors sell competing patented products in different regions of the country and the patentee-defendant sells nationwide, royalties that discriminate on the basis of fields of use would aid little in targeting individual competitors — unless, by chance, the demand in each competitor's region were concentrated in one or a few fields of use. By contrast, a territorial discrimination would pose a danger in this context.

Secondary-line price discrimination might pose less of a risk than the primary-line discrimination if, for example, discrimination across different fields of use would not have the effect of offering more favorable treatment to one direct competitor than to another.²¹⁶ Secondary-line injury only results if different rates are charged to firms in direct competition, a circumstance that could have the effect of "bring[ing] about structural changes in that industry which at best will be artificial."²¹⁷ Baxter applies this analysis to *Grand Caillou*,²¹⁸ but he does not fully recognize the relevance of patent policy to the analysis.²¹⁹ Although he is correct that "[t]he optimum allocation is that which would prevail if the [invention] were available to each segment royalty-free,"²²⁰ his analysis ignores the effect on incentives. By emphasizing that the primary objective should be to minimize any distortion in the allocation of production among firms,²²¹ Baxter essentially preoccupies himself with monopoly loss (the denominator of the ratio) and fails to consider whether the overall effect on the ratio would be desirable.²²² Thus, two steps are involved in judging the effects of secondary-line price discrimination. First, one must determine whether there are any adverse secondary-line effects, which might be inferred from, or negated by, the nature of the discriminatory structure and the sales patterns of competing firms. Second, if there are such effects, one must then determine the net effect of the dis-

²¹⁶ See Gibbons, *Field Restrictions*, *supra* note 102, at 433. If competing licensees do in part sell in the same field, they would pay the same royalty rate for that use, if one assumes that there was no further discrimination among individual licensees of, or buyers from, the patentee.

²¹⁷ Baxter, *supra* note 101, at 283.

²¹⁸ *Grand Caillou Packing Co.*, [1963-1965 Transfer Binder] TRADE REG. REP. (CCH) ¶ 16,927 (June 4, 1964) (barring patentee of shrimp-peeling machine from charging different rental rates in different regions of the country), *aff'd in relevant part and rev'd in part sub nom.* LaPeyre v. FTC, 366 F.2d 117 (5th Cir. 1966).

²¹⁹ See *supra* p. 1847 (criticizing Baxter for stating that the "legality of the seller's monopoly is irrelevant" in this context, Baxter, *supra* note 101, at 297).

²²⁰ Baxter, *supra* note 101, at 291.

²²¹ See *id.* at 291-93.

²²² This error is very similar to the one Baxter makes in analyzing royalties based upon an unpatented end product. See *infra* Section VII.B.

criminatory practice on the ratio — a task that will probably prove much more difficult.

B. Permissibility of Practices that Facilitate Price Discrimination

If one concludes from Section A that price discrimination is desirable, one must then determine whether the entire range of restrictive practices that can be used to accomplish price discrimination should be permitted. This Section briefly presents and analyzes the most frequently discussed practices. The analysis is confined to examining the use of the various practices as mechanisms for price discrimination; it does not deal with the complex issues that each restrictive practice raises, independent of patent considerations, in the antitrust context.

Discriminatory royalty rates are the most direct mechanism for price discrimination. For instance, when a patentee feels that heavy users derive more value than do light users, it often will set the royalty as a function of the amount of the patent's use. Another technique for charging higher prices to heavy users is to tie the use of some related product sold by the patentee to the use of the patent and charge a price in excess of cost for the tied product.²²³ This excess serves the function of a royalty. Alternatively, if a patentee thinks it possible to recover a greater return on some types of uses of its invention than on others, it can charge a higher royalty for those uses.²²⁴ Field-of-use restrictions might be helpful in accomplishing this kind of discrimination;²²⁵ such restrictions make it easier to keep track of how much of each licensee's output is produced in each possible field of use, because each licensee is confined to only one field.

The ratio test does not clearly indicate whether generally prohibited practices — such as tying arrangements and the division of fields among competitors — should be permitted in the patent-antitrust context simply because they might be used in conjunction with a price discrimination scheme. If discriminatory royalties alone could achieve the desired purpose, the ratio test would suggest prohibiting any additional restrictions because their use as a vehicle for price discrimination simply increases the denominator and thus decreases the ratio. Yet to the extent that such restrictions are profitable, they also increase

²²³ Tying restrictions were held illegal in *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917).

²²⁴ Defining when a royalty is discriminatory is a serious problem in this and related contexts. Baxter analyzes this issue at great length. See Baxter, *supra* note 101, at 281–87. If discriminatory royalties are to be permitted, however, there is no operational need for a precise, nonarbitrary definition.

²²⁵ The legality of field-of-use restrictions in the patent context was originally established in *General Talking Pictures Corp. v. Western Elec. Co.*, 304 U.S. 175 (1938), but has since become a more ambiguous question. See L. SULLIVAN, *supra* note 99, at 558.

the patentee's reward. The overall effect on the ratio is therefore ambiguous.

Because of their potential harm, one must be cautious about allowing additional restrictions. The greatest danger accompanying field-of-use restrictions,²²⁶ for example, is that such restrictions could operate to divide the market and thus to facilitate cartelization, as discussed in subsection IV.B.1.²²⁷ The same danger exists with territorial restrictions purportedly used to facilitate price discrimination.²²⁸ As suggested by the analysis in subsection IV.B.1 — which was directed at price restrictions but which largely applies to territorial restrictions as well — it is quite possible that the denominator will increase to reflect the full loss, whereas the numerator might increase more moderately because the patentee will often receive only a portion of the monopoly profits.²²⁹

In many circumstances, however, the danger of cartelization through field and territorial restrictions might well be less significant than the danger of cartelization through price restrictions. Because the first two methods result in market divisions, they are not likely to be used for cartelization in established industries in which stable investments, customer relations, and the like would tend to be disrupted.²³⁰ But in instances in which fields of use are first being developed, or in which lines of specialization²³¹ or regions of operation²³² are already largely established, the danger of cartelization is greater.

When the danger of collusion is significant, one might consider Baxter's general proposal that the patentee be required to offer non-

²²⁶ For tying restrictions, and for field restrictions motivated by reasons other than price discrimination, some of the same analysis would apply, depending upon how it was claimed that the patentee profits from the practice.

²²⁷ See, e.g., Gibbons, *Field Restrictions*, *supra* note 102, at 461–62. Baxter's analysis of this point, see Baxter, *supra* note 101, at 341, is excellent.

²²⁸ The use of territorial restrictions as a disguise for cartelization is noted by L. SULLIVAN, *supra* note 99, at 534–35, and Gibbons, *Territorial Restrictions*, *supra* note 145, at 905, although not in the context of discussing their possible use to facilitate price discrimination.

²²⁹ Field restrictions, like territorial restrictions, might be defended in some circumstances as provisions that facilitate product development and promotion along the lines suggested by the argument in favor of resale price maintenance. See *supra* pp. 1862–63 & note 172. To the extent that such a defense was plausible, one would again confront the question of how well courts can distinguish good uses from bad uses, which raises the related issues discussed in the context of resale price maintenance. See *supra* Section IV.C.

²³⁰ See Gibbons, *Field Restrictions*, *supra* note 102, at 462; *supra* note 183.

²³¹ See Gibbons, *Field Restrictions*, *supra* note 102, at 462. The fact that specialization already exists does not imply that field restrictions would not reinforce such divisions when, for example, firms in each field would fear entry from firms in related fields if not for the restrictive arrangement.

²³² The analysis from the preceding footnote is equally applicable here, except that the reference to "related fields" would be changed to "neighboring territories."

exclusive licenses on the same terms that it offered all prior licenses.²³³ In any field in which it offered a license, the patentee would have to offer all comers a license at the same royalty rate.²³⁴ This approach seeks simultaneously to permit field restrictions when necessary in order to accomplish price discrimination, and to avoid the danger of market division.²³⁵ It fails, however, to eliminate the danger, because firms can tacitly agree not to demand a license in each other's field. Such an agreement could be quite effective, because firms can credibly threaten to seek retaliatory licenses in the field of any firm that violates the agreement. Thus, the danger of cartelization, although more limited, would still exist even under Baxter's scheme.

Some might argue that we should permit restrictions in addition to discriminatory royalty rates because such restrictions can help patentees monitor the activities of licensees.²³⁶ Such monitoring is presumably desirable because it helps ensure that the patentee will obtain its desired reward under its discriminatory royalty scheme. In most circumstances, however, this purported aid to monitoring is likely to be superfluous. The enforcement of discriminatory royalty rates by monitoring the licensee's sales of different products typically will not be difficult, especially with privileged access to the licensee's records.²³⁷ Moreover, other restrictions pose many of the same monitor-

²³³ See Baxter, *supra* note 101, at 345-47. Gibbons concurs in this proposal, but he would also require that the patentee offer licenses in its own field or fields of use. See Gibbons, *Field Restrictions*, *supra* note 102, at 427. This proposal, unlike Baxter's, would require courts to regulate royalty levels, because no benchmark would be readily available. Gibbons does not explain the patentee's motivation for keeping certain fields to itself in the first place. See *id.* at 473 (evidencing a misunderstanding of the patentee's self-interest in permitting licensees to achieve monopoly profits). Nor does he explain why such a result would be inconsistent with either patent policy or a proper resolution of any patent-antitrust conflict. As long as the patentee can control the royalty level for licensees operating in its own field, no significant reason exists for the patentee to keep sales to itself. See generally *supra* Section IV.A (discussing market-protection theory for price-restricted licensing). On the other hand, aside from the substantial administrative difficulties, Gibbons' addition to Baxter's proposal might pose little danger.

²³⁴ Because it requires licensing only in instances in which the terms are already established by the patentee, Baxter's proposal avoids the need to engage courts in valuations that they may find difficult or distasteful.

Unless the patentee were attempting to create a cartel, or to encourage product development, see *supra* note 229, licensing a number of firms in each field would be in its interest because the firms would then maximize sales. See Turner, *supra* note 67, at 471 (making this point without noting the possibility of product development). Thus, as in Part IV, observation of particular behavior, in this case exclusive field or territorial licensing, does limit the range of possible explanations but does not necessarily lead to an automatic resolution of the issue.

²³⁵ This compromise does not preserve the possibility of achieving the benefits similar to those attributed to resale price maintenance, see *supra* note 229, which depend upon the exclusivity of the license.

²³⁶ See, e.g., L. SULLIVAN, *supra* note 99, at 557-58; Markovits, *Tie-Ins and Reciprocity: A Functional, Legal, and Policy Analysis*, 58 TEX. L. REV. 1363, 1379-80 (1980).

²³⁷ See generally L. Kaplow, *supra* note 125, at 44-49 (examining general tendency of many

ing problems that arise with a simple discriminatory royalty scheme. With field restrictions, for example, one must still monitor the output in the authorized fields if one assumes — as is often the case — that royalties are a function of output.²³⁸ With customer restrictions, one must again measure quantity, and the patentee must also ensure that the restriction is not violated. With a tying arrangement, the patentee must ensure that the licensee is not buying the tied product from others.²³⁹ The easiest way to gain such assurance will often be to compare purchases with production and sales records; such comparisons would have been sufficient to allow the patentee to monitor the royalty directly.

If additional restrictions are prohibited, firms might still attempt to impose them covertly by incorporating them into their royalty structure. Such attempts, however, should generally be easy to detect. For example, the patentee might charge each licensee an exorbitant royalty in all but one field of use, a field that could differ for each licensee. Such a scheme would accomplish the same result as a field-restricted license. The result would be easy to detect, however, because if all the patentee truly had in mind were price discrimination, it would have set the royalty rate in each field at the same level for each licensee.

In sum, one can argue that restrictive practices other than discriminatory royalties should not be permitted on the theory that they facilitate price discrimination, because they increase the denominator without affecting the numerator, and thus yield a lower ratio. Although there might be some cases in which monitoring would be difficult without restrictive practices, such practices are usually not essential to the monitoring function. On the other hand, if one agrees with Bowman that restrictive practices rarely if ever cause any harm, or if one believes that discriminatory royalty schemes are in fact difficult to enforce without restrictive practices, one might allow the restrictions in some instances. Under this latter approach, however, one must deal with the increased danger of disguised cartelization.²⁴⁰

commentators to ignore or underestimate less restrictive alternatives). Such information is also publicly available in many instances. Of course, the added incentive to cheat might affect the reliability of such statistics.

²³⁸ If royalties were a function of profits, field restrictions would eliminate the need for careful accounting checks only if the licensee produced nothing other than the licensed product. Otherwise, profits would still have to be accounted for and traced to the licensed product. Thus, the manipulability of the accounting measures of profits also presents a problem.

²³⁹ In the case of a tying arrangement for which it is optimal to set a high price on the patented product and a *below-market* price on the tied product — that is, when heavy users are the low-value users — there would be no need to fear such evasion, although there would arise the opposite problem of excessive purchases of the subsidized tied product for resale to others.

²⁴⁰ There is also the danger that monitoring the sales activities of competitors, directly or indirectly, will facilitate collusive behavior. See generally Stigler, *A Theory of Oligopoly*, 72 J.

VII. APPLICATIONS: PATENTEE CONTROL OF UNPATENTED END PRODUCTS

A frequent issue in patent-antitrust litigation involves the degree to which restrictions imposed by the patentee may be related to unpatented processes, products, or services. For example, the patentee might attempt to tie unpatented products to the sale of its patented product or to control the unpatented output produced by its patented process. The most typical arguments offered are either that such restrictions should be prohibited because they go beyond the scope of the patent — a view that has prevailed in some contexts²⁴¹ — or that they should be permitted because they allow the patentee merely to receive the full reward attributable to its invention.²⁴² This Part focuses upon one particular arrangement: the charging of royalties based upon sales of an unpatented end product when the patent covers only one particular input. This arrangement is described more fully in Section A. I emphasize this example primarily because it has been the subject of extensive commentary. The analysis, however, is directly applicable to the use of other restrictions that are employed for the same purposes. The arguments for and against the prohibition of such restrictions are associated with Baxter and Bowman, respectively. Sections B and C consider their justifications in turn and show how each has concentrated primarily on one portion of the ratio. Section D shows that when the numerator and denominator are considered simultaneously, the problem is clarified, although its resolution becomes more complex.

A. The Example: Royalties Based on Sales of an Unpatented End Product

Consider a situation in which a patentee's invention is used by its licensees²⁴³ in the manufacture of one or more end products that are not themselves subject to patent protection.²⁴⁴ If the patented input can be used only in a fixed proportion to output — for example, one and only one patented bottom can be attached to each bucket produced — the choice between an input-based and an output-based royalty is immaterial because there is a one-to-one relationship be-

POL. ECON. 44, 46 (1964) (discussing how the inability to detect cheating makes cartel enforcement more difficult).

²⁴¹ See, e.g., *Brulotte v. Thys Co.*, 379 U.S. 29, 33 (1964) (royalty obligation extending beyond life of patent); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 516-18 (1917) (tying arrangements).

²⁴² This view is similar to Bowman's position. See *infra* Section VII.C.

²⁴³ A sale (assignment) in which payments depend upon the future business of the buyer would raise precisely the same issue as would a similar licensing arrangement.

²⁴⁴ If the patentee also had a patent covering the end product, there would be no question that the patentee would be permitted to charge a royalty based upon sales of that product.

tween the two.²⁴⁵ The analysis therefore focuses on the more frequent case in which there is some potential for varying the amount of the patented input.²⁴⁶ For example, if the royalty for use of a patented fertilizer were increased, farmers might be able to substitute additional land, other fertilizers, different crop-rotation practices, or increased pesticide use for some of the patented fertilizer.

The potential for substitution by users of the patent gives the patentee an incentive to base royalties directly on the sales of the end product. When the royalty is based upon use of the patented input, the user of the input can decrease royalty payments by changing its production mix to decrease reliance on the input.²⁴⁷ If, however, the royalty is based upon the amount of output produced, regardless of how much or how little of the patented input is used, the producer will determine its input mix based upon the actual cost of each input and avoid the possible distortion resulting from the royalty charged for the input.²⁴⁸ Thus, an output-based royalty avoids inefficient substitution away from the patented input²⁴⁹ and generally permits

²⁴⁵ See W. BOWMAN, *supra* note 103, at 72; F. SCHERER, *supra* note 21, at 301-02 & n.12 (noting that this conclusion depends on the assumption that the end-product market is competitive).

²⁴⁶ Such potential almost always exists, although changes in the amount of the patented input may alter the end product somewhat. For example, if the inside coating for a television screen were patented and the price per unit of the coating (or the royalty on its use) increased, one would expect smaller screens to be produced. The analysis in text would then be applicable.

²⁴⁷ The response of increasing the royalty rate does not fully avoid this problem, because any increase in the royalty based on use of the input will cause a further reduction in use of the input. The patentee can always profit more if it can base its royalty on the end product, as long as there is some degree of input substitutability. This proposition can be demonstrated in two steps: (1) for any given royalty based on the input, the corresponding output-based royalty (the existing input royalty multiplied by the average amount of input used for each unit of output) would, by definition, earn the same profit for each unit of output; (2) the producer will change its production mix to a more efficient combination of inputs, which will lower its costs and thereby result in an increase in output, which in turn will increase total royalty payments.

²⁴⁸ Because royalty levels will affect the amount of output, there could be some indirect influence upon the input mix resulting from possible variations in the optimal input combination as output changes. Such variations are not, however, distortions in production efficiency.

²⁴⁹ Other mechanisms could be used to accomplish similar purposes. See, e.g., Baxter, *supra* note 101, at 301 (identifying tying arrangements and vertical integration as alternatives to an output-based royalty). A tying arrangement that required the producer to buy all its inputs from the patentee, in predetermined proportions, would have the same effect. This practice, however, might be more cumbersome for the patentee to arrange and would require that the patentee be intimately familiar with each licensee's production technology, including how the licensee should respond to short-term fluctuations. Thus, as discussed in the context of price discrimination, see *supra* Section VI.B, the less restrictive alternative of end-product royalties might be preferable, especially because this alternative seems even better suited to the task. Vertical integration is another way to prevent input substitution. Yet it too seems more restrictive than output-based royalties, and it might be an option for only a few patentees because the problem of substitution is fully avoided only if the integration covers all end-product producers that would otherwise be licensed. See generally Blair & Kaserman, *Vertical Control with Variable Proportions: Ownership Integration and Contractual Equivalents*, 46 S. ECON. J. 1118,

the patentee to derive more profit from the transaction, just as any firm's market power increases if substitution is not an option for buyers. Furthermore, the producer using the patented product produces with a more efficient input mix. On the other hand, it is possible that an end-product royalty will result in a greater net restriction of output of the end product. The dispute between Baxter and Bowman centers largely on how one should evaluate this set of effects.

B. Baxter's Argument

Baxter characterizes end-product restriction as a situation in which the patentee has extended its monopoly of the patented input to the unpatented end product.²⁵⁰ Baxter believes that permitting the end-product royalty will further restrict output and thus produce a net monopoly loss. He also believes that, because all inputs are underutilized when output is diminished, this loss in efficiency will outweigh any benefit arising from a more efficient input mix. He therefore concludes that end-product restrictions should be prohibited.²⁵¹

Baxter's analysis of the economic effects of end-product restrictions is questionable.²⁵² But even if the analysis is accepted, his argument is troubling because — as is true of his comparability approach generally²⁵³ — he focuses only on the ratio's denominator. His point is simply that the monopoly loss will be greater if royalties are based on end products rather than on inputs. Yet because Baxter concedes that the reward to the patentee will also be greater,²⁵⁴ his perspective does not rule out the possibility that the ratio will be greater, or at least about the same, if the restriction is permitted.

C. Bowman's Argument

Bowman's analysis emphasizes that permitting the patentee to base its royalty on the end product avoids the inefficient use of inputs by licensees.²⁵⁵ In addition, he explicitly notes — and proves through examples — that the output under an output-based royalty might be either higher or lower than when royalties can be based only upon

1120-23 (1980) (illustrating the similar effects of vertical integration and royalties when used for such purposes); Blair & Kaserman, *Vertical Integration, Tying, and Antitrust Policy*, 68 AM. ECON. REV. 397 (1978) (demonstrating the similar effects of tying and vertical integration when used for such purposes). Baxter applies his analysis of output-based royalties to price and output restrictions as well. See Baxter, *supra* note 101, at 330-31.

²⁵⁰ See, e.g., Baxter, *supra* note 101, at 302-03, 353.

²⁵¹ See *id.* at 303-06.

²⁵² The actual effects are described in Section VII.D.

²⁵³ See *supra* Section III.D.

²⁵⁴ See Baxter, *supra* note 101, at 301.

²⁵⁵ See W. BOWMAN, *supra* note 103, at 76-88.

use of the patented input.²⁵⁶ Of course, if output were higher, Baxter's argument based upon net inefficiency would turn against him, and Bowman's position would be strengthened.²⁵⁷ Yet for those cases in which output would indeed be curtailed, Bowman does not attempt to contradict Baxter's claim that the net effect on economic efficiency would be adverse when the input and output effects are compared.²⁵⁸

Bowman's attack on Baxter comes from a somewhat different angle. He emphasizes that "no payment can be extracted by the patentee which is not ascribable to the competitive superiority afforded by the patented resources without which the consumers would be even worse off."²⁵⁹ But this application of Bowman's competitive superiority approach is subject to the same criticisms developed in subsection III.C.2 — the argument focuses solely on the numerator, patentee reward. Although Bowman's other arguments do bear on the magnitude of the denominator, he does not advance any argument that would support the inference that the denominator generally would be small enough to make one confident that the overall ratio would be high. Moreover, Bowman is making the wrong comparison. The quoted argument demonstrates only that allowing the patentee to base royalties on the end product is preferable to the situation in which the patentee had never developed the invention in the first place, not that allowing end-product royalties is better than prohibiting such royalties and allowing input-based royalties instead.²⁶⁰

Bowman's argument is, however, responsive to some of the spirit of Baxter's critique. Bowman's analysis demonstrates that the patentee has not really gained a monopoly over the unpatented end product, for the patentee cannot charge royalties that are higher than the value its invention contributes. If the patentee attempted to set its royalties above this level, producers would simply manufacture the end product without the patented input.²⁶¹

²⁵⁶ See *id.*

²⁵⁷ Yet the general objection that the reward might be excessive must still be considered. See *infra* p. 1887 & note 269.

²⁵⁸ Baxter, however, cannot be correct in every case; if the output effect were zero, there would be a net gain through reduction in input inefficiency, and that gain could not be offset for at least some small range of output reduction.

²⁵⁹ W. BOWMAN, *supra* note 103, at 88; see *id.* at 100 (discussing patentee's "exploiting the full advantage his patent affords users").

²⁶⁰ See also *supra* note 127 (making similar criticism of Bowman's approach in general); cf. W. BOWMAN, *supra* note 103, at 110-11 (criticizing Baxter for ignoring the question whether apportionment of production is less efficient, "not compared with competition after the patent has expired, but compared with [the] single monopoly price while the patent is in force"). Bowman is correct that Baxter errs in comparing end-product royalties to the competitive result, but Bowman himself errs in making the comparison to the situation in which the patent does not even exist. These errors parallel their tendencies to favor the antitrust and patent sides of the conflict.

²⁶¹ See W. BOWMAN, *supra* note 103, at 89-93.

D. Applying the Ratio Test

The examination of end-product royalties well illustrates the analysis developed in Sections III.C and III.D in which Baxter's and Bowman's general positions were compared to each other and were contrasted with the ratio test. Once again, Baxter and Bowman emphasize different halves of the analysis. The ratio test, by integrating both halves, provides a more complete understanding.

Much of the analysis necessary for applying the ratio test to output-based royalties has already been provided. Section VII.C noted that, if output-based royalties increased output, there would be an unambiguously positive effect.²⁶² Yet the more frequent result of direct output-based royalties will probably be that the price paid by consumers will increase and output will fall.²⁶³ In that event, the net effect on economic efficiency depends upon the particular circumstances.²⁶⁴ Despite the uncertainty over whether the denominator of the ratio increases or decreases, however, the fact that end-product royalties unambiguously lead to an increase in the numerator²⁶⁵ (patentee reward) makes it more plausible that the ratio would increase if such royalty schemes were permitted.²⁶⁶ Although one can neither state

²⁶² When the denominator is less than zero — for example, when there is a net increase in output (that is, less deadweight loss, so that loss is *reduced*) — the ratio could be considered infinite because there are gains in terms of both patent and antitrust policy. *But see infra* p. 1887 & note 269.

²⁶³ This proposition can be demonstrated by examining the somewhat analogous action of vertical integration from the input supply stage to the final product stage. *See* F. SCHERER, *supra* note 21, at 302; Hay, *An Economic Analysis of Vertical Integration*, 1 INDUS. ORG. REV. 188 (1973); Warren-Boulton, *Vertical Control with Variable Proportions*, 82 J. POL. ECON. 783, 784, 788–90 (1974). These articles analyze vertical integration, which has characteristics similar to those of end-product royalties. Both mechanisms transfer control from a single input (or group of inputs) to the end product. Thus, there will be similar effects in terms of the price and output of the end product as well as the incentives in choosing the input mix. *See supra* note 249. Nevertheless, in his criticism of Baxter for characterizing end product royalties as a mechanism for achieving a monopoly over the end product, Bowman notes an important difference. *See supra* p. 1885. If a firm with a monopoly over one input achieved full forward integration, it would have a monopoly at that downstream level and would thus be able to charge the full monopoly price. In contrast, the patentee charging royalties based upon end-product sales faces the constraint that if the royalty is too high, its patented input will not be used at all. Conceivably, this added constraint is sufficient to make the net welfare effect positive, but I do not now see any way of proving that would be the result. Moreover, as long as vertical integration did not achieve a monopoly at the downstream level, the other firms would provide the same constraint upon the patentee because if it raised its price too far, those other firms could profitably operate without using the patented input.

²⁶⁴ *See* Warren-Boulton, *supra* note 263, at 784, 792–96, 799–800.

²⁶⁵ *Cf.* Mallela & Nahata, *Theory of Vertical Control with Variable Proportions*, 88 J. POL. ECON. 1009, 1021–23 (1980) (noting such an increase in context of vertical integration); Vernon & Graham, *Profitability of Monopolization by Vertical Integration*, 79 J. POL. ECON. 924 (1971) (same).

²⁶⁶ Scherer's discussion in the vertical integration context is instructive:

Integration increases the input monopolist's profit both by permitting lower cost production and by broadening its control over prices. Since these two effects have

with certainty that permitting end-product royalty schemes improves the ratio, nor confidently identify the range of circumstances under which it might not,²⁶⁷ the argument for permitting them does seem stronger than that for disallowing them.²⁶⁸ Of course, as previously noted, there is the additional question whether the overall increase in reward would provide a disproportionately large incentive in such instances.²⁶⁹

VIII. CONCLUSION

One might attempt to formulate a rough approach to patent-antitrust doctrine by drawing together some recurring themes that emerge from the various applications. The first step would be to determine whether the observed patentee practices are in reality a subterfuge for collusion or other exclusionary conduct. Such practices probably will fail under the ratio test. If a practice did not fall into the subterfuge category, one would have to engage in a second and far more complicated stage of analysis in order to apply the ratio test. In light of the deficiencies in our understanding of the patent system, decisions derived at this stage would arguably have to be limited to the sort of cost-effectiveness analysis described in subsection II.B.1(c), under which some prohibitions are traded for others in an attempt to achieve the current level of patentee reward at the minimum possible cost.

opposite welfare implications, no simple conclusions can be drawn as to whether on balance the vertical extension of monopoly power into a competitive stage makes society better or worse off.

F. SCHERER, *supra* note 21, at 302. In the patent-antitrust context, the increase in the profit of the input monopolist (the patentee) resulting from lower production costs is additionally valuable to the overall welfare of society because of the incentive effect. In addition, broadened control is not an unambiguous evil, as in the typical antitrust context, because the added monopoly profit from this effect rewards the patentee as well. Overall, the effect of the first component, lower production costs, is doubly good, and that of the second, broadened control, is ambiguous.

²⁶⁷ If it could be supposed that the adverse output effect has a ratio of reward to monopoly loss similar to the ratio implicit in the patent life, there is a strong argument that the ratio for this practice is high because the efficiency in input effect would add to the numerator and subtract from the denominator; the ratio would thus be unambiguously greater than the ratio implicit in the patent life.

²⁶⁸ With this argument, compare the discussion of the desirability of price discrimination in the patent context in light of uncertainty concerning the output effect. See *supra* pp. 1874-75.

²⁶⁹ Cf. *supra* pp. 1875-76 (discussing price discrimination). See generally *supra* subsection II.A.3 (discussing proportionality of reward and value of the patent); Section II.C (discussing need to adjust patent life if patent-antitrust doctrine is modified). If this were thought to be the case, one could shorten the patent life accordingly and permit this practice if it is indeed more efficient than other ways in which patentees recoup rewards. See *supra* note 267. If, alternatively, one prohibits output-based royalties, there arises the problem that many firms do not need such schemes to accomplish the same results. Integrated firms are an example. For a parallel discussion in the context of price discrimination, see the analysis at p. 1874 of how to treat patentees that can accomplish the undesirable result without resort to the forbidden practices.

But any other configuration of doctrine — including one that provided far more or far less aggregate reward, even to the extent of permitting all restrictive practices or permitting none — could not be decisively criticized because there is no way of knowing whether the current level of reward provided by the combination of the patent system and patent-antitrust doctrine is anywhere near the optimal level.²⁷⁰ If one emerges from all this without losing hope, an approach must be developed for those cases (which may be all cases) in which the practice in question may have any number of effects, some leading to far lower ratios than others. Unless one has confidence in our ability to determine at moderate cost which of the many possible effects are relevant in any particular instance, the best that we can probably do is to prohibit at least those practices that exhibit a serious potential for substantial loss.

Although the patent-antitrust intersection has long been acknowledged to be a most difficult area, the applications discussed in Parts IV through VII, as well as the summary approach just offered, reaffirm the indications in Part II that any careful attempt to resolve patent-antitrust issues will be far more complex than has previously been realized. The fact that most of the issues demonstrated to be essential in Part II have been altogether ignored reveals the insufficiency of prior formulations by courts and commentators. What remains uncertain is why the basic assumptions underlying previous approaches have never been examined sufficiently even to reveal the indeterminacy problem that was discussed in Part I. It is possible that prior students of the patent-antitrust intersection simply have been too complacent in analyzing the conflict, or that they have been afraid of what they might have found had they asked all the necessary questions.

Now that the magnitude of the problem has been revealed, a new range of solutions might seem more attractive. In particular, the technical complexity of the patent-antitrust conflict and the inseparable need for political choice in resolving it may spur the urge to transfer responsibility for resolving this issue from the courts to either Congress or an administrative agency. On the other hand, it is unclear whether this issue is significantly more problematic in any of these respects than many other issues the courts face. In particular, the tension between the patent and antitrust statutes hardly renders this conflict unique. The antitrust laws have come into conflict with a variety of other laws, with varying results,²⁷¹ although these conflicts

²⁷⁰ This assumes that the alternative patent-antitrust doctrine would not violate the ratio test. Of course, the extreme regimes that either permit all practices or prohibit them meet this caveat by default.

²⁷¹ See, e.g., *Broadcast Music, Inc. v. Columbia Broadcasting Sys.*, 441 U.S. 1 (1979) (copyright law); *Parker v. Brown*, 317 U.S. 341 (1943) (state regulatory law); *Fashion Originators' Guild v. FTC*, 312 U.S. 457 (1941) (common law of unfair trade practices).

have received far less attention. There are often conflicts among statutes, and always conflicts among various policies, the latter raising the same sorts of problems as those encountered with the former. Moreover, the conflict between patent and antitrust policies that has been analyzed in this Article should, if anything, be easier to resolve than virtually all other conflicts because the primary competing issues can be translated into a "common denominator" — economic welfare loss — to a far greater degree than one could hope for in most other areas of the law.²⁷² Finally, although the state of the art in the economics of antitrust and patent policies seems primitive, it is probably more developed at both the theoretical and empirical levels than is the analysis of a vast array of other issues that the courts regularly confront. In the end, the problematic nature of existing patent-antitrust policy cannot readily be dismissed as exceptional, but rather may be seen to suggest the existence of a wide range of deeper conflicts that lie hidden beneath other legal doctrines.

APPENDIX: DERIVATION OF THE OPTIMAL PATENT LIFE AND PATENT-ANTITRUST DOCTRINE

This Appendix briefly sketches a more formal derivation of the results reached in Sections II.A through II.C of the Article. The benefits of the patent system net of the direct costs of invention (B) are a function of inventive activity. Inventive activity is in turn a function of the reward or profit (P) provided by the patent system. The system consists of two components: a patent life (L) and a set of restrictions on exploitation practices (R). These relationships can be expressed as follows:

$$(1) \quad P = P(L, R), \text{ and}$$

$$(2) \quad B = B(P(L, R)).$$

For convenience of notation, R can be thought of as a vector with each element (R_i) corresponding to each possible restriction on patent exploitation that might be imposed. The magnitude of R_i denotes the tightness of a restriction in effect. It takes on a value of zero if the practice upon which the restriction might operate is not at all restricted — for example, if price-restricted licensing is permitted, the corresponding R_i equals zero. Similarly, it takes on a value of one in the event of complete prohibition. For present purposes, it is helpful to

²⁷² This massive simplification was accomplished in this Article only by ignoring a large portion of the most important considerations. See Kaplow, *supra* note 20, at 1821–26 (sketching some of the reasons that antitrust law cannot be viewed in the simple manner suggested in this Article and citing additional sources); *supra* note 23 (indicating another set of such reservations concerning patent policy).

think of the R_i 's as continuous variables.²⁷³ Although there are grounds on which this assumption could be defended,²⁷⁴ I offer it here only to simplify the exposition for the moment. The results will be interpreted explicitly only for those cases in which $R_i = 0$ or $R_i = 1$.

In a similar fashion, the cost of the patent system (C) can be expressed as follows:

$$(3) C = C(L, R).$$

The goal is to maximize benefits less costs of the patent system, as expressed by the formula:

$$(4) B(P(L, R)) - C(L, R).$$

An interior solution²⁷⁵ implies that the following first-order conditions must be satisfied:

$$(5) B'P_L - C_L = 0, \text{ which implies:}$$

$$(5A) \frac{P_L}{C_L} = \frac{1}{B'} = r_L; \text{ and}$$

$$(6) B'P_{R_i} - C_{R_i} = 0, \text{ for all } i, \text{ which implies:}$$

$$(6A) \frac{P_{R_i}}{C_{R_i}} = \frac{1}{B'} = r_i, \text{ for all } i.^{276}$$

P_L , C_L , P_{R_i} , and C_{R_i} denote the partial derivatives of P and C with respect to L and R_i . B' denotes the derivative of B with respect to P . The term r_L in equation (5A) corresponds to the ratio implicit in the patent life, referred to in subsection II.B.1,²⁷⁷ and the term r_i in equation (6A) is the ratio for each restriction R_i . Interpreting these expressions is sufficient to yield most of the results in sections II.A through II.C.

From equation (5), the optimal patent life satisfies the condition that $B'P_L = C_L$, which simply means that the marginal benefit of changing the patent life must equal the marginal cost. These expres-

²⁷³ This means that any of these variables in principle could have any value between zero and one, in addition to the extreme values.

²⁷⁴ The most persuasive reason is that courts could permit many practices to intermediate degrees. Another is that the courts could employ a random strategy under which each of two outcomes was chosen with a predetermined probability. See *supra* note 88.

²⁷⁵ In addition to the restrictions on the values of the R_i 's, it can be assumed that L must be greater than or equal to zero.

²⁷⁶ Equation (5) is derived by setting the derivative of (4) with respect to L equal to zero, and equation (6) by setting the derivative of (4) with respect to R_i equal to zero, for all i .

²⁷⁷ See *supra* pp. 1831-32.

sions must be evaluated for some vector R because both P and C are functions of R , which indicates the dependence of the optimal patent life on the existing patent-antitrust regime regulating exploitation of the patent.

Similarly, from equations (5A) and (6A), it can be seen that the ratio implicit in the patent life (r_L) should be equated with the ratios for each possible restriction (r_i 's), because all ratios must equal $1/B'$ at the optimum.²⁷⁸ But this conclusion must be reconciled with the notion that the ratios for various restrictions differ. The resolution of this apparent contradiction derives from the fact that each R_i is constrained to be between zero and one. (One cannot have more restriction in any dimension than total restriction ($R_i = 1$) or less restriction than none at all ($R_i = 0$).) Thus, ratios may well be quite different from each other at the optimum. If it is reasonable to assume that the ratio for a given restrictive practice does not vary substantially as one moves from partial to total restriction, it would be most likely that there would be a corner solution for that practice — that is, R_i would equal either one or zero.²⁷⁹ Alternatively, if for administrative reasons or limitations of feasibility, only the all-or-nothing choice is available, one would also examine corner solutions.²⁸⁰

The ratio test described in Section II.B, which implicitly applied to such corner solutions because an all-or-nothing approach to restrictions was taken, can be derived as follows. Consider the case where r_i is less than r_L . From equations (5A) and (6A), this implies

$$(7) \frac{P_{R_i}}{C_{R_i}} < \frac{1}{B'}$$

Rearranging terms, and recalling that B' is positive (more profit increases benefit when at the optimum²⁸¹) and C_{R_i} is negative (more restriction decreases social cost of exploitation), yields

$$(7A) B'P_{R_i} - C_{R_i} > 0.$$

This inequality indicates a positive derivative of (4) with respect to R_i (compare the expression in (7A) with equation (6)); hence (4) is

²⁷⁸ Similarly, $P_L B'/C = 1$, which is the direct implication of marginal benefit equaling marginal cost at the optimum. The B' term in the numerator differentiates this ratio from r_L , as described *supra* p. 1831.

²⁷⁹ Of course, if there is an interior solution, it is characterized by the equality of r_i and r_L . If the patent life is viewed simply as one of the restrictions, the same results follow. At the optimum, all ratios equal $1/B'$. Because the ratio for the patent life presumably varies substantially depending on the length of the patent life, it is quite possible that an interior solution exists and that some patent system is therefore justified. Yet if a corner solution still results — that is, if L equals 0 — the patent system should be abolished.

²⁸⁰ The case in which only a few intermediate values are feasible would lead to an analogous comparison among those points.

²⁸¹ See *supra* note 45.

maximized by setting R_i as high as possible. The optimal solution is thus $R_i = 1$; in other words, the practice should be prohibited. Similarly, if r_i is greater than r_L , the optimal solution is $R_i = 0$; that is, the practice should be permitted. These two conclusions taken together constitute the test that compares the ratio for each restriction with the ratio implicit in the patent life.²⁸²

The cost-effectiveness analysis described in Section II.B can be derived by examining equation (4). Because the procedure in subsection II.B.1(c) holds P constant, B is constant. But exchanging restrictions on practices with low ratios for restrictions on practices with high ratios decreases the total cost (C); hence net social benefits are increased.

This derivation also yields some insight into the reason for the incorrectness of the proposition that reward should be proportional to the value of the patent, an issue discussed in subsection II.A.3. The value of the patent, as traditionally understood, does not appear in the optimization equations directly. The total value of all patents in the system can be implicitly determined as follows. Given the optimum, we must know the value of B' , and that value corresponds to some particular value for B . The value of B in turn corresponds to a given quantity of inventive activity, which has an aggregate value. That aggregate value can be compared with total reward, which can be determined from the specification of the prevailing system, L and R (see equation (1)). These totals for value and reward could then be converted to averages. Thus, the raw comparison of reward to value for any given patent is many steps removed from the marginal conditions for optimality (equations (5) and (6)) and the corresponding ratios of marginal reward to marginal loss (equations (5A) and (6A)) that have been emphasized as the foundation for analysis in this Article.

²⁸² There still remains the reservation that stems from the fact that changing from $R_i = 0$ to $R_i = 1$, or vice versa, is a discrete rather than an infinitesimal change. It might be that for $R_i = 1$, the ratio exceeds $1/B'$ and that for $R_i = 0$, the ratio is less than $1/B'$. This result can occur because relaxing the restriction — that is, moving from $R_i = 1$ to $R_i = 0$ — increases B ; if B'' is less than 0 (the diminishing marginal returns assumption), increasing B implies a decrease in B' and hence an increase in $1/B'$. Thus r_i is compared to a higher r_L when $R_i = 0$ than when $R_i = 1$. If intermediate values for R_i are not possible, then it is necessary to compare the overall net social benefits for each configuration of possibilities and to choose the one that is best.