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*Towards an Integrated Theory of Intellectual Property*

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# TOWARDS AN INTEGRATED THEORY OF INTELLECTUAL PROPERTY

*Gideon Parchomovsky*[*] *& Peter Siegelman*[**]

## ABSTRACT

*This Article addresses a curious gap in the theory of intellectual property. One of the central dogmas in both the legal and economic literatures is that patents, copyrights and trademarks constitute separate forms of protection, each serving different purposes and designed to operate independently of the others. By challenging this dogma, however, this Article shows that certain combinations of intellectual property protection give rise to important synergies. When a patentee can develop brand loyalty among its customers, the existence of trademark protection allows her to extend its protection even after her patent expires, and thereby earn higher profits than would be possible without such leverage. Paradoxically, our model reveals that this patent/trademark leverage is actually efficiency-enhancing: it gives patentees an incentive to price less monopolistically than they would if their protection terminated upon the expiration of the patent. Importantly, this is not a purely theoretical result: several case studies demonstrate that firms actually do combine patent and trademark protection in much the way we describe. We show that the same synergies are at work when trade-secrecy is combined with trademark protection.*

*The unique perspective we develop in the Article has important descriptive, normative, and methodological implications. Descriptively, we show that the deadweight loss of patent and trade secrecy protection is lower than is commonly believed, and that incentives to innovate are higher. Normatively, we call for a reversal of the prevailing judicial hostility to combining patent and trademark protection, and explain how the law can take advantage of leveraged patents to improve the tradeoff between dynamic and static efficiencies in innovation policy. For example, we demonstrate how policymakers can shorten patent protection, while simultaneously increasing incentives to innovate. Moreover, we design a separating mechanism that accomplishes this desirable result without imposing undue informational*

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*burdens on policymakers. Finally, we highlight the need for an integrated analysis of intellectual property. When synergies exist, exclusive focus on the parts often leads to an incomplete and distorted perception of the whole.*

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## INTRODUCTION

According to a famous legend, six blind persons once set out to discern the shape of an elephant. Unable to follow all of its contours, each observed only a single part of the majestic mammal. As a result, the men and women arrived at six different perceptions of the object of their study. Failing to synthesize their isolated observations, the six could not appreciate the true nature of what they attempted to describe. The moral of the story is that discrete analysis of the parts, accurate though it may be, often distorts one's perception of the whole. The current state of intellectual property theory is a case in point.

In recent years, the importance of intellectual property law–both as an academic discipline and as a real world phenomenon–has risen meteorically.[1] Oddly, however, there exists a striking misfit between the academic theory of intellectual property and its use in the real world. Economists and legal scholars tend to treat each of the constituent fields of intellectual property as discrete and insular.[2] Worse yet, the same insularity has pervaded the Supreme Court's intellectual property jurisprudence. Most recently, in *Traffix Devices Inc. v. Marketing Displays Inc.,* Justice Kennedy opined that "[trademark law] does not exist to reward manufacturers for their innovation in creating a particular device; that is the purpose of the patent law and its period of exclusivity."[3] In this view, patents and copyrights offer limited

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[1] *Drug Development: Intellectual Property and Patent Protection Are New Concerns*, BIOTECH WEEK 10 (May 16, 2001) (reporting that a survey of 272 senior executives in the pharmaceutical, biotechnology, and medical product industries revealed that "the development and protection of intellectual property is seen as the most critical area, as nearly all the senior executives surveyed identified an urgent need to address issues such as protecting proprietary research, valuing intellectual property, and extending patent protection"); Joff Wild, *A Yawning Gap that too Many Companies Fail to Recognize: Accounting for IP*, FIN. TIMES (June 21, 2001) ("There is a growing belief that, with the increasing influence of the knowledge economy, directors cannot deliver best value to shareholders unless they know the true value of a company's intellectual property.")

[2] See, e.g., Richard A. Epstein, *Addison C. Harris Lecture, November 9, 2000*, 76 INDIANA L.J. 803, 804-05 (2001) (contending that "intellectual property comprehends at least five or six separate areas" and arguing that "the mere fact that intellectual property law subsumes these six separate fields does not guarantee that any proposition that holds good for one of these areas will necessarily carry over to a second"); Ruth Okediji, *Givers, Takers, and Other Kinds of Users: A Fair Use Doctrine for Cyberspace*, 53 FLA. L. REV. 107, 141, 141 n.192 (2001) (suggesting that "[c]ourts have generally been careful to articulate distinctions between patents and copyrights").

[3] 121 S. Ct. 1255, 1262 (2001). We would like to note that our criticism is addressed to the Court's disregard of the important commonalities between patent and trademark protection. As we make clear in Part V.A., *infra,* we agree with the Court's ruling in

protection to novel processes or intellectual products, while trademark law protects good will.[4] Those who actually use intellectual property protection, however, appreciate that its various modalities can be combined to yield important synergies: patents can help create goodwill, and trademarks can be used to appropriate the gains from innovation.[5]

The conventional view has acknowledged the possibility of employing alternative modes of intellectual property to protect a given business asset—most notably, the availability of patent *or* copyright protection for software.[6] But it has largely ignored–and occasionally been hostile to–the possibility of combining different modes of intellectual property to reinforce one another. Much like the blind persons in the elephant tale, existing analysis has failed to discern the important synergies that flow from combining different modes of protection. In this article, we seek to redress this omission by exploring the consequences of combining various modes of intellectual property protection.[7] We focus on the possibility of combining patent and trademark protection by leveraging patents through trademarks, but we also discuss the synergies between trademarks and both trade secrets and copyrights.

The possibility of leveraging patents through trademarks calls into question the dominant paradigm in intellectual property. Although patent, copyright, and trademark are the three principal subfields in the area of intellectual property, the first two are traditionally deemed to rest on a different economic foundation from the latter. From an economic standpoint, patents and copyrights embody a tradeoff between ex ante

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this case.

[4] *See* Doris Estelle Long, *First, "Let's Kill All the Intellectual Property Lawyers!": Musings on the Decline and Fall of the Intellectual Property Empire*, 34 J. MARSHALL L. REV. 851, 889 (2001) (suggesting that "the Traffix case raises serious concerns about the future of trademark intersections with both patents and copyrights").

[5] *See* Siegrun D. Kane, TRADEMARK LAW: A PRACTITIONER'S GUIDE 1-7 (3d ed., Practicing Law Institute, Dec. 2001) ("Trademarks, patents, and copyrights . . . [a]ll . . . may apply to a single product."). Empirically-oriented economists have recognized that patents are not the only or even the most important sources of appropriability. We discuss this literature *infra*, TAN 93.

[6] *See* Jay Dratler, Jr., INTELLECTUAL PROPERTY LAW: COMMERCIAL, CREATIVE, AND INDUSTRIAL PROPERTY v (Release 3 1993) ("Traditionally, patent and copyright lawyers have represented different clients, addressed different legal problems, and only poorly understood each other's work.").

[7] Commentators employing "web" metaphors to describe intellectual property law have foreshadowed some of our insights. See, e.g., Dratler, supra note 6, at v (describing intellectual property as "a seamless web . . . .").

and ex post perspectives.[8] Ex ante, society seeks to encourage innovation and expressive creativity by awarding market exclusivity over the products that result from these activities.[9] The cost of copying innovative products and original expressive works is invariably lower than the cost of producing them initially,[10] and in a competitive market, the price will be driven down to the marginal cost of copying. Thus, absent exclusivity inventors and authors will be unable to appropriate the full social value of their products, and too little innovation is likely to result.[11] On the other hand, once an invention or a copyrighted work has been produced, society wishes to cabin the distortions caused by exclusivity by limiting the duration of patents and copyrights.[12]

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[8] William Landes & Richard Posner, *An Economic Analysis of Copyright Law*, 18(2) J. LEGAL STUD. 325, 326 (1989) (explaining that "[s]triking the correct balance between access and incentives is the central problem in copyright law"); Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 990 (1997) (noting that excessive intellectual property protection deters subsequent innovation as it "freeze[s] development at the first generation of products.").

[9] *See* U.S. Const. art. I, § 8, cl. 8 (empowering Congress "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Rights to their respective Writings and Discoveries"); see also *Mazer v. Stein*, 347 U.S. 201, 219 (1954) (explaining that "[t]he copyright law, like the patent statutes, makes reward to the owner a secondary consideration . . . . The economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that it is the best way to advance public welfare through the talents of authors and inventors in 'Science and useful Arts.'").

[10] *See* Carl Shapiro & Hal R. Varian, INFORMATION RULES 3 (1999 Harvard Business School Press) (observing that "production of an information good involves *high fixed costs* but *low marginal costs*, for example, "100-million dollar movies can be copied on videotape for a few cents.") (emphasis in original).

[11] Or, as Richard Posner succinctly explained the rationale underlying the patent system, "the manufacturer . . . will not sow if he won't be able to reap." Richard A. Posner, ECONOMIC ANALYSIS OF LAW 43 (5th ed. 1998).

[12] The limited duration is not dictated by economics alone, of course; it is mandated to some degree by the intellectual property clause in the Constitution. Even before the ratification of the Constitution and the adoption of the U.S. patent and copyright laws, English jurists struggled to reconcile ex ante incentives and ex post distortions. See *Sayre v. Moore*, 102 Eng. Rep. 139, 140 (1785) (Lord Mansfield, C.J.) (cited in *Cary v. Longman*, 102 Eng. Rep. 138, 140 n.(b) (1801) (Lord Kenyon, C.J.)) ("The rule of decision in this case is a matter of great consequence to the country. In deciding it we must take care to guard against two extremes equally prejudicial; the one, that men of ability, who have employed their time for the service of the community, may not be deprived of their just merits, and the reward of their ingenuity and labor; the other, that the world may not be deprived of improvements, nor the progress of the arts retarded.").

Trademark protection, by contrast, is not usually thought to embody a comparable tradeoff.[13] Rather, its purpose is to permit firms to establish or maintain goodwill, and to preserve their reputation among consumers.[14] Thus, trademark protection is, in principle, infinite in duration.[15]

Despite the different economic and legal theories underlying them, however, we contend that both patents and trademarks allow firms to appropriate the benefits of investment in R&D and product quality.[16] While the effect of patents on investment in R&D is well recognized,[17] the complementary effect of trademarks on innovation has received

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[13] A trademark does not "depend upon novelty, invention, discovery, or any work of the brain. It requires no fancy or imagination, no genius, no laborious thought." Trade-Mark Cases, 100 U.S. 82, 94 (1879). "Rather, trademark protection is awarded merely to those who were the first to use a distinctive mark in commerce." Robert P. Merges, Peter S. Menell, Mark A. Lemley & Thomas M. Jorde, INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 525 (Aspen 1997).

[14] See William M. Landes & Richard A. Posner, *Trademark Law: An Economic Perspective*, 30 J.LAW & ECON. 265 (1987). Some have criticized recent developments in trademark law as going substantially beyond this purpose, allowing trademarks to become an anti-competitive force. See, e.g., Mark A. Lemley, *The Modern Lanham Act and Death of Common Sense*, 108 YALE L. J. 1687 (1999) [hereinafter Lemley, *Common Sense*], which draws heavily on insights developed in Ralph S. Brown, Jr. *Advertising and the Public Interest: Legal Protection of Trade Symbols*, 57 YALE L. J. 1165 (1948).

[15] See Kane, *supra* note 5, at 1-8 ("Trademark law, unlike patent and copyright law, confers a perpetual right. So long as the trademark continues to identify a single source, the user of a confusingly similar mark is liable for trademark infringement.").

[16] On appropriability, see Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEG. STUD. 247, 247, 249 (1994) (noting that the patent system solves the "appropriability problem"–the problem that innovation would be inhibited if a firm could not recover the costs of invention–by creating property rights in inventions, but the solution also entails three secondary economic problems: monopoly leading to a deadweight loss, rent-seeking, and inhibition of future innovation).

[17] For example, the leading textbook on industrial organization describes the incentive effects of patents as follows: "The funds supporting invention and the commercial development of inventions are front-end 'sunk' investments; once they have been spent, they are an irretrievable bygone. To warrant making such investments, an individual inventor or corporation must expect that once commercialization occurs, product prices can be held above postinvention production and marketing costs long enough so that the discounted present value of the profits (or more accurately, quasi rents) will exceed the value of the front-end investment. In other words, the investor must expect some degree of protection from competition, or some monopoly power. The patent holder's right to exclude imitating users is intended to create or strengthen that expectation." F.M. Scherer & David Ross, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 622 (3d ed. 1990).

virtually no attention.[18] Combining patent and trademark protection can create two important types of synergies for a firm. First, the existence of a patent can reduce the cost of establishing a strong trademark because the exclusivity granted by the patent may lower the advertising expenditures necessary to create a dominant brand.[19] Establishing brand loyalty may be easier under conditions of exclusivity than when one has to fend off numerous rivals.[20] Xerox, for example, succeeded in establishing such strong branding for its patented photocopy machines that its mark has become virtually synonymous with the product, and almost fell into the public domain for genericism after consumers began to use "xerox" as a verb and a noun.[21]

Conversely, brand recognition can be used to extend the protection afforded by patents well beyond the legal protection period. For example, consumers remained loyal to Bayer Aspirin for decades after it went off patent, in spite of the existence of identical generic drugs that sold for much less, and despite the fact that the mark, "Aspirin," had

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[18] However, commentators have recognized that trademarks provide an incentive to invest in existing goods. See J. Thomas McCarthy, MCCARTHY ON TRADEMARKS AND UNFAIR COMPETITION 2-4 (3d ed. 1996) (noting that trademarks "create an incentive to keep up a good reputation for a predictable quality of goods," and thereby "fix responsibility" for low quality products).

[19] The relationship between advertising and monopoly power is notoriously complex; but any given amount of advertizing by Acme Widgets is likely to be more successful in attracting customers if it has 100 percent of the market than if it shares the market with N other firms whose advertising competes with or offsets its own. In this sense, competitive advertising has aspects of prisoner's dilemma–each brand's ads may largely serve to offset those of its rivals, and all established firms might be better off if they could agree (without violating antitrust laws) to advertise less, or not at all. See Lemley, *Common Sense*, at 1691 n.21; see also Douglas G. Baird, Robert H. Gertner & Randal C. Picker, GAME THEORY & THE LAW (Harvard University Press 1994) (explaining the prisoner's dilemma, equilibrium solutions, and applications of game theory to traditional legal problems).

There are non-strategic considerations that may cut in the other direction, however, and lead a monopolistic industry to advertise more (per dollar of sales) than a competitive one. See Robert Dorfman and Peter O. Steiner, *Optimal Advertising and Optimal Quality*, 44 AMER. ECON. REV. 826 (1954).

[20] See *infra*, text accompanying note 93, for examples.

[21] See Paul Goldstein, COPYRIGHT, PATENT, TRADEMARK AND RELATED STATE DOCTRINES, CASE AND MATERIALS ON THE LAW OF INTELLECTUAL PROPERTY [get page number; overdue at Fordham Library as of 2/11/02] (4th ed. 1999) (relating the story of the "Xerox" trademark's close encounter with the public domain).

been pronounced generic.[22] It is this type of synergy that will be the main focus of this article.

Our goal in this article is to explore these synergistic effects, and demonstrate their significant normative implications. The holistic view of intellectual property that we develop in this article enables us to offer several novel insights about the theory and practical use of intellectual property law.

First, we observe that the existence of synergies between patents and trademarks challenges the conventional wisdom that the economic effect of a patent grant is limited to the statutory protection term of 20 years. Combining patent and trademark protection may afford patentees a considerably longer period of protection than is commonly assumed. An important implication of this observation is that if the present statutory duration were chosen to reflect the optimal tradeoff between rewarding innovation and limiting monopoly power, then patentees who extend their patent with a successful trademark are actually receiving longer protection than the statute contemplates.

We use the term *"trademark leverage"* to describe patentees' ability to charge supracompetitve prices even after the patent has lapsed and the invention is protected only by a trademark. Our second point is counter-intuitive–we submit that the enhanced protection afforded by such leveraged patents is actually welfare-enhancing. The reason is that leveraging patents through trademarks generates incentives for patentees to price more competitively over the patent life, without adding monopolistic distortions in the trademark period. In short, leverage allows for a more-favorable tradeoff between incentives to innovate and monopolistic pricing than is traditionally envisioned.

Economic analysis of patent law—traditionally conducted on a stand-alone basis—assumes that the patentee will maximize her rents during the term of protection by charging the monopoly price for the invention.[23] Specifically, the patentee will restrict the quantity of output below the competitive level, to the point at which its marginal revenue is equal to its marginal cost. This generates a social deadweight loss, since some consumers who would be willing to pay more for the product than its marginal cost are unable to purchase it from the monopolistic

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[22] See Charles C. Mann and Mark L. Plummer, THE ASPIRIN WARS : MONEY, MEDICINE AND 100 YEARS OF RAMPANT COMPETITION (1991); *Bayer Co. v. United Drug Co.*, 272 Fed. 505 (2d Cir. 1921) (finding Aspirin a generic mark with respect to consumer, though not producer, sales).

[23] Robert Cooter & Thomas Ulen, LAW AND ECONOMICS 128 (3d ed. 2000).

patentee; the gains from trade that would be available in a competitive market are lost as a result of the patentee's monopoly.[24]

The possibility of leveraging patents through trademarks transforms the analysis. When patents can be extended through creation of brand loyalty, the patentee will strive to maximize her rents not over the 20-year patent term, but rather over the combined period of patent *and* trademark protection. Hence, a forward-looking patentee will consider not only current output, but also the effects of current output on future demand. Specifically, a profit-maximizing patentee will charge less than the monopoly price during the patent period if doing so enhances its branding and leads to higher profits over the long run. Thus, we posit that even patentees who wield monopoly power by dint of the legal exclusivity conferred upon them, may prefer *not* to extract the full monopolistic rent afforded to them by the patent grant. This prediction is not merely of theoretical significance; it finds support in commercial reality. Evidence from various industries shows that, in some circumstances, patentees behave in accordance with our analysis, raising output above the monopolistic level (and lowering prices) in order to increase their future profits from trademark protection.

Critically, the welfare gain from lower prices is not offset by a corresponding loss attributable to a longer duration of protection. Once the patent expires, the former patentee's loyal customers pay a higher-than-market price for the off-patent product, but the marginal (new) customers buy from the new entrants, who charge the competitive price and eliminate any deadweight loss.[25] In other words, the ability to combine patents and trademarks makes it possible for the patentee to shift profits from the "distortionary" patent period to the competitive trademark period, where the patentee can charge higher-than-competitive prices without reducing the overall quantity supplied.[26] As

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[24] *Id*.

[25] Deadweight loss arises from the fact that, in maximizing profits, a monopolist will cut back on the quantity it produces, thereby refusing to sell to some consumers who would be willing to pay more than the cost of producing the good in question. The difference between consumer valuation and producer cost, for these foregone sales, is the economist's measure of the deadweight loss of monopoly.

[26] Put another way, the patentee's loyal customers are subject to a kind of price discrimination, and thus, are worse off than they would be if they could buy at the competitive price. But the higher prices they pay are a pure transfer to the patentee, with no efficiency consequences. See Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1873-82 (1984) (discussing price discrimination and patent law); Richard A. Posner, ANTITRUST LAW 203-04 (2d ed.

a result of this shift, the deadweight loss in the patent period is lowered, without any accompanying cost in the subsequent trademark period. Patent leveraging thus increases welfare.

Third, we demonstrate that the same welfare-enhancing effect that arises from combining patent and trademark protection also occurs when trade secrets and trademarks are combined. Although trade secrecy does not have inherent time limits, it lapses if the protected information falls into the hands of competitors, either through a breach of secrecy or through reverse engineering. For the purpose of our analysis, this risk serves the same function as the time limitation on patents: it mitigates the incentive of the trade secret holder to price monopolistically. Realizing that the trade secret may expire at any given time, a rational trade secret owner will prefer not to price monopolistically during the trade secrecy period if doing so will sufficiently increase the long term value of her brand. In this case, too, the net welfare effect of combining the two modes of protection may be positive.[27]

Finally, we examine how legal policy should take account of the possibility that patent and trademark protection can be combined. We argue that the Supreme Court's failure to appreciate the positive synergies between patents and trademarks led it badly astray in the landmark case of *Singer Mfg. Co. v. June Mfg. Co.*[28] In expressing its strong disapproval of Singer's strategy of leveraging its patents through a trademark, the Court concluded that the "…coincidence between the expiration of the patents and the appearance of the [trademark]… tends to create a strong implication that the company [acted] in order thereby to retain… the real fruits of the monopoly when the monopoly had passed away."[29] According to our analysis, the Court erred in

2001) (discussing price discrimination in the licensing of patents); cf. Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, (2001) (discussing price discrimination and copyright law). Readers of this article may be particularly interested in Stanley Liebowitz's findings on the role of price discrimination in markets for academic journals. See Stanley J. Liebowitz, *Copyright Law, Photocopying, and Price Discrimination*, in 8 RESEARCH IN LAW AND ECONOMICS: THE ECONOMICS OF PATENTS AND COPYRIGHTS 181 (John Palmer & Richard O. Zerbe, Jr. eds., 1986).

[27] Although there may be some instances in which Copyright and Trademark protection can be combined, leverage does not seem to apply to Copyright protection generally, as we discuss below, Part IV.B.

[28] 163 U.S. 169 (1896).

[29] *Id*. at 181.

condemning a practice that increases welfare. Thus, *Singer* and its progeny should be overturned.

Moreover, our analysis counterintuitively suggests that efficiency-minded policy makers would be justified in either shortening or lengthening the patent term, or indeed leaving it at its present length. Any of these is a defensible alternative because leverage creates *both* greater incentives to innovate and a lower static deadweight loss, generating a more-favorable tradeoff between these two goals, which policy-makers may wish to exploit in a variety of ways. Leverage pushes out the "possibility frontier," allowing policy-makers a range of desirable options.

In particular, we propose a self-selection mechanism that allows society to offer patentees the same level of profits as the current system, at a lower cost in deadweight loss. Alternatively, policy makers might opt for a higher level of profits for patentees, with no increase in deadweight loss. We offer an illustrative example of how such policies might be implemented.

In the final section of this article, we take on a series of possible objections to our argument, including the presence of advertising, the extension of the model to a more realistic multi-period world with discounting, and the empirical finding that–at least for some products–prices *rise*, rather than falling, on expiration of a patent. None of these, we show, requires substantial modification of our conclusions.

## I. THE INSULAR VIEW OF INTELLECTUAL PROPERTY

### A. The Theory

Intellectual property law rests on an elegant model that divides the field into three principal subfields—copyright, patent and trademark—each protecting a distinct subject matter, and promoting a unique social goal: copyright law protects expressive works; patent law protects functional products, processes and designs; and trademark law protects information about the source of goods and products. The separation among these three subfields is reinforced by the different prerequisites necessary for securing each mode of protection. Copyright protection requires works to be original, incrementally creative,[30] and

[30] See *Feist Publications, Inc. v. Rural Telephone Service Company, Inc.*, 499 U.S. 340, 345 (1991) (explaining that "'[o]riginal,' as the term is used in copyright, means only that the work was independently created by the author . . . and that it possesses at

fixed in a tangible medium of expression. Patent protection extends to inventions that are new,[31] useful,[32] and nonobvious[33] to a person skilled in the relevant art.[34] Trademark protection is sparked by the use of a mark in trade. Furthermore, the three subfields differ in the duration of the protection they afford. Copyright protection lasts for the life of the author plus 70 years.[35] Patent protection extends 20 years from the date of filing for utility patents,[36] and 14 years from the moment of issuance for design patents.[37] Trademark protection continues potentially forever, as long the mark is used in trade.

The economic rationale for copyrights and patents is also assumed to be different from the rationale for trademarks. Copyrights and patents are predicated on the need to provide an economic incentive for the creation of "public goods" such as inventions and expressive works.[38]

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least some minimal degree of creativity").

[31] See 35 U.S.C. § 102 (1994).

[32] See 35 U.S.C. § 101.

[33] See 35 U.S.C. § 103.

[34] See Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUMBIA L. REV. 839, 840, 844 (1990) ("During prosecution of a patent, a Patent Office examiner reviews an application to determine what is patentable. To be patentable an invention must meet all the statutory requirements for patentability: novelty, utility and non-obviousness." In addition, "while decisions regarding what claims to allow are constrained by a number of legal principles, and by the invention itself, in many cases the Patent Office has considerable room for discretion.").

[35] See 17 U.S.C. § 302.

[36] See 35 U.S.C. § 154.

[37] See 35 U.S.C. § 173.

[38] *See, e.g.* Kenneth Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609 (1962). Robert M. Hurt & Robert M. Schuchman, *The Economic Rationale of Copyright*, 56 AM ECON. REV. 421, 425 (May 1966) (papers and proceedings) William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 326 (1989); *also* Richard P. Adelstein & Steven I. Perez, *The Competition of Technologies in Markets for Ideas: Copyright and Fair Use in Evolutionary Perspective*, 5 INT'L REV. L. & ECON. 209, 218 (1985). For a view that intellectual works do not share the distinguishing attributes of public goods, see Tom G. Palmer, *Intellectual Property: A Non-Posnerian Law and Economics Approach*, 12 HAMLINE L. REV. 261, 273-87 (1989).

Public goods are defined by two distinctive characteristics: Non-rivalry in consumption and non-excludability of benefits. *See, e.g.*, Richard Cornes & Todd Sandler, THE THEORY OF EXTERNALITIES, PUBLIC GOODS, AND CLUB GOODS 6-7 (1986). A good is non-rival in consumption when consumption by one person does not diminish the consumption opportunities available to others. *See id.* at 6.

A good displays non-excludable benefits when individuals who have not paid

Since expressive works and inventions contain information—the quintessential public good—absent legal protection, competitors would copy such works without incurring the initial costs of producing them. Unauthorized reproduction would drive down the market price to the cost of copying, original authors and inventors would not be able to recover their expenditures on authorship and R&D, and as a result, too few inventions and expressive works would be created.

To make matters worse, many of the inventions that would not be produced absent intellectual property protection are likely to be of great social value. Socially important inventions often implicate not only large expenditures, but also a high level of risk. Inventors, who work under conditions of extreme uncertainty, do not know, *ex ante*, whether the R&D process will yield the anticipated result. Nor do they know how the invention will fare commercially.[39] Subsequent copiers, on the other hand, confront no similar risks since they have the privilege of being able to reproduce, risk-free, only those inventions with proven commercial success.

Copyright and patent law eliminate the inherent advantage of copiers, and thereby restore the incentive to innovate. By creating and enforcing exclusive rights in intellectual goods, copyrights and patents not only stifle unauthorized copying, but also enable authors and inventors to charge for the use of their works. In addition, copyright and patent law provide the necessary foundation for market exchange between providers and consumers of intellectual goods. The development of a market, in turn, produces two desirable effects: it increases the return on authorship and innovation, and it lets the forces of supply and demand set the price of intellectual goods.

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for it cannot be prevented from availing themselves of its benefits. *See id.* It should be noted that the impossibility of exclusion is hardly ever absolute. When exclusion by contract is considered, very few goods, if any, display non-excludable benefits in the strict sense of the term. Thus, it is more accurate to describe goods as displaying non-excludable benefits when it is prohibitively costly to bar non-payers from enjoying the good. *See* Patrick Croskery, *Institutional Utilitarianism and Intellectual Property*, 68 CHI.-KENT L. REV. 631, 632 (1993). The non-excludability property of public goods implies that they will be under-produced by the market.

[39] See Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 994 (1997) (noting that "invention and creation require the investment of resources–the time of an author or inventor, and often expenditures on facilities, prototypes, supplies, and the like," and therefore absent intellectual property protection, creators or inventors would live "in constant peril of discovery and disclosure").

The economic justification for trademark protection is rather different. Unlike patent and copyright protection, which seek to spur creation of inventions and expressive works, trademark protection purports to enhance competition among providers of goods and services.[40] By identifying the source of goods and services, trademarks promote competition in two related ways. Trademarks enable businesses to convey information to consumers about the quality of products and services, reducing consumers' search costs.[41] This informational function of trademarks is especially valuable in the context of "experience goods," products whose attributes consumers cannot discern before purchasing them,[42] and must rely on prior experience in deciding among competing brands. Trademarks allow consumers to associate product and service attributes with certain firms, and base their consumption decisions on this association. For this reason, on the supply side, trademark protection spurs firms to maintain and improve the quality of their products and services.[43] The availability of trademark protection protects firms against free-riding by competitors, enabling them to reap the fruits of their investment in superior products and services. Furthermore, trademark protection provides firms with an incentive to establish brand recognition and loyalty, by "educating" consumers about the virtues of their products. Thus, trademarks constitute an important channel of communication between firms and consumers, with the attendant twin effects of motivating the former to improve the quality of their products and services, and enabling the latter to differentiate among various products on the market.

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[40] *See* S. Rep. No. 1333, 79th Cong., 2d Sess. 3 (1946); H.R. Rep. No. 219, 79th Cong., 1st Sess. 2 (1945). ("[t]rade-marks defeat monopoly by stimulating competition."). For an argument that excessive trademark protection can have anti-competitive effects, see sources cited *supra* n. 14.

[41] See e.g. Nicholas Economides, *Trademarks*, *in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 601, 602-03 (Peter Newman ed., 1998) (noting that trademarks "facilitate and enhance consumer decisions"); William P. Kratzke, *Normative Economic Analysis of Trademark Law,* 21 MEMPHIS ST. U. L. REV. 199, 214-17 (1991). George Stigler, *The Economics of Information*, 69 J. POL. ECON. 213 (1961).

[42] The term "experience goods" was coined by Philip Nelson, *Advertising as Information*, 82 J. POLITICAL ECON. 729 (1974). A search good is one whose important attributes may be ascertained before purchase or use.

[43] William M. Landes & Richard Posner, *Trademark Law: An Economic Perspective*, 30 J. L. & ECON. 265 (1987). Landes and Posner note that trademarks have a self-enforcing quality since "they denote consistent quality, and a firm has an incentive to develop a trademark only if it is able to maintain consistent quality." *Id*.

Law and Economics scholars have largely ignored the existence of synergies among the various types of intellectual property protection.[44] For example, the leading Law and Economics text suggests that the economic justification for patents is that they are "temporary monopol[ies] that reward invention."[45] By contrast, trademarks are designed to "lower consumer search costs and create an incentive for producers to supply goods of high quality."[46]

## B. The Case Law

The insular view of intellectual property has also been a persistent theme in the Supreme Court's intellectual property jurisprudence. The tone was set in three classic decisions. In *Baker v. Selden*,[47] the Supreme Court was asked to decide whether the respondent, Selden, could obtain copyright protection for a system of book-keeping by means of a book in which the system was explained. Pointing to the different subject matters of copyright and patent protection, and the different requirements for each, the Court refused to allow copyright protection for patentable subject matters, repeatedly emphasizing the need to keep the province of copyright separated from that of patents. It concluded that to do otherwise would amount to "a fraud upon the public."[48]

Fifteen years later, in *Singer Mfg. Co. v. June Mfg. Co.*,[49] the Supreme Court elucidated the relationship between patents and trademarks. The issue confronting the Court in *Singer* was whether a mark that had been used in connection with a patented subject matter becomes generic at the expiration of the patent. While the Court stopped short of ruling that any mark associated with a patented product falls into the public domain when the patent expires, it established that the

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[44] As we discuss *infra*, Section III.A, there has been some appreciation of these synergies in the mainstream economics literature.

[45] Robert Cooter and Thomas Ulen, LAW AND ECONOMICS 128 (3d ed. 2000). The authors also note that "the price [of a patented good] falls and the quantity increases *as soon as the patent expires* (emphasis added)." *Id*.

[46] *Id*. at 137. Similarly, a recent survey article notes that "unlike copyright and patent, trademark protection did not originate as an incentive for innovation or creativity. [Instead, t]he primary function of trademarks is to provide rules of orderly marketing . . ." Stanley M. Besen and Leo J. Raskind, *An Introduction to the Law and Economics of Intellectual Property*, 5 J. ECON. PERSP. 3, 21 (1991).

[47] 101 U.S. 99 (1879).

[48] *Id.* at 103.

[49] 163 U.S. 169 (1896).

existence of a previous patent is a factor to be weighed in determining the validity of a mark. Specifically, the Court ruled that the "Singer" mark fell into the public domain at the expiration of the patents on the sewing machines.[50] Critical to this finding was the Court's strong disapproval of Singer's attempt to leverage its patents through trademarks by establishing the name "Singer" and the shape of its machines as trademarks in the years preceding the expiration of its patents. The proximity in time between the appearance of the trademark on the machines and the impending expiration of its patents implied to the Court that Singer had sought to extend the benefits of its monopoly beyond the patent protection period.[51] Rephrased in economic terms, the Court acted to bar Singer from enjoying monopolistic rents—what the Court called "the real fruits of the monopoly"—in the post-patent period.

Nearly four decades later, the Supreme Court further solidified the conceptual separation between patents and trademarks in *Kellogg Co. v. National Biscuit Co.*[52] In *Kellogg,* the Court was given an opportunity to revisit its ruling in *Singer,* after Kellogg had brought a trademark infringement suit against Nabisco for using the mark "Shredded Wheat" after the expiration of Kellogg's patent. Construing *Singer* broadly, the Court enunciated that upon the expiration of a patent "there passe[s] to the public… not only the right to make the article as it was made during the patent period, but also the right to apply thereto the name by which it had become known."[53] Effectively, the Court's decision may be read to have established a *per se* rule that a mark designating a patented product becomes generic at the end of the patent term.[54]

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[50] The operative result of this finding was to allow the defendant to affix the "Singer" mark to its products, so long as it clearly indicates that it, not Singer, is the manufacturer of the machine. For a case suggesting that the "Singer" mark was subsequently resurrected, *see Singer Mfg. v. Redlich,* 109 F. Supp. 623 U.S.P.Q. 85 (S.D. Cal. 1952).

[51] *Singer*, at 181.

[52] 305 U.S. 111 (1938).

[53] Id. at 118.

[54] This extreme view, articulated by Paul Goldstein, COPYRIGHT, PATENT, TRADEMARK, AND RELATED STATE DOCTRINES 247 (4th ed. 1997), would suggest that when the patent on Prozac expired in August of 2001, new producers could market their chemically identical product (fluoxetine) as "Prozac." In other words, Eli Lily's exclusive right to use the brand name Prozac would vanish with the expiration of its patent. The fact that no generic entrants ever market their product under the original trade name suggests that Goldstein may not be correct (or that producers are all too risk-averse to find out).

These cases prompted some leading intellectual property scholars to suggest that "the three federal regimes are preemptive of each other—that the same innovation cannot be protected by both patent and copyright law, or by both patent and trademark law."[55] Subsequent decisions by lower courts repudiated the preemption theory as between copyright and patent. In *Application of Yardley*,[56] the Patent and Trademark Office (PTO) refused to issue a design patent on an ornamental wristwatch on the ground the Spiro Agnew caricature featured on the watch face had been registered independently in the Copyright Office. In reversing the PTO, the Court of Customs and Patent Appeals explained that Congress intended there to be a degree of subject matter overlap between the protection afforded by design patents and that granted by copyright.[57] Accordingly, the court ruled that the "election of protection" doctrine, on which the PTO relied in denying the patent, is "in direct conflict with the clear intent of Congress."[58] Over two decades later, in 1995, the Copyright Office finally followed the PTO and announced that it was abandoning the election doctrine, under which it had refused for many years to register copyright claims over pictorial, graphic, and sculptural designs for which design patents had been issued.[59] These policy changes have opened the way for *concurrent* copyright and patent protection for the same subject matter, and have proven to be of great significance in the context of computer software.[60]

Importantly, the Supreme Court's rulings in *Singer* and *Kellogg* as to the illegitimacy of leveraging patents through trademarks have not been revisited. Thus, while businesses can chose between trademark and patent protection, and may be able to secure *concurrent* trademark and

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It is possible, however, that the *Kellog* Court's broad rule stems fromthe fact that the mark "Shredded Wheat" was descriptive, if not generic from the beginning.

[55] Dryefus & Kwall at 848; see also Michael J. Kline, *Requiring an Election of Protection for Patentable/Copyrightable Computer Programs (Part I)*, 67 J. PAT. & TRADEMARK OFF. SOC'Y 280 (1985) (arguing that an election abandoning copyright protection should be made upon the issuance of a patent).

[56] 493 F.2d 1389 (C.C.P.A. 1974).

[57] 1394 citing *Mazer v. Stein*.

[58] *Id*. at 1394.

[59] See Douglas R. Wolf, *The Doctrine of Elections: Has the Need to Chose Been Lost?*, 9 CARDOZO ARTS & ENT. L.J. 439, 463-64 (1991) (discussing the election of protection doctrine, and, as of 1991, the Copyright Office's embrace of the doctrine).

[60] See Mark A. Lemley, Peter S. Menell, Robert P. Merges & Pamela Samuelson, SOFTWARE AND INTERNET LAW 38-45 (2000) (explaining that various substantive areas of law may be employed to protect computer software, including trade secret law, copyright law, patent law, trademark law, sui generis laws, and contract law).

patent protection for functional designs, they likely cannot combine trademark and patent protection *sequentially* in order to leverage their patents. Attempts to leverage patents through trademarks will be frowned upon by the courts.[61]

In sum, the Supreme Court's intellectual property jurisprudence suffers from three principal defects. First, the insistence on viewing copyright, patent and trademarks as protecting distinct social goals—a position shared by many law and economics scholars—is in many cases simply wrong. As we will show, trademark protection also spurs innovation, and can complement the incentive provided by patents to expend resources on R&D.

Second, the legal emphasis on protection, rather than on value, has driven a wedge between the legal approach to intellectual property and that of the business community. Speaking to managers of intellectual property, Carl Shapiro and Hal Varian advise that "[your] goal should be to choose the terms and conditions that maximize the *value* of your intellectual property, not the terms and conditions that maximize protection."[62] Instead, courts have wrongly adopted rules that are hostile to value-maximization.

Third, and most importantly, the judicial treatment of intellectual property is not helpful for policy analysis. Courts' formalistic approach has prevented them from evaluating the welfare implications of combining different modes of intellectual property protection. We will demonstrate that combining different modes of protection may give rise to important synergies that have so far gone unrecognized, and thus, contrary to the prevailing view, enhance social welfare.

## II. A SIMPLE MODEL OF PATENT/TRADEMARK LEVERAGE

The combination of patent and trademark protection generates two complementary advantages for the intellectual property holder. First, the limited monopoly afforded by patent protection may facilitate the establishment of brand loyalty during the patent life. Thus, patent protection enhances the value of the company's mark. Moreover, brand loyalty enables patentees to preserve some of their market share after the patent protection expires. This implies that trademark protection can supplement patent protection. The net effect of combining patents and

[61] See discussion of *Traffix*, *infra*, section V.A.

[62] Hal Varian & Carl Shapiro, INFORMATION RULES 5 (1999) (emphasis in original).

trademarks is stronger protection than that afforded by either alone. Surprisingly, however, we will demonstrate that despite this stronger protection for patentees, leveraged patents are actually welfare-enhancing, since they mitigate patentees' disposition to price monopolistically.

To see why trademark protection lessens the incentive to price monopolistically, imagine a world without any trademarks at all. In such a world, when the patent on an invention expires, anyone can produce and market it under the patentee's mark. To take a concrete example, when Prozac went off patent, any pharmaceutical company would have been able to produce the drug and market it under Eli Lily's "Prozac" mark; no generics would exist.

The absence of trademark protection should affect patentees in two ways. First, patentees would take full advantage of the patent grant by pricing monopolistically while they were able to do so. Second, patentees would have less incentive to invest in the quality of their products and services. Without brands, brand loyalty is meaningless.

The introduction of trademark protection that extends beyond the patent life completely transforms the analysis. By enabling companies to create brand loyalty, trademark protection not only makes it rational for them to invest in the quality of their products, but it also puts pressure on them to increase the number of sales during the patent term in order to broaden their loyal customer base for the post-patent period. Thus, trademark protection may reduce the social deadweight loss generated by patent protection. In this part, we present a formal model that shows how leveraging patents through trademarks may improve social welfare. We then support our theoretical results with empirical evidence from various sources. Finally, we discuss how various factors such as advertising and a more sophisticated dynamic model affect our findings.

## A. The Model

To illustrate the effect of trademarks on patents, we construct a stylized two period model.[63] In the first period, the firm can use patent

[63] For the sake of simplicity, we condense the 20 year statutory period of patent protection into a single period, and ignore issues of discounting which are peripheral to our basic insight. In the appendix, we offer a dynamic multi-period model in which we consider each year of patent protection separately, and allow the monopolist to choose optimal quantity over time, allowing for discounting. Our dynamic model

protection to select the feasible price-quantity combination that maximizes its profits. In the second period, the patent protection lapses, and the firm must rely exclusively on brand loyalty created earlier, plus trademark protection, to secure supracompetitive profit.[64] We show that the existence of trademark protection leads the patentee not to exploit her full monopoly power, as she would in a world where patents were the only available form of protection.[65]

Assume that the demand for the patented invention is described by a linear (inverse) demand curve,

(1) $P = a - bQ$

where $P$ is the prevailing price, $Q$ is the quantity chosen by the patentee, $a$ is the maximum price the patentee can charge (at $Q$=0), and $-b$ is the slope of the demand curve. Assume further that the patentee produces at constant marginal cost, $c$.[66] Since the patentee is a monopolist while the patent is in effect, *in a single period model with patent protection,* she would maximize her profits, represented by

demonstrates essentially the same result as above, although the assumption of long-lived consumers is in tension with the existence of brand loyalty.

[64] Although the patentee is assumed to be forward-looking, consumers are not. Hence, we do not model consumers as choosing between buying today versus buying next period. Such consumer "myopia" is a standard assumption in these contexts, *see* Paul Klemperer, *Markets with Consumer Switching Costs*, 102 Q. J. ECON. 375 (1987) or Jean Gabszewicz, Lynne Pepall, and Jacques-Francois Thisse, *Sequential Entry with Brand Loyalty Caused by Consumer Learning-by-Using*, 40 J. INDUSTRIAL ECON. 397 (1992), and seems intuitively plausible.

[65] We stress that we are far from the first to point out that a monopolist who considers the long run will have reasons for selling more than (and pricing below) the single-period monopoly optimum. For example, Darius W. Gaskins, Jr., *Dynamic Limit Pricing: Optimal Pricing under Threat of Entry*, 3 J. ECON. THEORY 306 (1971), showed how a forward-looking monopolist would lower prices over time in order to deter entry. Klemperer's model of switching costs yields the same insight–oligopolistic firms may price at less than the static oligopoly optimum in order to attract loyal users. See Klemperer, *supra* n. 64. Other reasons for pricing below the static monopoly optimum include network externalities and 'learning-by-doing' (dynamic scale economies).

Our story is related to the "Coase Conjecture" about the inability of a monopolist producing a durable good to extract monopoly profit over time. See, Ronald H. Coase, *Durability and Monopoly*, 15 J Law & Econ 143 (1972). Coase's insight was that the monopolist's potential future output may compete with her own present output, so that consumers might rationally wait until next year to buy if the price this year is too high. While there are some parallels, the large and complex literature spawned by Coase's insight does not bear directly on our model.

[66] Without loss of generality, we assume c is equal to zero.

(2) $A = (a - bQ) \times Q.$

To accomplish this, she will choose the quantity, $Q$, that solves

(3) $MA/MQ = a - 2bQ = 0.$

This implies that $Q^*$, the profit maximizing quantity for the patentee, is $a/2b$. Intuitively, the monopolist sets marginal revenue equal to marginal cost (here, 0) in order to maximize profits. Note, however, that $Q^*$ is only half of the socially optimal output, represented by $a/b$.[67]

Assume, now, that instead of a single period of patent protection, patentees can also take advantage of trademark protection at the expiration of the patent. Demand is the same as in equation (4) in both periods. We now consider how this changes the patentee's behavior during the lifetime of the patent. As we will show, the exact effect of trademark protection depends on how the firm's pre-expiration sales influence its profitability in the second period once the patent has lapsed.

To start with the simplest case, suppose the patentee cannot take advantage of trademark protection after the patent expires. This might occur if *Singer* and *Kellog* are read to ban trademark protection for previously patented products, or if the characteristics of the product make development of brand loyalty impossible.[68] In this situation, once the product goes off patent, anyone can produce it, and the price will fall to the competitive level. Since the original product is indistinguishable from the version produced by the entrants, the law of one price requires that the previously patented and new versions must sell at the same price. As long as entry is possible, price will be driven down to marginal cost, with zero profit.[69]

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[67] In a competitive market, price equals marginal cost. With marginal cost equal to zero and a linear demand curve, this requires $0 = a - bQ$, which implies $Q = a/b$.

[68] We found several instances in which more than one entity has the same name or produces the same product. The best example is the trade name "Bayer Aspirin." When Bayer lost its U.S. plant to an American firm during World War I, it also lost "the Bayer name and Bayer Cross [the company's trademark]. [As a result,] both companies sold Bayer Aspirin. To put it another way, two different, competing enterprises used an identical name to sell an identical product. . . .[T]he two Bayer aspirins fought each other for more than seventy years." Charles C. Mann and Mark L. Plummer, THE ASPIRIN WARS : MONEY, MEDICINE AND 100 YEARS OF RAMPANT COMPETITION 15 (1991).

[69] Assuming no fixed costs, which we have already factored out of the problem. Note that we are also assuming that product quality is exogenously fixed, so that in the absence of trademark protection, firms would not run-down the quality of their products.

If the patentee expects in period 1 that the market will be competitive in period 2, it will maximize profits in period 1 by charging the monopoly price. Since nothing she does in period 1 affects her profits in period 2, she faces the monopolist's one-period maximization problem and behaves accordingly.[70] This is the standard account of how patentees behave. As we will show, however, the conventional view is merely a special case of a more general model, which allows for the patentee to retain some market power in period 2 by establishing brand loyalty among her period 1 customers.[71]

In a two-period world *without* brand loyalty, the patentee will act as a monopolist while it can do so (in period 1). However, once we consider brand loyalty made possible by trademark protection, it becomes clear that the patentee may prefer not to charge the full monopoly price. We suggest that a patentee who can cultivate brand loyalty while the patent is in effect will prefer to forego some revenues in the patent period in order to obtain higher profits after the patent lapses. We use the term *"trademark leverage"* to describe patentees' ability to charge supracompetitve prices even after the patent has lapsed and the invention is protected only by a trademark.[72]

Inherent in the definition of 'brand loyalty' is the notion of prior use. Indeed, it would be odd for consumers to be loyal to a product they have never tried. Hence, the number of sales made while the patent is in effect will affect the patentee's loyal customer base in period 2. Critically, this means that increasing sales in period 1 enables patentees to charge supracompetitive prices to more customers in period 2 than would otherwise be possible.

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[70] Formally, $A = P_1Q_1 + P_cQ_2$, where $P_c$ is the competitive price. In this case, the second-period profit is zero,so the patentee doesn't care what quantity it sells in period 2, only in period 1.

[71] The existence of trademark makes it possible for consumers to identify the output of each firm, and this might be thought to make each firm less-than perfectly competitive with its rivals. Should the behavior in period 2 then be modeled as monopolistic competition? Jean Tirole suggests not. In THE THEORY OF INDUSTRIAL ORGANIZATION 288 (1988), Tirole writes that "[t]he point of monopolistic competition [theory] is . . . not to study strategic aspects between products (such as product positioning and price competition), but rather to abstract from them to simplify the analysis and study other issues, such as the number of products offered by a market economy."

[72] We stress that the existence of 'leverage' depends on the characteristics of the product being sold. For a discussion of factors that enhance or limit the development of brand loyalty, see *infra*, TAN 76 to 85.

Formally, we model this effect as a *switching cost*, so that any consumer who tries the product in period 1 incurs a cost, S > 0, to purchase a different brand in period 2.[73] The introduction of switching costs drives a wedge between the price the patentee can charge her loyal customers and the price new entrants can charge this group. In other words, consumers who buy from the patentee in the first period will be willing to pay a premium of $S$ for the previously patented product, even when identical products are available at a lower cost. Therefore, when the patent expires and entry drives the price down to the competitive level, the price that patentees can charge loyal customers in period 2, $P_2$, is $P_c+S$.

The patentee would never find it in her interest to charge less than $P_c$ (which would earn negative profit), and if she were to charge more than $P_c + S$, she would lose all her customers. Hence, the patentee will always choose the price in period 2, $P_2$, to be $P_c + S$.[74]

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[73] This phenomenon can occur for a number of reasons, many of which can be captured under the rubric of "switching costs," defined as a cost that a consumer must pay to change brands. For example, consumers may learn how to use a product by consuming it: think of a regular airline traveler who has learned how to find her way around United's terminal. She may then prefer to fly United rather than American, even if American offered an identical flight at a lower cost. Sheer force of habit, or uncertainty about product quality, may also lead some consumers to continue buying brands they have purchased in the past, even when lower-priced substitutes exist.

There has been a substantial body of work in this vein, largely focusing on the consequences of switching costs for equilibrium in game-theoretic models of oligopolistic markets. The pioneering work that offers a typology of switching costs and a sophisticated analysis of their effects is Paul Klemperer, *supra* n. 64.

The work most similar in spirit to ours is Jean Gabszewicz, et al, *supra* n. 64. They model a two-period game, with a monopolistic incumbent producing a new product in the first period and then facing an oligopolistic rival in the second. Consumers learn about the product by consuming it, and this creates brand loyalty in period 2 for those who tried the incumbent's product in period 1. Their main result is similar to ours–the incumbent will expand its customer base in period 1 by producing more and charging less than the one-period monopoly optimum. This sacrifice of profits in period 1 is a form of investment in brand-loyalty; its return comes because lower prices and more customers today allow the firm to keep prices above the competitive level for loyal customers tomorrow. Although it does not discuss either trademarks or patents, the paper is important because it demonstrates that our basic insight does not depend on our admittedly extreme assumption that the market is perfectly competitive in the second period (after the patent lapses).

[74] The patentee no longer faces a downward-sloping demand curve once the patent expires. Her loyal customers will purchase exactly the same quantity they bought last period at any price below $P_c + S$, and will purchase nothing at all at any price above this level. Hence, there is no price-quantity tradeoff until the patentee's price exceeds

At price $P_c + S$, the patentee will sell the same quantity in the second period as she did in the first. Hence, the patentee's *two-period* optimization problem becomes:

(5) $\underset{Q_1}{Max}\ A = P_1Q_1 + (P_c + S)Q_1 = (a - bQ_1)Q_1 + (P_c + S)Q_1.$

where $P_1$ is the price charged in the patent period, $P_c$ is the price charged by the competitive entrants, and S is the switching cost for the patentee's loyal customers. To find the profit-maximizing output over the two periods, $Q^{**}$, the patentee solves

(6) $MA/MQ_1 = a - 2bQ_1 + S = 0,$

which implies

(7) $Q^{**} = (a + S)/2b = Q^* + S/2b.$

The first thing to note is that the patentee's optimal quantity choice *with* trademark leverage is the same as its choice without leverage, plus the positive term $S/2b$. Hence, the optimum quantity under a leveraged patent is always larger than without leverage ($Q^{**} = Q^* + S/2b > Q^*$).

The reason for this result is simple. For a leveraged patentee, an increase in first period quantity has two effects: on the one hand, expanding output above the single-period monopoly level reduces current profits. But on the other hand, more output today means more loyal customers and higher profits next period, an effect which is made possible by trademark leverage. A firm that takes leverage into account will optimally produce more than one that does not because the leveraged firm's marginal revenue is always larger at any given quantity.

The welfare consequences of patent leverage follow from its effect on first-period output. The more the patentee produces in period 1, the lower is the price and the smaller the monopolistic distortion or deadweight loss. While the patentee does charge its loyal customers a higher-than-competitive price in period 2, this has no effect on quantity demanded because the marginal (inexperienced) purchasers can buy at the competitive price in this period. That those who do buy from the former patentee in period 2 pay more than the competitive price has no efficiency consequences, since the *marginal* buyers pay the appropriate price and everyone who values the product more than its cost is able to buy it. Of course, the higher price paid by loyal buyers generates higher profits for the former patentee, but this has purely distributional effects.

the competitive price by more than the switching cost, *S*.

Higher consumer prices translate directly into higher profits for the patentee, with no quantity reduction and hence no deadweight loss.

Finally, note that the leverage effect is directly proportional to the size of the consumer switching cost, and negatively related to the slope or elasticity of the demand curve. The first relationship should be obvious. Higher switching costs make consumers less likely to switch, and make capturing consumers more valuable. Hence, as $S$ increases, each dollar of lower profit from output expansion in period 1 is traded-off against higher profits in period 2, which encourages additional production in the first period.

As the slope parameter, $b$, gets larger and the demand curve gets steeper, the leverage effect becomes weaker. The reason is the converse of the one given above. The more price-sensitive is period 1 demand, the greater the fall in period 1 price for any given quantity increase. Hence, inelastic demand imposes on the patentee a larger burden in foregone profits in period-1 for each additional period-2 customer it seeks to retain.

Table 1 provides a numerical illustration of our results using the parameters listed below.

Table 1: Profits and Welfare Over Two Periods,
With and Without Trademark Leverage[a]

| | Patent Only | Patent + Trademark | Absolute Change | Percent Change |
|---|---|---|---|---|
| Patentee's Profits | 2500.0 | 3025.0 | 525.0 | 21.0 |
| Consumer Surplus | 6250.0 | 5962.5 | -287.5 | -4.6 |
| Total Welfare | 8750.0 | 8987.5 | 237.5 | 2.7 |
| % of Maximum Welfare | 87.5 | 89.9 | | |

[a]Calculated based on parameter values: a = 100, b = 1, S = 10, c = 0.

The table demonstrates that the addition of even a relatively modest switching cost (equal to one-fifth of the monopoly price) can have significant effects: the patentee's profits are 21 percent higher, and in spite of this, total static welfare is nearly 3 percent higher with leverage than without it.[75]

[75] The explanation for this result is that leverage creates three effects:

1. The patentee increases period-1 output, which lowers her profits and raises consumer welfare. Consumers gain more than the patentee loses, however, owing to

It is important to stress that the dynamic or *long run* welfare gain from leveraged patents is potentially substantially larger than the static 2.7 percent listed in the table. The reason is that the table counts as the welfare gain from leverage only the reduction in static deadweight loss (monopolistic quantity distortion) while the patent is in effect. But in addition to reducing deadweight loss, the ability to leverage patent protection through trademarks and brand loyalty also raises the patentee's profits–in our example, by a hefty by 21 percent. This in turn creates a larger incentive for Research and Development expenditures on the part of future patentees, since any innovation is worth 20 percent more with leverage than without. Hence, we expect that leverage should give rise to additional innovations that will yield further welfare gains over the long run. The 2.7 percent welfare gain should thus be seen as a lower bound.

## B. Refinements and Limitations

The foregoing analysis has implicitly taken the possibility of leverage as a given. We assumed that customers always exhibit brand loyalty, which patentees can cultivate by lowering prices, regardless of the characteristics of the product or industry. In reality, however, the possibility and magnitude of trademark leverage depend on various factors, such as product characteristics, demand-side characteristics, and the existence of intrabrand spill-overs.

### 1. Product Characteristics

The economics literature draws a distinction between search and experience characteristics of products.[76] Search characteristics are those "that the consumer can determine by inspection prior to purchase of the brand."[77] Experience characteristics are those that can only be

the reduction in deadweight loss.

2. Loyal customers pay more in period 2 than they otherwise would.

3. This raises monopoly profit (by more than it fell in period 1), but does not create any deadweight loss because it represents a pure transfer from consumers to the (former) patentee.

[76] *See*, Nelson, *supra* n. 35.

[77] Id at 730.

ascertained by actual consumption of the product.[78] Although it is convenient to speak of search or experience *goods*, in reality virtually all goods exhibit a mixture of search and experience characteristics. Consider clothes, for example. Even though consumers can observe the design and color of clothing without purchasing it, there are still important attributes that may only be learned through long term use, including durability, comfort, and compatibility with other clothes. Once such factors are taken into account, it becomes clear that there are very few, if any, pure search goods.

Brand loyalty is easier to cultivate for heterogeneous products with important "experience" characteristics. The first factor means that consumers may have preferences across different brands along one or more dimensions. In the context of cars, for example, these might include status, safety, gas mileage, and service. The more heterogeneous the product, the greater the potential for brand loyalty. In addition, if such characteristics must be experienced in order to be appreciated, consumers will be less willing to switch brands once they have found one they like.[79] Even for goods whose characteristics can be evaluated without actually purchasing them, higher search costs should also promote brand loyalty. Thus, more complex products with important experience characteristics should be more amenable to the exercise of leverage.

### 2. Demand-Side Characteristics

In addition to product attributes, brand loyalty may also be affected by the attributes of the consumers who purchase the product. For example, elderly consumers are likely to be more brand loyal to products such as pharmaceuticals out of fear that alternate drugs will not work as well.[80] This aversion to trying new drugs is reasonable as long as elderly

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[78] Id at 730.

[79] Certain drugs are an apparent exception: some consumers will pay substantially more for branded Advil or Tylenol, even though generic Ibuprofen or Acetaminophen are, by law, chemically identical. The premium commanded by Bayer Aspirin long after the identical product was available from competitors at dramatically lower prices is another example of the same phenomenon. Presumably, producers have succeeded in creating artificial distinctions in the mind of consumers even though the underlying physical products themselves are not appreciably different.

[80] See James J Dettore; Allison B Carter; Suzanne C Hoppough, *Branding Lessons from Consumer Marketing*, PHARMACEUTICAL EXECUTIVE, May 1, 2001, at 48 ("Loyalty is an extremely important part of pharmaceutical branding. Consumers who

consumers are satisfied with their current medicines, since experimentation with new ones subjects them to some risk of harm. Moreover, switching to new products, even superior ones, is less valuable for elderly consumers because the cost of searching will be amortized over a smaller number of remaining purchases. Conversely, teenagers' consumption patterns are strongly affected by social pressures to conform with what peers are buying.[81]

Another source of brand loyalty is the degree to which consumers fail to take their own future consumption into account when making present consumption choices. Searching for an alternative product is more attractive if a superior product, once discovered, will be purchased repeatedly, simply because the gains per purchase are multiplied by a larger number of purchases. If consumers ignore the fact that they will purchase the product repeatedly, they will thus be more likely to stick with their current choice rather than search for an alternative product.

Brand loyalty is also plausibly influenced by consumers' tastes for variety. Consumers who prefer variety will be predisposed to switch among brands in order to enrich their consumption experience. By contrast, if consumer preferences are subject to habit-formation, so that repeated consumption alters the consumer's underlying utility function in favor of the product consumed, brand loyalty will be correspondingly enhanced.

### 3. Rate of Technological Change

Another factor that affects the degree of trademark leverage is the rate of technological innovation. For trademark leverage to be valuable for patentees, the patented product must remain of commercial value at the end of the patent life. The rate of innovation therefore sets a ceiling on the value of patent protection, since superior technology may render a prior innovation obsolete even before its patent expires. For example,

have used a medication for a long time often balk when their insurance companies no longer cover that brand. They go to great lengths to get their favorite products, such as calling or writing letters to insurance companies and doctors. Brand loyalty benefits are long term. Consumers fill certain prescriptions continually for years-sometimes for their entire lives.").

[81] Eric Posner, *Law and The Emotions*, 89 GEO. L.J. 1977 (2001).

the advent of DVD technology might make a patent on a VCR valueless before significant brand loyalty has a chance to develop.[82]

In an empirical study, Mark Schankerman found that the rate at which patents depreciate varies by industry. For example, pharmaceutical and chemical patents were estimated to depreciate at a rate of 3-4 percent per year, whereas mechanical and electronic patents depreciated more rapidly, at a rate of 10-15 percent per year. This suggests that the value of trademark leverage will be higher for certain patentees than for others. The slower the rate of depreciation, the easier it is to establish brand loyalty.

#### 4. Spillovers and Brand Equity

Under most branding regimes,[83] brand loyalty may spill over across products because customers may generalize from one product to another made by the same firm. For example, if a consumer has a positive experience with her first type of Kellogg cereal or Ford car, she may be more likely to try a second product made by the same manufacturer.

If both of a firm's brands are protected by patents, then inter-brand spillovers should make little difference to pricing and quantity decisions. But suppose that product *A* is patented, while product *B* is protected only by a trademark. In this case, consumers who purchase product *A* may be induced to buy product *B* as well. This, in turn, increases the patentee's incentive to lower the price of product *A*. A cut in the price of product *A* will not only increase demand for that product, but will indirectly raise demand for product *B* as well, as consumers transfer their favorable

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[82] This statement should be qualified given the analysis of spillovers across products in subsection II.C.4, *infra*.

[83] There are many alternative branding structures. A leading marketing textbook lists four:

1. Individual Brand Names: General Mills produces each product (Bisquick, Betty Crocker) under a separate label.

2. Blanket Family Name for all products: a strategy followed by, e.g., General Electric.

3. Separate family Names for all products: a strategy followed by, e.g., Sears (Kenmore appliances, Craftsman tools, etc.).

4. Company trade name plus individual product name: examples include Ford (Ford Taurus, Ford Escort), or Kellogg (Kellogg's Rice Krispies, Kellogg's Corn Flakes). Philip Kotler, MARKETING MANAGEMENT: ANALYSIS, PLANNING, IMPLEMENTATION AND CONTROL (9th ed., 1997) at 450.

experiences with *A* to other goods made by the same firm.[84] Therefore, spillovers across products of the same firm/brand are likely to further the importance of trademark leverage, just as spillovers of brand loyalty across pre- and post-expiration demand for the same product do.[85] One can thus think of cross-product spillovers as the cross-sectional analog to time-series brand loyalty, with essentially the same consequences–firms will be led to lower prices on monopolistic (patented) goods in order to increase demand for competitive (unpatented) goods in the same family of brands.

While a complete theory of brand loyalty is well beyond the scope of this paper, Table 2 provides a summary of some of the relevant factors that determine the extent to which consumers will persistently buy the same brand, even when similar alternatives sell for less.

[84] Products A and B are thus technically economic complements, since $dQ_A/dP_B < 0$. The rationale here has nothing to do with the standard story arising from utility maximization subject to a budget constraint, however. Instead, operating in the background, there is uncertainty about product quality, in the face of which consumers rely on the firm's name to draw inferences about the quality of prospective purchases.

[85] Of course, the decision about which brand naming strategy to adopt is not exogenous. A company that makes fertilizer and pancake mix will be more likely to follow the first strategy rather than second or fourth, precisely to avoid 'contaminating' one of its brand names with associations from the other.

Table 2: *Factors Promoting or Retarding Brand Loyalty*

| **Market or Product Characteristic** | **Effect on Brand Loyalty** |
|---|---|
| Homogeneous or Simple Product | Little rationale for brand loyalty if all products are similar–e.g., nails, gasoline, paper. |
| "Search" Attributes Important | Products whose key attributes are well-described prior to purchase are easy to compare; consumers should be willing to switch to another brand if specifications (or price) are superior to usual choice.[86] |
| Information Costs | Consumers have more/better information about products they have already purchased.[87] More information about rival products (e.g., *via* CONSUMER REPORTS) yields less loyalty. |
| Habit-Forming Product | Products that change tastes of consumers generate higher brand loyalty. |
| Low Price Product Relative to Search Cost | Consumers don't find it worthwhile to sample widely as long as current brand seems satisfactory, because little price or utility gain–e.g., toothpaste. |
| Product Appeals to Esp. Habit-Prone Customers | E.g, life insurance (risk-averse), arthritis medicine (elderly), etc. |
| Frequent Purchase + Consumer Myopia | If one-time switching cost amortized over large number of future purchases, consumers should be willing to switch brands even if price difference is small relative to the switching cost.[88] |

[86] Nelson, *supra* n. 35.

[87] Nickolay Moshkin and Ron Shachar, *Switching Costs or Search Costs*, Working Paper, Eitan Berglas School of Economics, Tel Aviv University (Jan. 13, 2000).

[88] See Appendix.

## III. EMPIRICAL EVIDENCE OF SYNERGIES

While the relationship among patents, trademark protection, and brand loyalty is–we believe–an original contribution of this article, a number of empirical studies support or are consistent with our model. We briefly discuss the prior academic literature, and then document several case studies in which firms have developed synergies between patents and trademarks in much the way our theory predicts.

### A. Previous Empirical Work

There is a substantial empirical literature documenting the existence of brand loyalty.[89] For example, a recent study by Coscelli finds loyalty is prevalent among consumers, even for drug brands that, by law, are chemically identical, and even after controlling for the prescribing behavior of physicians.[90] Allenby and Lenk also find persistence in buying patterns over time, using supermarket scanner data on a variety of consumer purchases.[91] Although their focus is on sellers' price/cost margins rather than on consumer behavior *per se*, Barsky *et al* uncover large price premia for "name brands" over essentially identical house brands, across a wide range of consumer products, a finding consistent with the importance of brand loyalty.[92]

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[89] See, e.g., Kotler, *supra* n.79.

[90] Andrea Coscelli, *The Importance of Doctors' and Patients' Preferences in the Prescription Decision*, 48 J. INDUSTRIAL ECON. (2000).

[91] Greg M. Allenby and Peter J. Lenk, *Reassessing Brand Loyalty, Price Sensitivity, and Merchandising Effects on Consumer Brand Choice*, 13 J BUS. & ECON. STAT. 281 (1995).

[92] Robert Barsky et al, *What Can the Price Gap Between Branded and Private Label Products Tell Us Markups?* Nat'l Bur. of Econ. Res. Working Paper 8426 (2001). Since the authors do not track individual consumers' purchases over time, their work does not actually demonstrate brand loyalty. But without such loyalty, it would hard to understand how, for example, Advil or Motrin could sell for substantially more than the house brand of Ibuprofen, which is chemically identical. This study is notable for its scrupulous care in eliminating product types for which the house brand might be of lower physical quality than the name brand, such as toilet tissue and soft drinks. *Id*. at 12-16. Raj Sethuraman and Catherine Cole, *Why do Consumers Pay More for National Brands than for Store Brands*, Marketing Science Institute, Report #97-126 (1997) demonstrate using survey data that many consumers have strong preferences for national over house brands, *even when they acknowledge that the higher prices charged by the former do not reflect quality differences*.

Beyond the existence of brand loyalty, there are scattered references in the empirical literature to synergies between loyalty and patents. For instance, writing in 1980, F. M. Scherer, author of the leading textbook in Industrial Organization, noted that

> . . . a company's image is [frequently] enhanced by being first on the market with a new product, and through this product differentiation advantage it may be able to maintain a favorable price differential or retain a sufficiently large share of the market to earn supranormal profits for some time. . . . [Hence,] product differentiation and natural lags [may] interact to [create] incentives for investment in research and innovation.[93]

Similar conclusions were reached by Levin, et al in a study of the factors that allow firms to appropriate the benefits of innovations.[94] Using survey data from interviews with high-level Research and Development executives, Levin et al conclude that in many industries, patents are relatively unimportant in protecting firms' R&D expenditures, in part because "investments to establish the brand name of a patented product may outlive the patent itself."[95]

After surveying the empirical literature on the causes and consequences of being the first firm to enter a market, Robinson *et al* conclude that

> [f]irst-mover advantages . . . are important in [several] industries. The sources of these first-mover advantages are varied, but customer familiarity and brand loyalty are

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[93] F.M. Scherer, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE (2nd ed., 1980) at 445. Only one study was offered as evidence for this proposition, however: Ronald Bond and David Lean, *Sales, Promotion, and Product Differentiation in Two Prescription Drug Markets*, Federal Trade Commission staff report (Washington, D.C.: Government Printing Office, Feb. 1977), chapters 3-6. Moreover, neither study draws the connection between trademarks and brand loyalty.

[94] Richard C. Levin, Alvin K. Klevorick, Richard R. Nelson & Sidney G. Winter, *Appropriating the Returns from Industrial Research and Development*, 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783 (1987).

[95] *Id*. at 784. While downplaying the importance of patents generally, the Levin *et al* study concludes that patents are crucial to protecting intellectual property in some industries (e.g., drugs, chemicals). And where trade secrets, rather than patents, are the means of protection, our analysis remains valid, as we explain in Section ?, *infra*.

> important. Overall, a market pioneer's enduring trademark protection is more important than patent protection.[96]

Moreover, they note that

> [F]irst-mover advantages developed in the marketplace are typically more general and long-lasting than product patent protection. . . . [In addition,] the empirical results indicate that trademark protection of the pioneer's brand name is often important. When consumers rely on the known and familiar pioneering name, gaining trial can be especially difficult for later entrants. Strong brand names are often maintained for literally generations. For example, 19 of the top 25 brand names in 1923 were still market leaders in 1983."[97]

In sum, the academic literature offers support for our view that brand loyalty is an important phenomenon and that it can be used in combination with patent protection to generate supra-competitive rates of return to firms with new products.

## B. Case Studies

In this section, we offer several examples of how patented products are marketed with an eye towards the expiration of the patent. In each instance, the patentees have adopted a strategy of building market share and brand loyalty for the period after the patent expires. Although the examples do not offer full sets of time-series data on pricing and output decisions, patentees do seem to be cutting prices and increasing output, and for precisely the reasons predicted by our model.

### 1. Roundup

One of the clearest examples of using a brand name to leverage one's patent protection is Roundup (chemical name, glyphosate), an

[96] William T. Robinson, Gurumurthy Kalyanaram and Glen L. Urban, *First-Mover Advantages from Pioneering New Markets: A Survey of Empirical Evidence*, 9 REV. OF INDUSTRIAL ORG. 1, 6 (1994).

[97] *Id*. at 17-18.

herbicide patented by Monsanto in 1980.[98] Roundup is the best selling agricultural chemical ever, with sales of $2.8 billion in 2000; it outsells other chemicals by five to one.[99] Despite the monopoly conferred by its patent, Monsanto began cutting prices on Roundup in the mid 1980s, in order to develop an additional customer base.[100] The company followed a "brilliant strategy of dropping its price years ahead of patent expiration. . . . 'It was a classic pricing strategy,'. . . 'a textbook case. Every 1 percent price drop led to a 2.5 or 3 percent increase in volume.' Even more, few competitors are willing to produce a generic version of Roundup . . . because Monsanto has protected its market dominance by cutting the price while finding new uses. This built loyalty while reducing the profit that potential competitors could reap by trying to lure away customers."[101] The company continued to drop prices as the date of the patent expiration neared.[102]

2. Nutrasweet

Patented by Searle in 1972, the artificial sweetener aspartame was not introduced on the market until ten years later under the brand name Nutrasweet. From the beginning, the company apparently focused on building brand loyalty for the period after the patent expired. Initially, Nutrasweet was available only to producers, and not to the public at all,

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[98] Robert Steyer, *Monsanto Reports Success for New Roundup*, ST. LOUIS POST-DISP., Dec. 22, 1996 at 1E.

[99] David Barboza, *A Weed Killer Is a Block to Build On*, N.Y. TIMES, Aug. 2, 2001 at C1.

[100] Steyer, *supra* note 94.

[101] Barboza, *supra* note 95.

[102] The retail price of Roundup fell from about $44 a gallon in 1997 to $34 in 1999 to about $28 in 2000. *Id*.

As both of the previous articles make clear, the company also adopted numerous other tactics to forestall competition besides cutting prices to build brand loyalty. For example, Monsanto made technical modifications to the chemical in response to consumer demand, and in an attempt to receive a new patent. The company also built substantial production capacity in advance of demand in order to forestall entry by competitors. And it agreed to license its product to competitors once the patent expired, making it unattractive for competitors to produce glyphosate themselves. Finally, Monsanto created crops that were genetically-engineered to be tolerant to Roundup, so that the herbicide could be sprayed directly on the fields, killing weeds but not the crops. Consumers who used Monsanto's genetically-modified ("Roundup-Ready") seeds had to sign an agreement promising to use only Monsanto's herbicides rather than generic glyphosate.

and sold for $90 per pound. "In 1984, as Coca-Cola Co. and PepsiCo were reformulating their newly-burgeoning diet colas to use aspartame sweetener rather than saccharin blends, Nutrasweet used its growing consumer loyalty base to negotiate more exposure for its brand. Nutrasweet cut the sweetener's price [by roughly 50 percent] to companies that featured the new '100 percent NutraSweet' trademark swirl on their packages, and bestowed even bigger breaks for ad campaigns mentioning the reformulation."[103] As the date of the patent's expiration neared, NutraSweet "started dropping its prices. . . . In 1989, prices were cut by 3 percent, and another 6 percent was lopped off in 1990. . . . In 1991, . . . the company cut prices by 10 percent, and it did so again in 1992. . . . The next year prices dropped by another 25 percent . . . ."

3. Tagamet

In 1993, SmithKline Beecham announced a direct-to-the-customer rebate of ten dollars per month on the ulcer medication Tagamet, for a $20/month savings over archrival Zantac.[104] This was apparently the first time that price cuts or rebates to consumers had ever been used to bolster sales of a prescription drug. Analysts linked the price drop to the fact that Tagamet was going off patent in May of 1994, and the desire to build brand loyalty before the advent of generic competition.[105]

4. Zovirax

An antiviral cream made for cold sores, Zovirax was initially available only by prescription. In 1992, its manufacturer, Burroughs-Wellcome, attempted to get approval for over-the-counter sales (at a substantially lower price) because the patent was due to expire in 1995. "Switching to selling over the counter is one of the strategies Wellcome is using to protect its revenue from Zovirax. It hopes to be able to build brand-loyalty among consumers, so enabling it to maintain sales when

[103] Nancy Millman, *King of The Tabletop; Nutrasweet Pours on Loyalty Effort*, CHI. TRIB., Sept. 17, 1995 at 1.

[104] Milt Freudenheim, *A Drug Promotion Based on Price Breaks the Prescription Tradition*, N.Y. TIMES, Nov. 9, 1993 at A1.

[105] Ernst R. Berndt, Davina Ling and Margaret K. Kyle, *The Long Shadow of Patent Expiration: Do RX to OTC Switches Provide an Afterlife?* (MIT working paper, 2000).

its patent runs out and competitors come in to the market."[106]

5. Bayer Aspirin

According to Mann and Plummer's careful history of Aspirin, the originator of the drug–Germany's Bayer Co.–explicitly took steps to leverage its patent protection through trademark after the patent expired.

> To counter the loss of its [American] patent, the firm turned to its trademark. Bayer would try to make consumers so thoroughly identify headache and fever relief with Bayer Aspirin that its rivals would have no chance. . . . [Bayer decided] to boost U.S. production of Aspirin [and to do so] in tablet form. Each tablet was stamped with the Bayer Cross [the company's trademark] and the tablets were put in Bayer packages, which for the first time let consumers see the name of the company that cured their headaches.[107]

Again, we see a familiar story of trademark leverage–an attempt to extend patent protection by means of trademark and brand loyalty, and an expansion of output while the product is still under patent in order to increase the number of loyal customers.

What these cases show is that, especially near the end of a patent's life (but sometimes much earlier), some firms do implement a strategy precisely like the one predicted in our model. In an effort to survive after the expiration of the patent makes generic competition inevitable, firms

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[106] Heather Connon, *Pharmaceutical and Medical Sales: Companies Keen to Switch*, THE INDEPENDENT (LONDON), July 22, 1992 at 14.

[107] Charles C. Mann and Mark L. Plummer, THE ASPIRIN WARS : MONEY, MEDICINE AND 100 YEARS OF RAMPANT COMPETITION 37 (1991). The reaction of the American Medical Association to this effort was strongly negative. An editorial in the Association's Journal echoed the insular view of intellectual property often expressed today, noting that

> [f]or seventeen years, it has been impossible in this country for anybody except the Bayer Company to manufacture or sell acetylsalicylic acid. . . .Needless to say, the American people have been made to pay exorbitantly for the monopoly our patent office granted this firm. . . . Not content with the iron-bound monopoly which it had been granted through our patent laws, the company attempted to further clinch its exclusive rights by giving the preparation a fancy name, "aspirin," and getting a trademark on this name.

Quoted in *Id*. at 38.

increase output and cut prices. (Of course, many other tactics are often pursued simultaneously as well.) This is described as an effort to build brand loyalty–an attempt to make the product distinctively attractive to consumers who will soon be faced with a cheaper generic alternative. What is not stressed in the reports on which these case studies are based is that the effort to develop and maintain brand loyalty also serves to increase overall efficiency.

## IV. EXTENDING THE ANALYSIS TO TRADE SECRECY AND COPYRIGHT

In this part, we examine the applicability of our findings to trade secrecy and copyright protection. We posit that despite the fundamental differences between trade secrecy and patents, the combination of trade secrecy and trademark protection generates the same efficiency effects we identified with respect to patents in cases in which trade secrecy creates market monopolies. In fact, the uncertain, or probabilistic, nature of trade secrecy—the fact that trade secrets may become public at any time—implies that the positive impact of trademarks in this context may be greater than in the context of patents. We also predict that combining copyright with trademark yields much smaller efficiency effects relative to those we identified for patents and trade secrets. This difference is due, predominantly, to the fact that copyright protection is so long as to make the possibility of additional trademark protection in the post-copyright period of very limited value for copyright owners. Thus, we expect the availability of trademark protection to have an inconsequential effect on the pricing decisions of copyright owners.

### A. Trade Secrecy

Originating in the middle of the nineteenth century,[108] trade secret law protects any information that derives independent economic value from being secret and is subject to reasonable secrecy precautions.[109] In

[108] See Robert G. Bone, *A New Look at Trade Secret Law: Doctrine in Search of Justification*, 86 CALIF. L. REV. 241, 247 (1998) (discussing the origin of trade secret law).

[109] Section 1(4) of the Uniform Trade Secrets Acts that has been adopted with some minor changes by over 43 states defines a trade secret as:

> information, including a formula, pattern, compilation, program, device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other

principle, trade secret law applies to unpatentable as well as patentable information.[110] Consequently, trade secrecy serves both as a complement to and substitute for patent protection. As a complement to patent law, trade secret law protects information that fails to meet the patentability standard for lack of novelty, usefulness, or nonobviousness.[111] As a substitute for patent protection, trade secrecy presents businesses with a choice between patent and trade secret protection. While firms can elect either option, they cannot employ both modes to protect the same information. The subject matter overlap is evident in trade secret litigation. As one commentator reported, most trade secret cases "involve technological subject matter–such as the formula for Coca-Cola, a process for making methanol, or the dimensions of a robot-operated machine."[112]

Notwithstanding the extensive subject matter overlap, patent and trade secret protection differ in three important respects. First, patent protection is conditioned on full disclosure; trade secrecy rests on non-disclosure. In the context of patent, it is the disclosure of valuable information that justifies the social cost associated with the legal monopoly.[113] In contrast, secrecy is the touchstone of trade secret law. Second, the protection bestowed by patent law is significantly stronger than that conferred by trade secret law. Patent protection bars others from manufacturing, using, selling and importing the invention while it

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> persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

Uniform Trade Secrets Act § 1(4) (amended 1985).

[110] See 1 Milgrim, supra note 4, §§ 1.08[1]-1.08[2]; also Bone, *supra* n. 108, at 248 ("almost anything can qualify as a trade secret, provided it has the potential to generate commercial value.").

[111] Bone, id. at 248 ("[u]nlike patent law, which only protects inventions that are 'nonobvious,' trade secret law protects all inventions that confer a competitive advantage, even ones that are not especially new.") (footnote omitted).

[112] *Id*. (footnotes omitted).

[113] This foundational exchange–the grant of a temporary monopoly in exchange for adequate disclosure–is a long-standing principal of patent law. See, e.g., *Grant v. Raymond*, 31 U.S. (6 Pet.) 218, 247 (an enabling disclosure "is necessary in order to give the public, after the privilege shall expire, the advantage for which the privilege is allowed, and is the foundation of the power to issue the patent."); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977) (suggesting that the primary importance of patents is their influence, through disclosure of new technologies, on future R&D, not their impact on ex ante incentives to innovate).

is patented. In fact, the protection is so broad that even if a competitor arrives at the patent invention independently and attempts to market it, she will still be liable for infringement; independent development does not shelter one against an infringement suit. The protection accorded by trade secret law is much more limited. Trade secret law protects the information holder only against improper appropriation by others. Liability under trade secret law requires a showing of "breach of contract, violation of a confidential relationship, theft, bribery, misrepresentation, and other wrongs."[114] Trade secret law does not prohibit copying of publicly available products. Nor does it forbid reverse engineering. Third, trade secret protection has no built-in time limit. Unlike patent protection, which endures for a uniform period of twenty years, trade secret protection lasts as long as a reasonable effort is made to keep the information secret, and no competitor succeeds in appropriating the information by legitimate means—usually by reverse engineering the product embodying the information. Thus, in principle, trade secrecy may last in perpetuity.

On first impression, the potentially infinite duration of trade secret protection seems to suggest that trademark protection is useless for trade secret holders. A closer examination, however, reveals that this conclusion is unwarranted. By its very nature, trade secret protection is uncertain. Competitors of the trade secret holder may at any time successfully overcome the secrecy legitimately and appropriate the protected information. Alternatively, they may arrive at the protected information independently. In other words, the successful continuation of trade secrecy is probabilistic. The protection *may* last forever, or end at any given moment. Table 3 gives the expected life of a trade secret, given various annual probabilities that the secret will be discovered.[115] For an annual probability of detection of 25 percent, the trade secret's expected life is 12 years, rising to 27 years for an annual detection rate of 17.5 percent.

[114] See Bone, *supra* n.104, at 250.

[115] The expected life is given by $\mathsf{3}_{t=0}^{\mathsf{4}}\, t\times(1-\mathsf{8})^{t}$, where $\mathsf{8}$ is the constant probability of discovery in any year and t is the number of years since the secret originated.

Table 3: *Expected Life of a Trade Secret, for Various Annual Probabilities of 'Discovery' by Rivals*

| | | | | | |
|---|---|---|---|---|---|
| Annual Probability of Discovery | 0.75 | 0.50 | 0.25 | 0.20 | 0.1 |
| Expected Life, in Years | 0.44 | 2.00 | 12.0 | 20.0 | 90.0 |

For our purposes, this fact makes trade secrecy closely analogous to patent protection, at least for secrets that are moderately likely to be discovered. Both patent and trade secret give firms the same advantage: lead-time. In the case of patents the lead-time is certain and limited, while in the case of trade secret protection the lead-time is uncertain and potentially unlimited.

The uncertain nature of trade secrecy creates a two term planning horizon for the rational trade secret holder—very much as it did for the rational patentee. The probabilistic event of termination should prompt the trade secret holder to consider not only of the trade secrecy period, but also the period that follows, in which trademark is the only available protection. Thus, even in the instances in which trade secrecy bestows a monopoly position,[116] a rational trade secret holder should sacrifice some of her monopolistic rents during the secrecy period in order to enhance her brand recognition and preserve higher revenues in the trademark period. As with patent protection, the need to rely on trademark protection in the future curbs the trade secret holder's penchant to price monopolistically.

One important difference between our analysis of patent and trade secrecy protection concerns the timing of the decision to reduce prices. The probabilistic nature of trade secrecy implies that trade secret holders

[116] Because trade secret law protects non-novel information, and because the protection accorded by trade secrets is weaker than that conferred by patents, not every instance of trade secret protection raises a monopoly problem. At the same time, trade secrecy also extends to inventions that could, in principle, be patented. In such cases, inventors will choose trade secret over patent protection only if their expected revenues from trade secrecy exceed their expected revenues from patent protection. This will happen when: (1) patent infringements are difficult to prove (as is sometimes the case with process patents); (2) the patentee lacks the wherewithal to afford litigation; (3) trade secrecy grants the inventor a monopoly that is expected to last longer than the statutory patent period. Obviously, the latter scenario is the most troubling since it imposes a potentially greater deadweight loss than patent protection, and no disclosure is made to the public.

will lower prices earlier than patentees will. Since patentees are assured 20 years of exclusivity, they will optimally choose to price monopolistically in the early years of the patent, and lower prices only as expiration nears. Trade secret holders face a different calculus. Assume, for example, that Energy Inc., holds a trade secret for a chemical composition used in solar panels. The company estimates that there is a substantial probability that its rivals will learn the formula of its vaunted trade secret in the first few years following its introduction. Under these circumstances, the company will want utilize trademark protection right away in order to offset the imminent risk of its secret being revealed. The need to rely on trademark protection early in the product's life increases the pressure on trade secret holders to invest in brand loyalty from the start of the product life cycle, rather than exploiting their market exclusivity in the early years as patent holders do. The earlier timing of the price reduction in the case of trade secret protection thus increases the efficiency gains from trademark leverage.

## B. Copyright

Copyright protection extends to any original expressive work fixed in a tangible medium of expression. Like patent protection, copyright protection is limited in time. The first federal Copyright Act of 1790 limited the statutory subject matter to books, maps and charts.[117] Through time, the subject matter of copyright law has dramatically expanded, and it presently includes musical works,[118] sculptural works,[119] audiovisual works,[120] architectural works,[121] designs,[122] and

[117]See Craig Joyce, William Patry, Marshall Leafer & Peter Jaszi, COPYRIGHT LAW 20 (5th ed., 2000).
[118]17 U.S.C. § 102(2).
[119] 17 U.S.C. § 102(5).
[120] 17 U.S.C. § 102(6).
[121] 17 U.S.C. § 102(8).
[122] Copyrightable designs include statuettes, see *Mazer v. Stein*, 347 U.S. 201 (1954) (holding that the patentability of the statuettes did not bar copyright as works of art), and belt buckles, see *Kieselstein-Cord v. Accessories by Pearl, Inc.*, 632 F.2d 989 (2d Cir. 1980) (concluding that the belt buckles were copyrightable because their primary ornamental aspect was conceptually separable from their subsidiary utilitarian function), but may not include nose masks representing animal probosci, see *Masquerade Novelty, Inc. v. Unique Industries, Inc.*, 912 F.2d 663 (3d Cir. 1990) (holding the animal shapes conceptually inseparable from the products' utilitarian purpose of creating humor), or mannequins, see *Carol Barnhart Inc. v. Economy Cover Corp.*, 773 F.2d 411 (2d. Cir. 1985) (holding mannequins not copyrightable because

computer software.[123] The expansion of copyrightable subject matter has not only engendered a degree of subject matter overlap between copyright and patent law, but has also increased the importance of trademark protection for copyright holders. Very much like patentees and trade secret holders, copyright holders can rely on trademark protection to maintain a proprietary interest in their works even after the copyright protection expires. Thus, it is not surprising that Disney trademarked all its famous animated characters in addition to copyrighting them. Similarly, Microsoft can combine copyright and trademark in protecting its software, and the Italian designer Alessi can employ the same combination to protect his innovative designs.

How will the trademark leverage affect the pricing decisions of copyright holders? We predict that the combination of copyright and trademark might mitigate the anti-competitive effects of copyright protection in some cases, but we expect the typical efficiency gains to be small. There are several reasons for the difference between patent and copyright leverage. First, trademark protection is virtually irrelevant to most types of copyrighted works, such as paintings, sculptures, and even movies. Once a film falls into the public domain, few consumers will pay more for a copy released by the original studio when identical copies are available on the market for less.

Second, consumers buy most copyrighted work for self-consumption only once; for most copyrighted works, there is no possibility of repeat sales. Once Jane owns a CD of Nirvana's "Never Mind," she can listen to the copyrighted music as much as she likes without buying another copy. The likelihood of Jane purchasing another copy of her favorite novel, James Joyce's "Ulysses," is even lower.

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the aesthetic and artistic features of the forms are inseparable from the forms' use as utilitarian articles).

Besides the doctrine of conceptual separability, future designs may be protected through "sui generis" copyright regimes, or through patent or trademark laws. See Joyce et al., *supra* note 114, at 200-01.

[123] See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983) (suggesting that computer programs are proper subject matter for copyright protection); *Apple Computer, Inc. v. Formula International, Inc.*, 725 F.2d 521 (9th Cir. 1984) (holding object code copyrightable); *Sega Enterprises Ltd. v. Accolade, Inc.*, 977 F.2d 1510 (9th Cir. 1993) (carving out a substantial "fair use" exception for "reverse engineering"). Besides traditional copyright protection, computer software may also be protected through patent, see *Diamond v. Diehr*, 450 U.S. 63 (1981) (upholding the patentability of software-related inventions), state trade secret protection, state contract law, "shrink-wrap" licensing, or "click-on" licensing. See Joyce et al., *supra* note 114, at 174-76.

Third, copyright protection is so long as to render the additional protection term afforded by trademark law virtually meaningless. The current copyright term is life of author plus 70 years for individually created works, and 95 years from publication or 120 years from creation (whichever is shorter) for works made for hire.[124] As Posner explained "as a result of discounting to present value, the knowledge that you may be entitled to a royalty on your book 50 to 100 years after you publish it is unlikely to affect your behavior today."[125] Therefore, before a work is created, the effect of trademark protection on the incentive to create is extremely small.

Moreover, the commercial life span of copyrighted products for which trademark protection is relevant is considerably shorter than the copyright term. Consider software. While branding certainly matters for software providers, copyrighted software becomes obsolete years before the copyright in the software expires. Thus, future trademark protection gives software providers no incentive to increase sales at present in the hope of making additional sales after the copyright protection ends.

Nonetheless, there may be some instances in which intra-brand spillovers may induce copyright owners to cut prices of copyrighted products in order to increase brand loyalty. Since most copyrighted works are experience goods, the purchasing decisions of consumers will, to some extent, be influenced by past consumption of other products of the same brand. In light of this fact, copyright holders may find it in their best interest to reduce prices of popular copyrighted products to attract consumers to try other products of the same brand. For example, "Blue Note," the famous jazz label, may rationally reduce the price of copyrighted recordings to entice jazz lovers to purchase the label's other recordings. Likewise, "Penguin," the reputed publishing house, may not extract the full rent afforded it by copyright protection on its current bestseller in order to convince consumers to buy its edition of "The Dialogs of Plato" and other public domain classics. So, on the margin,

[124] See 17 U.S.C. § 302 (describing duration of copyright). In the case of "works made for hire," the employer is considered the author of the work and is regarded as the initial owner of the copyright unless the parties have agreed otherwise. See 17 U.S.C. § 201(b). "Work made for hire" is defined in the statute. See 17 U.S.C. § 101.

[125] Richad A. Posner, ECONOMIC ANALYSIS OF LAW 46-7 (5th ed., 1998). At a 5 percent annual interest rate, $1 in 100 years is worth only $0.007–less than a penny–in present value.

concerns for intra-brand spillovers may induce copyright holders to price more competitively.[126]

## V. IMPLICATIONS FOR LAW AND POLICY

Patent policy embodies a tradeoff between dynamic and static efficiency. On the one hand, if innovations can be freely copied, innovators will have no way of appropriating any of the gains they generate, nor of recovering the costs they have incurred in research and development. The upside, however, is that the prices of the innovations that are produced would be low, and every consumer who values the product at more than its cost would be able to purchase it. In the absence of patents, then, there would be essentially no static deadweight loss, but society would incur serious dynamic inefficiencies by eliminating much of the incentive to innovate. This, however, is not the balance society has chosen between dynamic and static efficiency. Instead we have elected to grant the patentee a limited-duration monopoly, allowing her to restrict output and charge monopolistic prices. This enables the patentee to appropriate more of the benefits of her innovation, and thereby provides an incentive to invest in R&D. But it comes at the cost of static deadweight loss, since invention prices are now set monopolistically, and some consumers who value the product at more than its marginal cost are unable to purchase it. Thus, any level of patent protection implies a corresponding deadweight loss. Importantly, both the incentive to innovate and static deadweight loss vary directly with the length of the patent term. Increasing dynamic incentives thus necessarily increases static losses, hence the tradeoff.

As we have shown, however, patents are not the only means for encouraging innovation; trademarks may complement patents in promoting this goal. The net effect of combined patent and trademark protection is a stronger incentive to innovate than that contemplated by Congress.[127] The increased protection, moreover, comes at no cost to society. In fact, it improves social welfare. Our analysis has demonstrated that leveraged patents produce the following three effects:

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[126] We discuss spillovers in the patent context *supra*, TAN 83.

[127] A review of the legislative history of Title 35 of the U.S. Code fails to disclose any reference to trademark. Neither the Congress that passed the original Patent Act, nor any subsequent Congress that amended the Act, mentioned the possibility of enhancing the incentive to create through a combination of patent and trademark.

1. Leveraged patents induce patentees produce more, and price more competitively than they would under a patent whose effect ends at expiration, as is traditionally assumed.
2. This additional output leads to lower static deadweight losses while the patent is in effect, but higher overall profits for the patentee, and hence yields greater ex ante incentives to innovate than a conventional patent.
3. Consumers who remain loyal to the patentee's product after the patent expires pay more than they need to, since they could avail themselves of competitive product at a lower price. However, this effect is purely redistributive: the consumers' loss is exactly equal to the patentee's gain, with no deadweight loss.

These observations have important consequences for innovation policy. They imply, for example, that patents may be shortened, and their attendant deadweight loss reduced without diminishing the incentive to innovate provided by existing patent protection. Conversely, incentives to innovate may be increased without imposing additional deadweight loss on society.

In the remainder of this part, we will demonstrate why hostility to leveraged patents is misguided by analyzing the Supreme Court's approach to the problem. We will then explain how legal policy should take advantage of leveraged patents to encourage innovation while reducing deadweight loss.

## A. Pitfalls In The Supreme Court's Approach To Leverage

Driven by strong hostility to the practice, the Supreme Court in *Singer*[128] and *Kellogg*[129] thwarted attempts at leveraging patents through trademarks by dramatically diminishing the trademark protection available to patented inventions. In both cases, the Court ruled that name by which a patented invention has become known falls into the public

[128] 163 U.S. 169 (1896).

[129] 305 U.S. 111 (1938). A possible variant on the Supreme Court's approach is to set a time limit on the trademark protection afforded to patentees. Under this approach, the names of previously patented products would be entitled to full trademark protection, but the protection would lapse after a certain period of time, by which point the name would fall into the public domain. While better than the Supreme Court's approach, this solution weakens the value of trademark protection to patentees, and thus, eliminates some of the patentee's incentive to lower prices during the patent's life.

domain at the expiration of the patent.[130] In *Singer,* the Court even permitted competitors to affix the name "Singer" to their sewing machines, thereby completely eliminating the possibility of leverage.[131] Harkening back to this conception, in *Traffix,* the Court held that expiration of a utility patent on a mechanism for keeping outdoor signs upright in inclement weather creates a rebuttable presumption that the particular design is ineligible for trade dress protection.[132]

Our analysis demonstrates that the Supreme Court's hostility to leveraged patents is ill-conceived. Not only did the Court fail to see the efficiencies generated by leveraged patents, but it also chose the least desirable intervention method. By restricting patentees' ability to leverage patents through trademarks, the Supreme Court has enhanced the incentive for patentees to price monopolistically during the patent life. Any diminution in the scope of trademark protection available to patentees increases the relative value of their patent monopoly, and correspondingly, forces them to rely on monopolistic rents to recover their investment in research and development. Thus, the net effect of the Court's policy is to increase the distortionary effect of patent protection and diminish social welfare.

In fact, the Supreme Court got it exactly backwards: it is marks that do *not* designate patented products that should be subject to heightened scrutiny, since they do not generate the same leverage effect as marks of patented products. This point leads to a more general insight. In recent years, there has been a spate of criticism of the expansion of trademark protection.[133] While we do not seek to justify this expansion generally, we wish to note its beneficial effect in the context of leveraged patents. To the extent that the enhanced trademark protection facilitates brand recognition, it makes it easier for patentees to preserve their loyal customer base, and thus increases the value of each sale made during the patent term. Therefore, the more trademark law protects branding, the stronger the incentive for patentees to reduce prices during the patent's

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[130] 163 U.S. 169; 305 U.S. 111.

[131] 163 U.S. 169.

[132] *Traffix Devices Inc. v. Marketing Display Inc*., 121 S. Ct. 1255 (2001) at 1260.

[133] See Mark A. Lemley, *The Modern Lanham Act and the Death of Common Sense*, 108 YALE L.J. 1687, 1688 (1999) (suggesting that by protecting trademark owners against uses that would not have been infringements even a few years ago and protecting as trademarks things that would not have received such protection in the past, courts "are well on their way to divorcing trademarks entirely fromthe goods they are supposed to represent"). Glynn S. Lunney, Jr., *Trademark Monopolies*, 48 Emory L.J. 367 (1999) makes a similar point.

life. The Court's misunderstanding of leveraged patents has led to a perverse result: while trademark protection generally has dramatically expanded, the protection afforded to marks of patented products has been set at a minimal level. While we support differential protection, we submit that it should go the other way around. Courts should grant stronger trademark protection to marks designating patented innovations than they do to other marks.

Trade dress protection calls for more nuanced analysis.[134] Trade dress protection covers "the appearance or image of goods or services as presented to prospective purchasers."[135] In analyzing trade dress protection for previously patented products, it is critical to distinguish between the aesthetic design elements and the functional configurations for which the utility patent was awarded. While we support extending trade dress protection to the *aesthetic* design elements of patented products, we oppose its extension to patented product configurations. The reason is simple: whereas protecting aesthetic design elements increases the leverage effect, protecting patented product configurations eliminates leverage altogether. The effect of extending trade dress protection to patented product configurations would be to give patentees perpetual exclusivity over those features. Naturally, under a legal regime in which patents do not expire, patentees would not need to rely on brand loyalty, and consequently, would have no incentive to reduce the price of patented products.[136]

## B. Relaxing the Tradeoff Between Dynamic and Static Efficiency

By conferring limited exclusivity upon inventors, patents affect efficiency in two ways: they spur innovation, but generate a deadweight loss. The first effect is positive and dynamic; the second is negative and

[134] We are grateful to Mark Lemley for pointing this out to us.

[135] Restatement (Third) of Unfair Competition section 16 (1993).

[136] In fact, this is exactly what the respondent, Marketing Display Inc., (MDI), attempted to do in *TrafFix*. MDI sought to obtain trade dress protection for its previously patented "dual spring mechanism" used for keeping outdoors signs upright in inclement weather conditions. Denying MDI's request, the Supreme Court ruled that MDI's expired utility patent is strong evidence that the dual spring mechanism is functional, and thus, ineligible for trade dress protection. Although the Court's analysis was doctrinal, and despite the fact that it relied on the insular view of intellectual property law that we criticized earlier, it reached the correct decision. Our analysis provides an independent, policy-oriented justification for the ruling.

static. This means that policymakers cannot simply choose the level of patent protection that maximizes the incentive to innovate. Nor can they select a level of patent protection that minimizes social deadweight loss. Rather, they must choose a protection level that strikes the right balance between the dynamic efficiency gain and the static efficiency loss. The current protection term–20 years from filing–presumably reflects Congress' judgment that any further incentives to innovate would not be worthwhile, given the additional static deadweight loss entailed by an extension of the term.

Conventional theorizing mistakenly assumes that patents exclusively determine the terms, or the "possibility frontier," of the tradeoff between dynamic and static efficiency. On this view, any deviation from the current level of protection is undesirable since it entails a social cost. Specifically, it is impossible to enhance dynamic efficiency further by increasing the incentive to innovate without also increasing social deadweight loss. Nor is it possible to lower social deadweight loss by shortening patents without simultaneously diminishing the incentive to innovate.

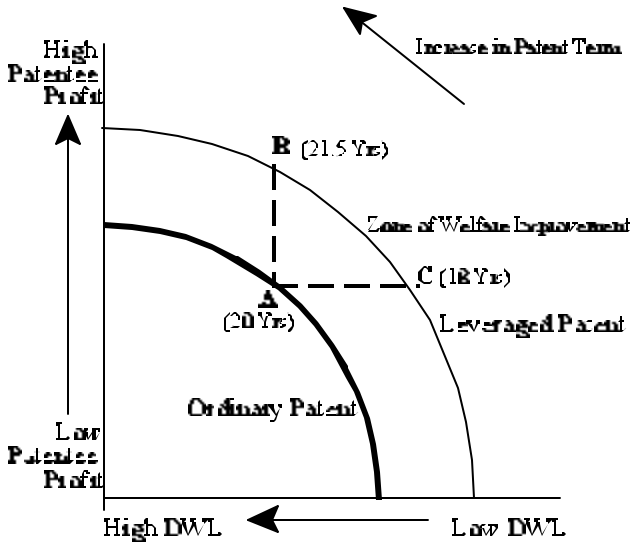
Our analysis of leveraged patents demonstrates that the terms of the tradeoff between dynamic and static efficiency are not as restrictive as previously thought. As we have shown, trademark protection can increase the payoff to patentees, and thereby enhance the incentive to innovate, while *reducing* the deadweight loss generated by patents. By relaxing the tradeoff between static and dynamic efficiency, leveraged patents shift outwards the possibility frontier delineated by patents. Consequently, they create new combinations of incentives to innovate and deadweight loss that are unavailable under discrete patent protection.

For example, the outward shift of the possibility frontier makes it possible to shorten patent terms without any dynamic efficiency sacrifices. Since leveraged patents have higher profitability than non-leveraged patents, the term of protection for leveraged patents may be shortened without reducing incentives to innovate below those contemplated by Congress for a non-leveraged patent. As long as the drop in profits due to the shorter patent term is lower than (or equal to) the gains from trademark protection, shortening patents would not adversely affect dynamic efficiency; it would at the same time lower the static deadweight loss caused by patent protection.

Conversely, leveraged patents enable policymakers to improve dynamic efficiency while maintaining static deadweight loss at the level of ordinary patents. Given that the static deadweight loss of leveraged

patents is smaller than for non-leveraged ones, policymakers might wish to *increase* the protection term for leveraged patents. Since society is willing to put up with deadweight loss of non-leveraged patents, the duration of leveraged patents may be extended until the corresponding deadweight loss equals that of non-leveraged patents. Extending the duration would increase the expected return on innovation, and thereby spur greater investment in R&D.

Figure 1 illustrates the argument graphically. It shows that for a standard patent (no leverage) there is a tradeoff between patentee profits (incentives to innovate) and static deadweight loss: to give the patentee higher profits, we have to lengthen the patent term, which increases the duration of the patentee's monopoly power and attendant distortionary pricing. As illustrated, however, the existence of leveraged patents pushes out the "welfare possibility frontier," making possible a range of new alternatives, all of which have *both* larger incentives to innovate and smaller deadweight loss than a standard patent. Hence, any point in the area formed by ABC represents an unambiguous welfare improvement over the initial point A (which represents a non-leveraged 20-year patent). For example, a 21.5 year leveraged patent has the same deadweight loss as a 20-year standard patent, but higher patentee profits. An 18-year leveraged patent has the same incentives to innovate as a 20 year standard patent, but smaller deadweight loss.




"Welfare Possibility Frontiers" for Patents
With & Without Leverage

Table 4 provides a numerical example. It shows that as compared with a conventional 20-year patent, a leveraged patent of the same length generates 2.8% higher profits and 9.4% less deadweight loss in net present value terms. To reduce static inefficiencies while maintaining the original level of profitability, policymakers could cut the patent length to roughly18 years, diminishing deadweight loss by almost 13% while keeping the patentee's profits the same.

Alternatively, to raise incentives to innovate with no increase in static inefficiency, the patent term could be extended to approximately 21.5 years, increasing incentives to invest in R&D by 10.7%, while leaving deadweight loss slightly below that of a conventional patent. There is such a thing as a free lunch!

Table 4: *Innovation Incentive and Deadweight Loss Under Conventional & Leveraged Patents, for Alternative Patent Lengths*[a]

| | Conventional Patent | Leveraged Patent | | |
|---|---|---|---|---|
| Term | 20 years | 20 years | 18 years | 21.5 years |
| NPV Patentee's Profits | 21,284 | 21,878 | **21,275** | 24,505 |
| Percent Increase vs. Col. 1 | — | 2.8 | **0.0** | 10.7 |
| NPV Deadweight Loss | 10,642 | 9,647 | 9,275 | **10,452** |
| Percent *De*crease vs. Col. 1 | — | 9.4 | 12.8 | **0.02** |

[a]Based on Appendix, assuming myopic consumers and parameter values a = 100, b = 1, S = 10, r = 0.1.

## C. Tailoring & Defaults

An obvious problem with the foregoing analysis is that it assumes that policymakers can determine which patents are subject to trademark leverage and can tailor their responses accordingly. In reality policymakers may often be unable to do so. The state of current theorizing in this area is very unsatisfactory, and as our earlier

discussion makes clear,[137] we lack the ability to make accurate predictions about when brand loyalty, and hence trademark leverage, are likely to be important. One should be wary of any theoretical improvement that requires superhuman policymakers or unfeasible information in order to make it implementable.

This does not mean that our findings are of no policy relevance, however. We suggest that informational constraints can be to some extent be overcome by allowing patentees to tailor their own patent/trademark protection from a menu proposed by regulators. Technically, we propose a separating equilibrium, in which policy-makers can induce patentees to behave optimally even when patentees have private information (about the extent of leverage) which regulators don't know.[138]

For example, suppose that policy makers determined that they wanted to reduce deadweight loss below that contemplated under current patent law (for non-leveraged patents), and were happy to keep patentee's incentives to innovate at current levels. They could then offer patentees a choice between a patent lasting 20 years with no trademark leverage, and a leveraged patent of 18 years. As Table 4 demonstrates, these two schemes produce the same profits for the patentee when leverage is possible. And for those cases in which patentees recognize that they are not in a position to exploit leverage,[139] they will simply choose the standard patent term (with no trademark protection, which would be valueless to them in any case). A comparison of Columns 1 and 3 in Table 4 reveals that this "tailoring" approach guarantees all patentees will have at least the level of protection contemplated by Congress (compare column 1, row 2 with column 3, row 2). For those patentees who will exploit trademark leverage, deadweight loss is reduced by almost 13 percent vis-a-vis conventional patents. Policy-

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[137] See text accompanying Table 1.

[138] Michael Rotschild and Joseph Stiglitz, *Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information*, 90 Q.J. ECON. 629 (1976) were the first to describe an equilibrium in which one party (the insurer) induces separation between two unknown types (of insureds) by offering a menu of contracts that lead each type to choose a different contract. Ian Ayres & Robert Gertner, *Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules*, 99 YALE L.J. 87 (1989) introduced these ideas of pooling and separating equilibria into legal theory.

[139] As we explained earlier, section II.B, not all products are equally "leverageable." Presumably, patentees have better information than regulators about whether they plan to exploit brand loyalty in marketing their patented innovation, and if so, how much.

makers do not have to know whether patentees plan to exploit trademark leverage or not: by offering a menu of choices, patentees can be induced to select the option that reduces deadweight loss by as much as possible without sacrificing incentives to innovate.

There are two problems with this approach that must be noted. First, although policy makers do not need to know which firms or industries will exploit trademark leverage and which will not, they *do* need to know the relevant parameter values underlying the patentee's decision problem, including the size of switching costs, interest rates, and the slope of the demand curve. This information is important because it determines the profitability of the leveraged patent, and hence sets the patent term that provides equivalent profits to a 20 year term with no leverage.

This problem is not as serious as it first seems, however. Suppose policy makers were completely ignorant of the underlying parameters, and offered patentees a choice between 19 years of patent protection with trademark protection on expiration or the 20 years with no trademark protection. Some patentees who select the first option would have been willing to give up an additional year of protection (as illustrated by Table 4), so the policy does not achieve the minimum feasible deadweight loss. Nevertheless, it still reduces deadweight loss as compared with the status quo, and hence represents an unambiguous improvement.[140]

A more significant difficulty is that the menu approach only works in one direction. Suppose that policy makers wished to provide *more* incentives to innovate than currently contemplated under a non-leveraged 20 year patent. Table 4 reveals that with leverage, patent terms could be extended to 21.5 years without increasing deadweight loss over a 20 year conventional patent. This would have the effect of increasing patentee profits by almost 11 percent, as in column 4. However, there is no way to offer this option only to those firms that wish to exploit trademark leverage: all firms will prefer a 21.5 year patent to a 20 year patent, *regardless of whether they will utilize trademark leverage or not*. But if the patentee does not utilize leverage (cut prices while the patent

[140] A similar argument can be made in reverse–if policy makers set the leverage-inclusive patent term "too low," no firms will prefer this alternative to the status quo. But this simply leaves us where we started, and does no harm.

is in effect), then the longer patent term unambiguously *increases* deadweight loss.[141]

## VI. OBJECTIONS AND ADDITIONAL FACTORS

In this section, we discuss three additional factors that might complicate the story we want to tell about the importance of trademark leverage and brand loyalty as a supplement to patent protection. Does it matter that firms can seek to develop brand loyalty by advertising rather than by expanding output during the patent period? How does the introduction of discounting and multiple periods affect our results? And finally, is our model vulnerable to the empirical finding that, at least for certain pharmaceuticals, prices are observed to rise–rather than fall–on the expiration of the patent?

### A. Advertising

In the real world, patentees always have the option of trying to build brand loyalty by advertising as well as, or instead of, by cutting prices and developing a base of experienced users. How does the possibility of advertising affect our conclusions?

One possibility is that advertising could substitute for greater output as a method of creating brand-loyalty: if patent-holders respond to the possibility of trademark leverage by attempting to create loyalty through increased advertising, rather than through increased sales, then the efficiency gains we described earlier may not be realized.[142] While this is certainly a possibility, we argue that neither the theory nor the empirical evidence support this view.

We turn first to considerations of theory. In a classic article written nearly fifty years ago, Dorfman and Steiner devised a simple

[141] Trademark leverage is thus like a string–it can be used to pull patentees in one direction (same profits but lower deadweight loss), but not to push them in the other (higher profits, same deadweight loss).

[142] On the basis of their asymmetric information model of consumer search costs, Moshkin and Shachar, *supra* n. 87 at 8, suggest that the growth in the total volume of products available increases "individuals' ignorance of the attributes of the alternative [products they do not consume]. The increase in ignorance is the asset of the large and established firms. Advertising rather than price cuts are the penetration tool of new firms and those which are growth oriented." These broad conclusions lack empirical support, however.

formula for the optimal ratio of advertising expenditures to total sales of a product.[143] Their equation says that the optimal advertising/sales ratio is

$$" = -0_a/0_p,$$

where $0_a$ is the elasticity of quantity sold with respect to advertising and $0_p$ is the conventional price elasticity of demand.[144] To see the intuition for this result, imagine that the firm can increase its quantity sold by one unit by means of either a $x increase in advertising or a $z drop in price. A profit maximizing firm will want the incremental *profit* from either course of action to be the same. The more effective is advertising (greater the demand shift per dollar spent) and the less effective is cutting prices (smaller the movement along the demand curve per dollar drop in price), the better the advertising looks relative to cutting prices.

To apply the Dorfman/Steiner insight in our context, we begin by noting that the case for trademark leverage is strongest for experience goods, which, as we defined them earlier, are products whose attributes cannot be appreciated except through actual consumption. But the more a product resembles an experience good, the less-likely it would be that advertising could substitute for actual use of the product in creating new demand. In the Dorfman/Steiner terminology, $0_a$–the efficacy of advertising–should be low for experience goods. It follows that patentees would be more likely to develop brand loyalty by inducing additional use (increasing quantity and decreasing price), rather than by expanding advertising.[145]

Moreover, we would expect to see more price-cutting and less advertising for those products where leverage is strongest. Even if we assume that leverage has no effect on the *efficacy* of advertising, the fact of leverage increases the long run price elasticity of demand. That is, a

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[143] Robert Dorfman and Peter O. Steiner, *Optimal Advertising and Optimal Quality*, 44 AMER. ECON. REV. 826 (1954).

[144] Technically, $0_a$ is the percent change in quantity demanded from a 1 percent increase in advertising, while $0_p$ is the percent change in quantity demanded from a 1 percent *de*crease in price.

[145] The pioneering work of Philip Nelson, *supra* n. 42, demonstrates that advertising may be a credible signal of product quality, even for "experience goods" for which important qualities are discernable only by direct consumption of the good. The reason is that advertising expenditures are a credible signal of product quality because they are only profitable if the firm is in business for the long term, and not a fly-by-night operation.

given drop in price has a bigger effect on total quantity demanded over the two periods with leverage than without it. Hence, not only does leverage make the numerator of the Dorfman/Steiner ratio smaller, it plausibly makes the denominator larger.

In sum, patentees should engage in less advertising per dollar of sales with leverage than without it. Regardless of whether advertising enhances or reduces welfare, the effects of leverage–the fact that selling more now allows for more sales later as well–will other things equal tend to reduce advertising. All this does not say that the patentee will engage in *no* advertising. It merely suggests that advertising will not be an attractive substitute for cutting prices in the case most important to our argument.

There is not much empirical evidence on the relationship between patents and advertising. However, one recent and extremely careful study by Berndt *et al* looked at marketing expenditures for patented drugs as the patent lapsed and the products were reintroduced as over-the-counter medicines. They find that marketing declined substantially as patent expiration neared. (The decline was even more pronounced with the onset of generic competition after the patent ended.) This is precisely the time when patentee will be increasing output and lowering price to generate new customers and brand loyalty.[146] Hence, the empirical evidence is at least consistent with our prediction that leverage leads to less advertising, rather than more.

Surveying a variety of studies, Robinson *et al* support this conclusion, noting that "industry studies and cross-sectional evidence consistently show that market pioneers spend less as a percentage of sales on advertising and promotion."[147]

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[146] Ernst R. Berndt, Davina Ling and Margaret K. Kyle, *The Long Shadow of Patent Expiration: Do RX to OTC Switches Provide an Afterlife?* (MIT working paper, 2000) at Table 1, p. 20. For Tagamet, the authors found that total marketing expenses as a percent of sales fell by 43% as patent expiration approached and by an additional 30% following expiration. ("Total" here means pages of journal advertising plus number of sales visits to doctors). For Zantac, the figures are 59.8% as the patent neared expiration, with an additional 73% after expiration.

[147] William T. Robinson, Gurumurthy Kalyanaram and Glen L. Urban, *First-Mover Advantages from Pioneering New Markets: A Survey of Empirical Evidence*, 9 REV. OF INDUSTRIAL ORG. 1, 18 (1994).

## B. Discounting & Dynamic Issues

Our simple model has only a single period in which the patent is in effect, followed by a single period when the product is protected, if at all, only by its trademark and brand loyalty. This section demonstrates the conditions under which our conclusions are sensitive to this assumption. A more complex model–in which patent protection lasts for 20 years and is followed by trademark protection extending into the infinite future–does not alter the results as long as consumers have a short time horizon or do not anticipate the future. When consumers are infinitely-lived and forward-looking, however, the patentee's price can not deviate much from the competitive level, since consumers will willingly incur a switching cost to "buy" the opportunity to purchase at the competitive price for the infinite future unless the savings from doing so are very small. Hence, brand loyalty essentially vanishes, and our story about building brand loyalty by increasing output is no longer as plausible.[148]

The more elaborate model generates two important conclusions. First, the trademark-leveraged patentee will always produce more than the "pure" patentee (i.e., one who generates no brand loyalty or has no trademark protection) in every period before the patent expires. And second, the leveraged patentee's optimal output rises over time during the patent period, with the bulk of the increase as the patent nears expiration; output then drops once the patent expires.

We summarize these conclusions in Figure 1, which graphs optimal output, assuming that leverage is possible and that the amount of brand loyalty depends on the average volume of consumers served

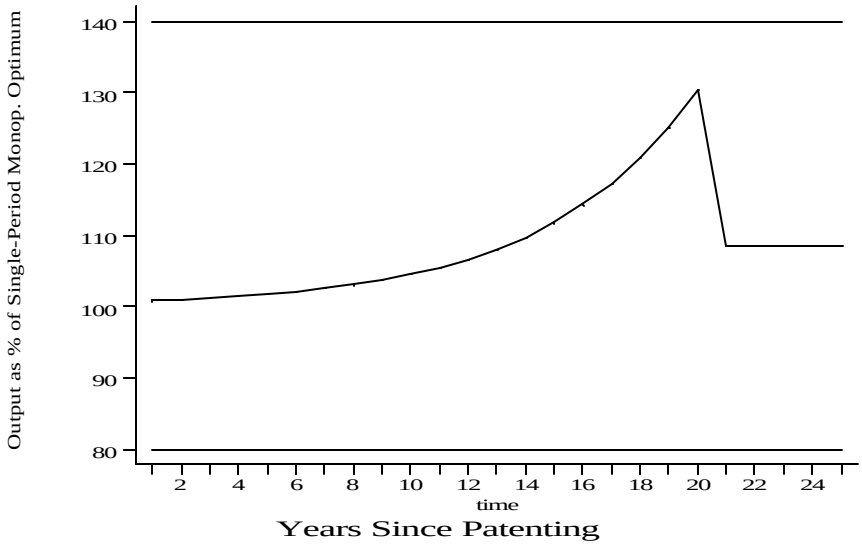
[148] We formalize this insight in the appendix, and demonstrate that there will still be a small brand-loyalty effect even in this case. Note that this problem is common to "rational expectations" type critiques of models with myopic behavior. It has the potential to occur in almost every model of switching costs, although it does not appear to have received much attention because most such models use only two periods.

Brand loyalty is both intuitively plausible and one of the best-documented facts in the marketing literature. I.P.L. P'ng & Reitman, *Why Are Some Products Branded and Others Not?*, 38 J. LAW & ECON. 207 (1995); Kotler, *supra* n. 83. If it turns out to be incompatible with the assumption of perfect foresight, so much the worse for that assumption.

during the patent period.[149] It shows that the patentee's optimal output in the first year of the patent is infinitesimally above the single-period monopoly level. As expiration approaches, however, output rises to more than 30 percent above the single-period monopoly level, then falling back substantially once the patent expires. Our theory is thus at least roughly consistent with the dynamics discussed in the case studies, in which patentees seem to reserve the bulk of their price-cutting and attempts to build market-share for the patent's twilight years.

[149] Technical details are explained in the appendix. The demand curve is assumed to be linear with parameters a = 100 and b = 1. The switching cost is 10, and the interest rate is 10 percent. We assume that consumers look only at the current period, rather than predicting their own future behavior (myopia).

Figure 1: *Patentee's Optimal Output Over Time Given Trademark Leverage, as Percent of Single-Period Monopoly Optimum*




C. Prices *Rise* on Expiration of the Patent?

Some theories predict that the price of a patented product will not fall, and may in fact rise, in response to the entry of generic competition, when the market is divisible into brand-loyal and price-sensitive consumers.[150] Moreover, there is empirical evidence that this happens, at least in some instances.[151] Is this a problem for our theory?

We start by noting that pricing in period 2 has no efficiency consequences in our model: as long as there are firms entering at the competitive price, then every consumer who should be served in the

[150] Richard G. Frank and David S. Salkever, *Pricing, Patent Loss and the Market for Pharmaceuticals*, 59 Southern Economic Journal 165 (1992). Richard G. Frank and David S. Salkever, *Generic Entry and the Pricing of Pharmaceuticals* 6 Journal of Economics and Management Strategy 75 (1997).

[151] Ernst R. Berndt, Davina Ling and Margaret K. Kyle, *The Long Shadow of Patent Expiration: Do RX to OTC Switches Provide an Afterlife?* (MIT working paper, 2000) at 23 find that "[N]either Tagamet Rx nor Zantac Rx adopted a policy of competing with generics on price following patent expiration, and instead increased prices. As a consequence, they lost very substantial market share, but retained sales to a small, relatively price-insensitive segment of brand-loyal consumers." Frank and Salkever present further empirical evidence of this behavior.

second period will be. True, some will pay more for the product than they could if they bought from the entrants at the competitive price, and this price discrimination does of course have distributional consequences which we might care about independently. However, there are no distortions to worry about in the post-patent period, and the fact that the incumbent firm charges a higher price to its brand-loyal customers is not, per se, an efficiency problem.[152]

We do, however, care about leverage–that is, whether the possibility of retaining some customers in period 2 induces the patentee to raise output and lower prices in period 1. Is the *raising* of prices in period 2 (focusing only on brand-loyal customers) inconsistent with our prediction that the patent-holder will increase output in period 1 in order to create additional loyal users?

Although our model predicts that the patentee's price for the branded product will fall, rather than rise, when facing generic competition, the answer to this question is "No."

We need to complicate our story by taking acount of heterogeneous brand loyalty, for example, by allowing for randomly distributed switching costs in period 2 among those who bought the product in period 1.[153] It still makes sense for the patentee to expand sales in period 1 in the hopes of landing someone with a (randomly) high switching cost, someone who can then be kept in period 2, even at a price that is much higher than the generic substitute. If only a small fraction of the population has high switching costs, it may make sense to charge 10% of the people a high price, abandoning the other consumers to generic competition, rather than charging, say, 30% of the consumers a lower price.

In sum, the fact that some sellers *raise*, rather than lower, prices on expiration of their patents does not reverse any of the conclusions of our model. Of course, the extent of leverage is still an empirical question, but the existence of leverage is not at all incompatible with an

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[152] Michael Pereira pointed out to us that there are further distributional problems that might arise if, for example, low-income or poorly-informed consumers remain loyal to the patentee's brand purely because they lack information about the existence or comparability of the generic substitute.

[153] For a model of this type, see Jean Gabszewicz, Lynne Pepall, and Jacques-Francois Thisse, *Sequential Entry with Brand Loyalty Caused by Consumer Learning-by-Using*, 40 J. INDUSTRIAL ECON. 397 (1992).

upward rather than a downward movement of price once the patent expires.

## D. Alternative Proposals

A final objection one might raise is that there are alternative mechanisms for reducing the deadweight loss associated with patent grants. The two competing proposals are Tandon's model of patents with optimal compulsory licensing,[154] and Ayres and Klemperer's model of probabilistic enforcement.[155] Essentially, both of these proposals are predicated on the same principle: reducing the patentee's protection while extending the patent term. While consideration of these competing proposals is certainly illuminating, it bears emphasis that neither of them concerns the problem we analyze, the interaction between different modes of intellectual property protection. Thus, neither Tandon's nor Ayres and Klemperer's proposal present a real challenge to our findings.[156] Furthermore, the competing models are completely theoretic, whereas leveraged patents are a real world phenomenon. Notwithstanding these key differences, we will show that insofar as reducing the deadweight loss associated with patent protection is concerned, leveraged patents have both important theoretic and practical advantages over both compulsory licensing and probabilistic enforcement.

### 1. Compulsory Licensing

In an important theoretical article, Tandon suggested an ideal patent system with optimal royalty rates—ones that "*optimally* trade off the negative incentive effects of licensing with the positive consumer price effects"[157]—and an infinite patent life. Tandon's basic insight is that society would maximize the gains from patent protection by

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[154] See Pankaj Tandon, *Optimal Patents with Compulsory Licensing*, 90 J. POL. ECON. 470 (1982).

[155] See Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 MICH. L. REV. 985 (1999).

[156] To a degree, our proposal is compatible with either of them, since we one could imagine, for example, leveraged probabilistic patents, or leveraged patents with compulsory licensing.

[157] Tandon, *supra* note 154, at 471.

subjecting all patents to compulsory licensing and simultaneously lengthening the life of patents. The compulsory rates force the patentees not to price monopolistically, while the longer protection term preserves the incentive to invest in R&D. The lion's share of the gains comes from the reduction in the deadweight loss engendered by patents; a considerably smaller improvement results from extending the protection term.

Leveraged patents have several advantages over compulsory licensing. First, Tandon's apparatus critically depends on the setting of optimal compulsory license rates, presumably by the court or Congress. This task, however, is well beyond the ability of most judges or lawmakers. In fact, courts and Congress face tremendous difficulties deciding *reasonable* royalty rates in intellectual property cases.[158] These difficulties stem from the uniqueness of intellectual goods, and from the risk element inherent in the inventive process. The royalty rate must adequately compensate the patentee not only for the cost of producing the patented invention, but also for the cost of the many research projects that have failed to yield a patentable result. Setting the royalty rate too low would have a chilling effect on innovation; setting it too high would reintroduce the problem of deadweight loss, and might even aggravate it. As Tandon succinctly cautions "[f]urther work is needed to suggest practical approaches to realizing the potential welfare gains which have been discussed."[159] An important advantage of our self-selection scheme lies in its simplicity. Leveraged patents do not require any complicated determinations. Moreover, because the patentee decides whether to leverage, leverage patents are certain not to harm the incentive to innovate.

Second, Tandon's compulsory licensing scheme presumably requires the setting of license rates for every patent issued by the patent office, or at least for any patent for which there is a potential licensee. This process is both expensive and wasteful. It requires either a judicial or an administrative determination of a "price" for an enormous number of inventions, many of which turn out to be of negligible social value.

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[158] See Robert P. Merges, *Contracting Into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1299 (1996) (identifying problems of a compulsory licensing scheme including wasted lobbying costs, changed conditions, and the potential for legislative "lock-in" rendering the royalty schedule inflexible over time).

[159] Tandon, at 484.

Leveraged patents are self-effecting. Not only does our scheme not require an expensive price setting mechanism, but it also adopts an ex post approach to the problem, ensuring that only patents of sufficient social value will continue to enjoy legal protection.

Finally, and most obviously, Tandon's proposal requires a legislative overhaul of the patent system. Currently, patents are not subject to compulsory licenses. Given the recent trend to expand and solidify intellectual property protection, the introduction of comprehensive compulsory licensing is unlikely. Leveraged patents, by contrast, are an existing phenomenon, and barring a significant legal change, they are here to stay.

### 2. Probabilistic Enforcement

A different mechanism for reducing the deadweight loss of patents has been proposed by Ayres and Klemperer. Eschewing the drawbacks of compulsory licensing, Ayres and Klemperer's proposal rests on the dual principles of uncertainty and delay. Specifically, Ayres and Klemperer proposed that patentees be allowed to bring lawsuits against infringers only at the end of the patent term, which would limit the remedy to monetary damages. Even then, however, patentees would not be able to collect the full damage they suffered, but rather a fraction of that amount to be determined probabilistically. As Ayres and Klemperer explain, under their proposed regime, the patentee of a true innovation--that is, an innovation deserving immediate and certain enforcement under current law--would have to wait until the day the patent expired to learn if a court would award damages for any past infringement; and the court would make this determination simply by flipping a weighted coin with, say, only an 80% chance of enforcement.[160]

The aim of the partial enforcement is to encourage a certain level of patent infringement. The infringing production would "expand industry output and decrease the market price,"[161] and thus, reduce the deadweight loss generated by patents. To compensate patentees for the drop in their returns, Ayres and Klemperer proposed that patent duration be extended. They noted that the necessary extension may be

[160] Ayres & Klemperer, at 995.
[161] Id. at 993.

approximated by "multiplying the duration by the reciprocal of the probability of enforcement."[162] For example, if the probability of enforcement is 50 percent, the duration should be increased by 200 percent.[163]

Leveraged patents are superior to probabilistic enforcement on several grounds. First, the delay and uncertainty Ayres and Klemperer seek to introduce might not only increase the likelihood that valid patents will not be enforced, but also that invalid patents will be. Indeed, the passage of time might reinforce the tendency of the courts to uphold questionable patents,[164] especially those that achieved commercial success.[165] Leveraged patents do not give rise to this risk. Second, Ayres and Klemperer seek to increase production of patented inventions by encouraging infringements. The downside of this mechanism is the notoriously high cost of patent litigation.[166] As Ayres and Klemperer

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[162] Id. at 1009.

[163] Id at 1009.

[164] Id. at 1020 (noting the Federal Circuit's "protection of patent qua property becomes an end in itself, trumping all other conceptions of the good."). This problem is compounded by the inherent incentive of patent examiners to approve application. See Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577 (1999).

[165] See Robert P. Merges, *Commercial Success and Patent Standards: Economic Perpectives on Innovation*, 76 CAL. L. REV. 803, 816 (1988) (noting that today, nonintrinsic evidence–referred to as the "secondary" or "objective" considerations–occupies an increasingly important place in nonobviousness determinations; the most important secondary consideration is the commercial success of the invention; see also Harris, *Apparent Federal Circuit Standards for Weighing Nonobviousness Argument that Prior Art Reference Teaches Away from Present Invention*, 70 J. PAT. & TRADEMARK OFF. SOC'Y 79 (1988).

[166] See *United States: Deciding When And How To Enforce Your Patent*, MONDAQ BUSINESS BRIEFING, Jan. 12, 2001 [2001 WL 8986875] ("Prospective counsel will generally request anywhere from one-third to one-half of the total recovery. Unless this number is a multiple of the typical $1.5 million litigation cost, in all likelihood he will not be interested. Simple arithmetic gives us $15 million in damages as a minimum threshold to arouse the curiosity of the potential counsel to continue to listen to the rest of your story. Practically speaking, however, most counsel will not consider a case where potential damages are less than $100 million. This amount of damages corresponds roughly to a half billion dollars in annual infringing revenues."). The situation may be even worse in the United Kingdom. See, e.g., Rosemary Bennett & Jean Eaglesham, *Legislation to Mandate Greater Damages for Patent Breaches*, FINANCIAL TIMES, Nov. 1, 2001 (reporting that the "UK is known to offer a difficult combination of high costs and relatively low damages for people trying to defend patent

admit "[s]ome forms of uncertainty and delay would undoubtedly lead to litigation costs that swamp the benefits of limited interim infringement."[167] Leveraged patents, by contrast, do not exacerbate litigation costs; they do not even necessitate judicial intervention. Third, Ayres and Klemperer rely on the average depreciation rates of patents from various industries in setting enforcement rates. This means that some individual inventors would be undercompensated by the judicial determination, while others would be overcompensated. Thus, Ayres and Klemperer manage to preserve the incentive to innovate only on average, but not in each individual case. Our proposal avoids this problem.

Finally, as is the case with Tandon's proposal, Ayres and Klemperer's require a comprehensive reform of the patent system. To work effectively, Ayres and Klemperer's proposal requires sweeping changes not only in patent remedies, but also in litigation processes. Such changes are highly unlikely. Leveraged patents are possible under the existing patent system, and firms have been taking advantage of this possibility.

Conclusion

In this Article, we have sought to fill a curious gap between intellectual property theory and practice. The theory consistently treats patents, copyrights and trademarks as separate forms of protection, each independent of the others. By contrast, real world businesses have long combined different modalities to increase their competitive advantage over rivals. While the discrete analysis has shed light on each of the subfields of intellectual property, it has obfuscated the important interconnections among them, and obscured the efficiency effects thereof. By adopting a unified perspective, we have been able to show that certain combinations of intellectual property protection give rise to important synergies, and thereby enhance economic efficiency. Specifically, we have demonstrated that the availability of subsequent trademark protection mitigates the proclivity of both patentees and trade secret holders to price monopolistically.

Our analysis of the synergistic effects among various modes of intellectual property has yielded important descriptive, normative, and

rights," and giving the example of James Dyson, is estimated to have spent more than $3 million on patent litigation against Hoover over his Dyson vacuum cleaners").

[167] Ayres and Klemperer at 1014. To avoid this problem, Ayres and Klemperer call for a reform in the patent system.

methodological implications. Descriptively, we have shown that the deadweight loss of patent and trade secrecy protection is lower than is commonly believed, and that the incentives to innovate are higher. Normatively, we have called for a reversal of the prevailing judicial hostility to leveraged patents, and explained how the law can take advantage of leveraged patents to improve the tradeoff between dynamic and static efficiencies in innovation policy. Most importantly perhaps, methodologically, we have demonstrated the need for an integrated analysis of intellectual property. When synergies exist, exclusive focus on the parts often leads to a distorted perception of the whole. And while there are many obvious differences between the study of intellectual property and an elephant parable, they do share a common moral: both point to the importance of an integrated analysis.

## APPENDIX: A DYNAMIC PRICING MODEL

Our simple model had only a single period in which the patent is effect, followed by a single period when the product was protected only by its trademark and brand loyalty. This section demonstrates that our conclusions are largely insensitive to this assumption. A more complex model–in which patent protection lasts for 20 years and is followed by trademark protection extending into the indefinite future–does not alter the results, as long as consumers have a short time horizon or do not anticipate the future.[168] Moreover, the dynamic model yields a result that is supported by the case studies we discussed earlier: patentees seeking to build brand loyalty will not increase output and cut prices uniformly over the patent period. Instead, they will cut output more heavily as the patent nears expiration.

Understanding the dynamics of brand loyalty and patent pricing requires a brief discussion about how brand loyalty is generated and maintained over time.[169] While there are many plausible formulations, we adopt a simple specification, in which the post-patent switching cost is a one-shot amount that is fixed for all consumers for all time; the number of consumers with switching costs depends on the *average* number served by the patentee over the 20 periods during which the patent is in effect. This formulation implies that the patentee can allocate

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[168] If consumers are infinitely-lived and forward-looking, however, the patentee's price can not deviate much from the competitive level, since consumers will willingly incur a switching cost to 'buy' the opportunity to purchase at the competitive price for the infinite future unless the savings from doing so are very small. Hence, brand loyalty essentially vanishes, and our story about building brand loyalty by increasing the stock of 'experienced users' is no longer as plausible.

There will still be a small brand-loyalty effect even in this case, but a common problem of brand loyalty stories of any kind is that they are not truly compatible with "rational expectations" on the part of consumers.

[169] Various alternatives seem behaviorally plausible, including:

1. The *size* of an individual customer's switching cost, $S_i$, is a positive function of the number of purchases made by that customer during the patent period;

2. The *duration* of the customer's switching cost–defined as the number of purchases of the rival product that the customer must make before switching costs are eliminated–is a positive function of the number of purchases during the patent period;

3. Either the size or duration of post-patent brand loyalty (or both) depend on both the *number* of previous purchases and their *timing*. For example, suppose–as might be reasonable–that brand loyalty decays over time. A customer whose only purchase was in period 1 would then have a lower switching cost than one whose only purchase was in period 20, immediately before the patent expired.

its output over the 20-year patent period in any way it wishes, but it is only the total output over the period as a whole that determines its loyal customer base after the patent expires.[170]

As is traditional in these situations, we solve the model by working backwards. That is, we first describe what price the (former) patentee can charge its stock of loyal customers once the patent has expired, assuming that the *number* of loyal customers is fixed and the patentee can only change the price it charges. We then use this information on optimal pricing in the post-patent period to solve for the optimal quantity of loyal customers created while the patent is in effect; simultaneously, we show how the patentee will allocate its output over the 20-year patent life in order to achieve this optimal quantity.

Post-Expiration Dynamics

Since we are now dealing explicitly with time, some additional notation is necessary. We denote by $r$ the annual interest rate, and by * the discount factor, which is simply $1/(1+r)$. We let $P_{p,t}$ denote the price charged by the (former) patentee in period $t$, and $P_c$ the competitive price.

If we allow for an infinitely-lived consumer and an indefinite trademark duration, the patentee's customers face a whole series of "consumption plans" once the patent expires in period 21. The first alternative is to buy from the competitor immediately, paying price $P_c$, plus switching cost $S$, this period. Since the switching cost is modeled as a one-time only payment, once a loyal consumer has tried the generic product, she can continue to purchase it at its quoted price, $P_c$, forever after. A second consumption plan would be to buy from the patentee at the price being charged this period ($P_{p,21}$) and switch to the competitor (at price $P_c + S$) *next* period, paying $P_c$ forever after. A third would be to buy from the patentee for *two* periods and then switch; and so on. Knowing this, the patentee must set current and future prices so that its loyal customers are just indifferent between switching and remaining loyal in each period, including the current one. In other words, the customer must expect to pay the same amount in present value whether she switches today, tomorrow, or not at all.

[170] In other words, producing 50 units each year for twenty years yields the same number of loyal customers as producing 25 units for the first 10 years and 75 units for the second 10 years of the patent's life.

Note, too, that the present value of $P_c$ each period from time t until infinity is just $P_c/r$.[171] This amount has to be discounted even *further*, however, to reflect the fact that the customer doesn't begin paying $P_c$ immediately, but instead must first pay $P_c + S$ and then wait at one period before being able to buy without any switching cost.[172] All this means that the consumer faces a choice between:

Switch Immediately: $(P_c + S) + {}^*P_c/r$, vs

Switch Next Period: $P_{p,\,21} + {}^*(P_c + S) + {}^{*2}P_c/r$, vs

Switch in 2 Periods: $P_{p,\,21} + {}^*P_{p,\,22} + {}^{*2}(P_c + S) + {}^{*3}P_c/r$, and so on.

The former patentee will choose the maximum possible $P_{p,\,t}$ at each point in time–the value that keeps the consumer just indifferent between buying from it and switching to the competitor. Hence, setting the first equation equal to the second and solving, we have:

$P_{p,\,21}$ . $(1-{}^*)S + {}^*P_c$.[173]

Given $P_{p,\,21}$, we can then solve for the patentee's price in the second period, $P_{p,\,22}$ by equating setting the second equation equal to the third. Again the result is that $P_{p,\,22}$ . $(1-{}^*)S + {}^*P_c = P_{p,\,21}$. In short, the patentee's price does not change over time. This price is just sufficient to make the patentee's prior customers indifferent between switching and remaining loyal in each period: the present discounted value of the consumption plan is the same whether the customer switches in period 1, 2, 3, ... or not at all.

Note that the analysis so far has assumed that the patentee's consumers have perfect foresight, at least once the patent has lapsed. That is, they compare today's switching cost with the benefit of being able to buy from the lower-priced competitor *for the rest of time*. This naturally limits the patentee's ability to markup her product over that of

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[171] How much would one have to put into a bank account to yield $P_c$ each year forever? A deposit of $P_c$ yields $P_c \times r$ per year in interest when the interest rate is $r$. Hence, a deposit of $P_c/r$ will pay $P_c$ in interest, which can be removed each year in perpetuity without touching the principal.

[172] To solve for the time path of the patentee's post-expiration price, we assume that there is a a fixed stock of infinitely-lived 'experienced' customers, each of whom has a constant switching cost, S. Hence, the demand curve is no longer relevant and the problem is one of choosing price, rather than quantity. We solve for the optimal stock of consumers below.

[173] Technically, $P_{p,\,21} = (1-{}^*)S + P_c[1 - {}^* + ({}^* - {}^{*2})/r]$, which is approximately $(1-{}^*)S + {}^*P_c$ for small values of the interest rate $r$.

her rivals–the limit is not the switching cost per se, but rather the present discounted value of the savings from switching to the cheaper generic product. Given that the consumer's switching cost only has to be paid once, that cost will obviously be less important the greater the number of additional purchases the consumer plans to make, since the same switching cost is amortized over a larger number of future purchases.[174] What this means, in short, is that the switching cost story breaks down almost completely if consumers have infinitely long time horizons. This in turn implies that patentees will not have any reason to cultivate brand loyalty while the patent is in effect, since the post-expiration return from doing so is only a tiny fraction of the switching cost instead of the full switching cost.

Instead of assuming that consumers compare the current switching cost with the present discounted value of their future savings from switching, however, we might plausibly make the opposite assumption that consumers are myopic.[175] In this case, the patentee's maximum post-expiration price would rise to $S + P_c$, reflecting the *full* value of the switching cost.

In sum, brand loyalty is only significant in an infinite-horizon model if we assume that consumers are not forward-looking.

Pre-expiration dynamics

Knowing that the post-expiration price will be $(1 - *)S + *P_c$ in each period, the patentee will be in position to plot her optimal quantity during the patent period. There are, however, two additional complications. First, the future revenue stream of $(1 - *)S + *P_c$ each period from the expiration of the patent onwards must be discounted to its present value *as of period 21*. This involves dividing by the interest rate, $r$, to capture the infinite nature of the revenue stream.[176]

Second, an increase in period-$t$ output will have a different effect on the present value of future profits depending on when it occurs. Define $\boldsymbol{Q} = (1/20)\sum_{t=1}^{20} Q_t$, i.e., average output over the 20 year patent

[174] For an interest rate of 5 percent, this means that the patentee can charge no more than approximately $0.05S + .95P_c$. In other words, the switching cost loses 95 percent of its "frictional" value when consumers are infintely-lived and forward looking.

[175] This is a standard assumption in the switching cost literature. See, e.g., Paul Klemperer or Jean Gabszewicz et al, *supra* n. 64.

[176] See *supra* n. 171.

life. An increase of one unit in any period will raise ***Q*** by 1/20 of a unit, but its *discounted* effect on post-expiration profits depends on when during the 20 years the increase occurs. Starting from the monopoly optimum, a one-unit increase in period 20 output lowers profits in period 20, but raises profits the next period, after the patent lapses by adding to 1/20 of a unit to the stock of loyal customers. By contrast, an increase in period 1 output lowers profits immediately but doesn't raise profits until the patent expires, 20 years hence. Thus, we must discount future profits caused by a period-t increase in output by $*^{21-t}$ to bring this future revenue stream to its period-$t$ value (and then further discount to bring this stream to its period 0 value).

Hence, the patentee's full problem is:

$$\underset{Q_t}{Max}\,\Pi = \sum_{t=1}^{21} (a - bQ_t)Q_t d^t + \left(\frac{Q_t}{20}\right)\left(\frac{d\,P_c + (1-d)S}{r}\right) d^{21-t}$$

which is solved by setting

$$\frac{\P\ \Pi}{\P\ Q_t} = ad^t - 2bQ_t d^t + \frac{d^{21-t}(d\,P_c + (1-d)\,S)}{20r} = 0.$$

This implies that the optimal quantity at time $t$, $Q_t^*$, solves

$$Q_t^* = \frac{a}{2b} + \frac{\dfrac{{}^{21-t}(d\,P_c + (1-d)S)}{20r}}{2bd^t},$$

where $a$ and $b$ are the intercept and slope parameters from the demand curve, and the other parameters are defined above.

Note that the first term in the expression for $Q_t^*$ is just the single-period monopoly output, $a/2b$, which is not time-dependent. The second term is strictly positive and an increasing function of time, from which we easily conclude:

1. The trademark-leveraged patentee will always produce more than the 'pure' patentee in every period; and

2. Optimal output rises over time during the patent period.

These results are entirely consistent with our two-period model. The chief difference is that if we assume consumers are forward looking in the sense described above, the patentee can only charge $*P_c$ + (1 - *)S, rather than ($P_c$ + $S$), and the leverage effect is correspondingly dimished.

As the figure in the text–which is drawn assuming that consumers are *not* forward-looking–illustrates, optimal output in the first year of the patent's life is only infinitesimally greater than the single-period monopoly level. As expiration approaches, however, output rises to more than 30 percent above the single-period monopoly level. Our story is thus at least roughly consistent with the dynamics of the case studies, in which patentees seem to reserve the bulk of their price-cutting and attempts to build market-share for the patent's twilight years.