

THE SOCIAL COSTS OF TECHNOLOGICAL PROTECTION MEASURES

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I. INTRODUCTION

The anticircumvention rules—which Congress enacted in 1998¹ to bolster the implementation of technological protection measures (TPMs) designed to prevent unauthorized use of copyright-protected materials—have been subjected to unrelenting criticism.² In this Ar-

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1. See 17 U.S.C. § 1201 (2000).

2. The critics are numerous. For a sampling, see June M. Besek, *Anti-Circumvention Laws and Copyright: A Report from the Kernochan Center for Law, Media and the Arts*, 27 COLUM. J.L. & ARTS 385, 467-69 (2004) (listing the main categories of criticisms of the anticircumvention rules); Reto M. Hilty, *Five Lessons About Copyright in the Information Society: Reaction of the Scientific Community to Over-Protection and What Policy Makers Should Learn*, 53 J. COPYRIGHT SOC'Y U.S.A. 103, 113-18 (2006) (criticizing the rules as granting copyright owners too much power, interfering with the free movement of goods, curtailing consumer prerogatives, and so on); Glynn S. Lunney, Jr., *The Death of Copyright: Digital Technology, Private Copying, and the Digital Millennium Copyright Act*, 87 VA. L. REV. 813, 844 (2001) (“[T]he [anticircumvention rules] replace[] the public interest in the creation and dissemination of works of authorship with the private interest of maximizing the revenue of copyright owners.”); Pamela Samuelson, *Intellectual Property and the Digital Economy: Why the Anti-Circumvention Regulations Need to Be Revised*, 14 BERKELEY TECH. L.J. 519 (1999); ELECT. FRONTIER FOUND., UNINTENDED CONSEQUENCES: SEVEN YEARS UNDER THE DMCA 1 (2006), http://www.eff.org/IP/DMCA/DMCA_unintended_v4.pdf (criticizing the rules for interfering with free expression, scientific research, fair use, and competition).

ticle I add another critical voice to the chorus, but from a new perspective. I argue not for modification or elimination of the rules, but rather for complementary legislation that corrects a feature of the rules that has until now been overlooked: implementing the technological protections that the anticircumvention rules promote imposes costs on persons who are not parties to the transactions that give rise to the costs. The fact that these harms are externalized leads to an oversupply of TPMs. Standard economic theory calls for a regulatory response that brings about a reduction in the use of TPMs to an efficient level. My proposal is to implement some such regulatory response.

My argument proceeds as follows. Since my proposal treats creative authorship as a productive activity subject to the usual laws of supply and demand, I begin in Part II by countering the doctrine of copyright exceptionalism—the naïve view that creative authorship, being a public good, is uniquely subject to unauthorized appropriation and therefore *sui generis* in the public policy issues it presents. I do this by showing that virtually all productive activity, not just that associated with creative authorship, is subject to unauthorized appropriation in varying degrees and, therefore, has a public-good aspect. I then make a terminological shift: rather than continuing to refer to the *public-good aspect* of creative authorship, I speak of the *positive externalities* generated by that activity. These two formulations are, as I explain, simply two different ways of characterizing a single phenomenon. Thus, employing the new terminology, I show that nearly all productive activity generates positive externalities.

The advantage of using the rubric of externalities is that it helps us to recognize two parallels that are crucial to my argument. The first is the parallel between the positive externalities generated by creative authorship and those resulting from other types of productive activity. The second is the parallel between the negative externalities resulting from the use of TPMs and the negative externalities arising from other types of productive activity. Recognition of these parallels supports my argument that similar regulatory regimes should be applied to the realms of creative authorship and of productive activity more generally, as far as control of externalities is

Of course, the anticircumvention rules also have their supporters. See BRUCE A. LEHMAN, INFO. INFRASTRUCTURE TASK FORCE, INTELLECTUAL PROPERTY AND THE NATIONAL INFORMATION INFRASTRUCTURE: THE REPORT OF THE WORKING GROUP ON INTELLECTUAL PROPERTY RIGHTS 230 (1995), available at <http://www.uspto.gov/web/offices/com/doc/ipnii/ipnii.pdf> (proposing enactment of anticircumvention rules); Jane C. Ginsburg, *Legal Protection of Technological Measures Protecting Works of Authorship: International Obligations and the US Experience*, 29 COLUM. J.L. & ARTS 11, 12 (2005) (“[L]egal protection for technological measures has helped foster new business models that make works available to the public at a variety of price points and enjoyment options, without engendering the ‘digital lockup’ and other copyright owner abuses that many had feared.”).

concerned. Such regulatory parity is already in effect in the form of legal regimes that allow creative authors and other producers to retain some of what would otherwise be *positive* externalities of their activities—copyright law in the case of the former and patent, trade secrecy, trademark, and contract laws in the case of the latter. My argument is that the same parity should apply in the case of *negative* externalities, implying a regulatory requirement that publishers implementing TPMs internalize the external costs of their use.

In Part III, I demonstrate that publishers' use of TPMs creates several types of negative externalities. Specifically, TPMs bring about a contraction of the public domain, reduce access to creative works through elimination of a market in used copies of those works, and potentially interfere with the working of a competitive marketplace. As with the positive externalities previously discussed, this characteristic of TPMs is shared with a variety of other productive activities that cause harms to third parties. Perhaps the most familiar such harm is pollution. Standard economic theory holds that if these harms are not internalized to the producer, they will be over-supplied—hence the range of regulatory responses to pollution. Applying the same reasoning, I argue that if the externalized harms caused by TPM use are not internalized to the publisher, TPMs will be overproduced—that is, publishers will implement TPMs in a quantity higher than that which optimizes societal welfare.

Thus, in Part IV I argue that there is a need for regulatory action aimed at confronting publishers with the externalized harms resulting from their TPM usage. Drawing from regulatory approaches that are routinely applied to other types of productive activities that create negative externalities, I canvass four possible approaches: traditional command-and-control regulation, reliance upon Coasean bargaining, Pigouvian taxes, and cap-and-trade allowances. The discussion addresses the advantages and disadvantages of each approach and—while recognizing that information shortfalls make any approach experimental at best—recommends implementing the last of these, cap-and-trade, as being the most market-oriented.

II. AGAINST COPYRIGHT EXCEPTIONALISM

The conventional justification for granting authors control over certain uses of their creative works is that in the absence of such control prospective authors would lack the incentive to create. The product of creative authorship, it is said, is a public good. It is a truism of economic theory that public goods will not be produced or will be un-

derproduced unless the government takes some role in producing them or encouraging production by the private sector.³

In this Part, I argue that analysis of public policy with respect to copyright must begin with the recognition that the provision of works of authorship is not uniquely afflicted with the incentives problem that derives from its status as a public good. To the contrary, most productive activities feature, to varying extents, a public-good aspect; or, to make the same point in terms that facilitate analysis, most productive activity results in positive externalities.

Placing creative authorship within a broader context of productive activity that involves externalities will lead, in Part IV, to my proposal that the public policy tools that are traditionally applied to counter negative externalities should also be applied in formulating copyright policy.

A. *The Public-Good Nature of Creative Authorship*

Creative authorship is conventionally regarded as a public good, being both nonrival⁴ and, in the absence of the legal protection offered by copyright laws, nonexcludable.⁵ A work of authorship is nonrival because, for example, the fact that one person is reading a book does not prevent another person from reading another copy of the same book. A work of authorship is nonexcludable to the extent that it is impractically expensive to prevent others from copying it.⁶ The problem with public goods is that in the absence of government intervention, they are undersupplied, since the producer will find it difficult, at least under traditional business models,⁷ to receive payment for its efforts.⁸

3. See RICHARD CORNES & TODD SANDLER, *THE THEORY OF EXTERNALITIES, PUBLIC GOODS, AND CLUB GOODS* 3 (2d ed. 1996) (locating this insight in the writing of Adam Smith).

4. A good is nonrival if one person's use of it does not interfere with another person's use.

5. A good is nonexcludable if it is impossible or prohibitively expensive to limit access to the good. The definition of a "public good" as one that is nonrival and nonexcludable is a common one, but there are differing views on what makes a good public, even among writers of basic economics textbooks: some require only nonrivalry, some only nonexcludability, and some introduce the factor of indivisibility. STEPHEN SHMANSKE, *PUBLIC GOODS, MIXED GOODS, AND MONOPOLISTIC COMPETITION* 191 n.1 (1991).

6. Although works of authorship may be nonrival and nonexcludable, the physical instantiations of them, which in most cases are required for them to have any utility, are both rival and excludable. See Kenneth D. Goldin, *Equal Access vs. Selective Access: A Critique of Public Goods Theory*, in *THE THEORY OF MARKET FAILURE* 69, 82 (Tyler Cowen ed. 1988) ("Ideas are of little value unless they [sic] distributed and/or used. Selective access to the distribution of ideas is easy (by charging fees for books or demonstrations) . . ."); see also NIVA ELKIN-KOREN & ELI M. SALZBERGER, *LAW, ECONOMICS AND CYBERSPACE* 51 (2004).

7. The traditional model for publishers of creative authorship involves locking up one's content and allowing access to it for a fee. In many contexts it has proven feasible to make money through some other business model, making copyright largely irrelevant to

Thus, the conventional utilitarian justification for the legal protection provided by copyright is that it is needed to overcome the public-good problem. The standard economic analysis of copyright posits that the cost of producing an exemplar of a work of authorship has two components: the fixed cost of creating the work and the variable cost of producing copies of it. For publishing copies to be a profitable endeavor, the publisher must be able to charge a price that covers both of these components of its costs. This requires charging more than the marginal cost of producing a copy.

If a competitor can costlessly appropriate the value of the author's creative effort, it can make money selling copies at the marginal cost of production (plus an increment that yields a normal rate of return). This is ruinous for the original publisher, which must either meet the competitor's price and never recover its fixed costs of creation or charge enough to recover those costs but see its sales drop to zero as it is undercut by the competition. The prospective author will calculate *ex ante* that authorship may be fulfilling but will not pay the rent and will instead direct his efforts to some more remunerative (though quite possibly less socially beneficial) endeavor. Society will then have to look elsewhere for sources of creative expression.

Copyright saves the day, granting authors (and, via transfer of copyright ownership, their publishers) the right to exclude others from certain uses of the fruits of their creative efforts. Potential competitors are precluded from appropriating costlessly the bulk of the economic value of what the author creates—precluded, that is, from copying or adapting the work or from distributing, performing, or displaying the work publicly.⁹

B. *Partial Public Goodness*

One key to recognizing the parallel between creative authorship and other types of productive activity with respect to their public-good nature is the observation that public goodness is not a categorical attribute but is rather a characteristic that may be present to

the incentive to produce. For example, many website operators make money without limiting access to their content, such as by allowing advertisements to be posted on their pages or by driving business to affiliated websites. For a taxonomy of e-commerce business models, see Michael Rappa, *Business Models on the Web*, <http://digitalenterprise.org/models/models.html> (last visited July 3, 2007).

8. B. CURTIS EATON & DIANE F. EATON, *MICROECONOMICS* 470 (2d ed. 1991) (“In many circumstances, if pure public goods are to be produced at all, they will be produced by some public authority rather than by profit-seeking firms, because no firm can profit by providing a nonexcludable good.”).

9. See 17 U.S.C. § 106 (2000); William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 *J. LEGAL STUD.* 325, 326 (1989).

varying degrees.¹⁰ The enjoyment I receive from sitting in the sun on an unspoiled beach may not be lessened if you pull up a chair at some distance from me, but it would be somewhat reduced if ten people sat nearby engaging in noisy activities and would be ruined if a thousand others had the same idea—so aesthetic goods may be partially nonrival.¹¹ If I want to prevent strangers from filching peaches from the trees in my front yard, I can at minimal cost put up a “Private Property, No Trespassing” sign to exclude many of them, but to exclude all of them, I would have to hire a security guard at prohibitive cost—so my home-grown peaches are only partially nonexcludable.

Creative authorship too may exhibit degrees of excludability.¹² The excludability of a good depends on several factors. One such factor is the cost of controlling access to the good in relation to its value. A valuable trade secret, such as the recipe for the eleven herbs and spices used in making Kentucky Fried Chicken, is highly excludable because its value to Yum! Brands, Inc., the current owner of the KFC brand, is very high, making the company’s precautions against disclosure cost effective.¹³ A studio-produced movie, on the other hand, is only partially excludable, because the cost of perfect exclusion—keeping the film in a vault, with no public showing or distribution—is too high. Copying the design of a boat hull or a semiconductor chip is not cheap, but it is much less expensive than creating the design oneself, so those designs are highly nonexcludable with respect to the relevant copiers.¹⁴ In recognition of that fact, Congress enacted *sui generis* protection of both types of designs.¹⁵

10. See DAVID N. HYMAN, PUBLIC FINANCE: A CONTEMPORARY APPLICATION OF THEORY TO POLICY 134-38 (4th ed. 1993); Yochai Benkler, *An Unhurried View of Private Ordering in Information Transactions*, 53 VAND. L. REV. 2063, 2066 (2000).

11. This feature of partial nonrivalry is sometimes referred to as “congestion.” See SHMANSKE, *supra* note 5, at 25.

12. I limit the discussion here to degrees of excludability, passing over the possibility of degrees of nonrivalry, since it is excludability that determines whether a prospective author will have an economic incentive to create.

13. The secret blend of herbs and spices is produced by two different suppliers, each of which knows the recipe for and produces only one portion of the blend. *KFC Corp. v. Marion-Kay Co.*, 620 F. Supp. 1160, 1163 (S.D. Ind. 1985). The two portions are then combined and provided to KFC franchisees. *Id.*; see also Wikipedia, KFC, <http://en.wikipedia.org/wiki/KFC> (last visited July 3, 2007) (“The Colonel’s ‘secret recipe’ of 11 herbs and spices is marketed as one of the best-kept trade secrets. The original handwritten recipe is purportedly locked in a vault in Louisville, Kentucky, with partial copies elsewhere as backup.”).

14. For an economic analysis of copying the design of boat hulls and semiconductor chips, see Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1591-1607 (2002).

15. For boat design protection, see Vessel Hull Design Protection Act, Pub. L. No. 105-304, 112 Stat. 2905 (1998) (codified as amended at 17 U.S.C. §§ 101, 1301-32, 1338, 1400, 1498 (2000)). According to a report from the Copyright Office evaluating the Act, “Much of the support for enacting the VHDPA was based on the fact that there are strong incentives for pirates to infringe boat designs because of the enormous resources that must be in-

The extent to which creative authorship is excludable also depends on its format and on the relevant copying technology, which together determine the cost and feasibility of making copies that are close substitutes. Before the development of movable type, the expression contained in a book was relatively excludable, since it was costly to make a copy. In an age of photocopy machines and computerized typesetting equipment, literary expression is less excludable, since copies that are close substitutes can often be made at a cost that is less than their economic value. Text on a website may be practically nonexcludable, since the cost to make a perfect copy is virtually zero and the cost of excluding unauthorized users (such as by adding password protection) may be prohibitive because it deters desired viewers.

A sculptural work is more excludable than a two-dimensional artwork, since the available substitutes (photographs, drawings) are not close ones and the cost of duplicating a sculpture is much higher than that of copying most two-dimensional works.

Thus, when discussing the public-good nature of an activity, we should speak of *degrees* of public goodness. This is, however, linguistically inconvenient. Fortunately, there is a related concept that will allow us to discuss the issues in less convoluted terms—the concept of externality. An externality exists when the activity of an economic agent affects the welfare of another party in a manner that is outside the legal control of that other party.¹⁶ Thus, a producer's decision to implement a particular mode of production results in a positive externality when it has the effect of producing some benefit for a producer or consumer who is not a party to any transaction involving the resulting product. In other words, if the consequence of an activity is a public good, then that activity has positive external-

vested in research to develop new designs or innovations." U.S. COPYRIGHT OFFICE & U.S. PATENT & TRADEMARK OFFICE, THE VESSEL HULL DESIGN PROTECTION ACT: OVERVIEW AND ANALYSIS 19 (2003).

For semiconductor design protection, see Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, 98 Stat. 3347 (codified as amended at 17 U.S.C. §§ 901-14 (2000)); *Altera Corp. v. Clear Logic, Inc.*, 424 F.3d 1079, 1081 (9th Cir. 2005) ("Pirate firms can strip the layers of a semiconductor chip and replicate the design at a cost substantially lower than the original firm's investment.").

16. See SHMANSKE, *supra* note 5, at 30 (An externality is "when some production, consumption, or exchange activity that occurs between agents affects the utility function or production function of some noncontracting agent."). To be an externality, the effect on third parties must not be reflected in the price of the transaction. See HYMAN, *supra* note 10, at 91 ("Externalities are costs or benefits of market transactions not reflected in prices.").

ities.¹⁷ It is the nonexcludability of public goods that gives rise to positive externalities.¹⁸

C. *Creative Authorship as a Species of Productive Activity*

The discussion above has established that (1) the public-good nature of creative authorship is the conventional justification of legal protection of copyright¹⁹ and (2) creative authorship is a partial, not a pure, public good—a characteristic that we can describe more conveniently by saying that authorship, in the absence of legal protection against unauthorized use, generates positive externalities to various extents depending on context.²⁰ Copyright serves the purpose of enabling an author to internalize some of the economic value of her creations that would otherwise be available to all takers as an externality.

The argument of this Section builds on the above points by showing that generation of positive externalities is not unique to creative authorship; on the contrary, it is characteristic of many other types of productive activity. As is the case with creative authorship, the existence of these externalities interferes with producers' incentives; if externalization of benefits prevents prospective producers from receiving a reasonable return, they will lack an *ex ante* incentive to engage in productive activity. To prevent this from happening, legal rules allow ordinary producers to internalize some of those externalized benefits, just as copyright offers this capability to authors.

The Section continues by identifying those factors which make the existence of positive externalities more or less of a problem from the standpoint of assuring that producers—both authors and industrialists—have the optimal economic incentive to engage in productive activity.

1. *Authors and Other Producers*

Many types of productive activity give rise to positive externalities. Consider the production of an archetypal hard good—the economist's "widget"—consisting of an item that must be conceived,

17. See CORNES & SANDLER, *supra* note 3, at 6 ("public goods can be thought of as special cases of externalities").

18. For examples of the use of this terminology in the copyright context, see Julie E. Cohen, *The Place of the User in Copyright Law*, 74 *FORDHAM L. REV.* 347, 366 (2005) ("It is widely acknowledged that some fair uses, including many transformative uses, create positive externalities from which society as a whole benefits greatly . . ."); Alfred C. Yen, *A Preliminary Economic Analysis of Napster: Internet Technology, Copyright Liability, and the Possibility of Coasean Bargaining*, 26 *U. DAYTON L. REV.* 247, 262 (2001) ("To the extent that external benefits conferred on free riders cause the underproduction of copyrightable subject matter, copyright law can be used to internalize those external benefits . . .").

19. Part II.A, *supra*.

20. Part II.B, *supra*.

developed into a commodity for which there is demand, produced, and marketed. As with works of authorship, the cost of producing a hard good has both fixed and marginal components. The fixed costs include the costs of developing the product and investment in facilities that are used to produce it. Marginal costs are the additional costs, such as for materials and labor inputs, that increase along with the quantity manufactured. The total cost of producing an exemplar of a product consists of an allocated share of the fixed costs plus the marginal cost associated with producing that exemplar.

A competitor of the original producer of an item can gain a competitive advantage if it is able to reduce the costs of its production below those experienced by the original producer. One way it may do this is by lowering its fixed costs through appropriating information that the original producer has, at some cost to itself, generated during the process of bringing the good to market. The information that the competitor may profitably appropriate includes (1) the original idea for the product; (2) the design of the product; (3) the fact that there is consumer demand for the product, which may be acquired through expenditures on surveys, focus group testing, and other market research;²¹ and (4) the most effective channels of marketing or distributing the product.²² In the absence of any right to prevent appropriation, this information is a positive externality of the original producer's productive activity.²³

As with copyright, legal rules reserve some, but not all, of the value of these externalities for the original producer. (1) The conception of the product may be protected, if at all, only by contract. The person who conceives the idea may disclose it to another on terms that contractually obligate the other not to make use of the idea in a way that harms the interests of the conceiver. However, any such restriction cannot bind third parties, such as potential competitors who learn of the product through observation of the marketplace. (2) The

21. Uncertainty about whether a particular product will succeed in the marketplace gives rise to "selection bias." See Frank H. Easterbrook, *Intellectual Property Is Still Property*, 13 HARV. J.L. & PUB. POL'Y 108, 115 (1990). "There will be hits and misses. The original designer bears the costs of both; the copier duplicates only the hits." *Id.*

22. For a somewhat different categorization of the types of informational assets that a competitor can appropriate from the original producer, see Samuelson & Scotchmer, *supra* note 14, at 1586-88 (detailing the development process of reverse-engineered products).

23. Second comers may also benefit from the original producer's efforts in ways that do not involve the appropriation of information. For example, competitors can take advantage of the increase in market demand for the product that is created by the original producer's marketing efforts. Consumers might not realize, for example, that they have a need for Christmas-tree-shaped automobile air fresheners that dangle from the rearview mirror until a pioneer producer disseminates marketing messages that prove this is so. Competitors can forgo the expenses needed to create this market demand. The original producer may be able to internalize some of the value thus created through branding its product, invoking trademark law. However, branding is unlikely to succeed in excluding competitors from an entire product category.

design of the product may be obvious from the face of it or may require some effort to discover. Aspects of the design may enjoy legal protection through laws protecting trade secrets or through patent law. The efficacy of these legal protections is limited. Trade secret protection may in principle last indefinitely, but will be unavailing if the owner does not make reasonable efforts to maintain its secrecy or if the secret can be discovered by observation.²⁴

With a few narrow exceptions,²⁵ there is no legal right to prevent competitors from reverse engineering ordinary goods to uncover their design.²⁶ Patent protection lasts no more than twenty years, after which the right to make the product and the information regarding how to make it and how best to use it (which is disclosed in the patent application) are freely appropriable. Moreover, many industrial inventions and designs are not patentable or are not of sufficient value to justify the expense of obtaining a patent. (3) The fact that there is consumer demand for the product is hard to conceal once the product is in the marketplace, though a producer may seek to limit the amount of information available to potential competitors by not releasing its sales figures. (4) The method of marketing or distributing the product might, but usually will not, be protectable by a business method patent.

Beyond these limited legal protections, original producers have another powerful ally enabling them to recover their development costs and make a profit despite the best efforts of imitative competitors, namely the first-mover advantage. Simply put, it takes second comers a while to accomplish their copying. During that interval the original producer is insulated from the negative effects of a competitor's acquisition of competitively significant information at a lower cost than the original producer had to pay.²⁷

In view of these considerations, it is clear that the positive-externality-generating (or public-good) aspect of creative authorship is not unique but is only a particular manifestation of a characteristic applying to productive activity in general. Like a prospective author, the prospective original producer of an ordinary hard good is assumed to engage in an ex ante calculation whether to invest in development and production of a product that takes into account (among other considerations) the appropriability of competitively im-

24. See UNIF. TRADE SECRETS ACT § 1(4) & cmt. (1985).

25. See *supra* note 15 and accompanying text (discussing legal prohibitions against reverse engineering of boat hulls and semiconductor chip topographies).

26. See UNIF. TRADE SECRETS ACT § 1 cmt. (1985) (recognizing reverse engineering as a proper means of uncovering a trade secret); Samuelson & Scotchmer, *supra* note 14, at 1582 ("Reverse engineering has always been a lawful way to acquire a trade secret . . .").

27. See J.H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 COLUM. L. REV. 2432, 2506-11 (1994).

portant information by second comers. If the value that competitors are able freely to appropriate is so significant that the original producer cannot hope to make a profit, then the would-be producer will invest elsewhere.

Thus, both prospective authors and prospective producers of ordinary goods can, with some justification, claim that they require legal prohibition against free appropriation of at least some of the intellectual spinoffs of their productive activities if they are to have an adequate economic incentive to engage in such activity. If there is a distinction to be made between these two cases, it is not in the *existence* of appropriable effort, but rather in its *extent*. That is, in different contexts there may be differences in the magnitude of the advantage vis-à-vis the original producer that a second comer can derive from his appropriation of externalized benefits created by the original producer. The next Section analyzes the determinants of the magnitude and the significance to the original producer of this appropriable value.

2. Comparative Appropriability

Since our goal is to ascertain the impact that externalization of benefits has on authors' and producers' incentives to engage in creative and productive activities, we should view the situation from the standpoint of the author/producer.

The producer's enterprise will be a profitable one only if it can sell its product for more than its average total cost of production, or *ATC*. The *ATC* consists of the total cost of manufacturing a given quantity of output, divided by that quantity. The total cost of manufacturing, or *TC*, is the sum of two components: the total fixed cost, or *FC*, and total variable cost, or *VC*. *FC* is the amount of the producer's expenses (such as equipment, office rental, product development, and so on) that do not vary with output. *VC* is the amount of the producer's expenses that do vary with output (such as cost of materials, labor costs, and so on).

What the second comer achieves by copying is a reduction in its fixed costs. In the case of ordinary goods, the reduction might be in expenses for market research and product development. In the case of works of authorship, the savings come from eliminating the cost of creating the work, which may consist either of the opportunity cost (if the second comer would otherwise be the creator) or the actual cost of acquiring the rights to a work (if the second comer would otherwise hire or commission another to create the work).

The second comer usually cannot appropriate *all* of the intellectual spinoffs of the original producer's activity. For example, the expertise the original producer achieves through its development ef-

forts is something that the second comer may not be able to acquire through copying activities, as is the advantage of being first to market with the product. The proportion of the original producer's fixed costs that the second comer can appropriate will depend on the particular circumstances; more or less of the value generated by the original producer's productive activity may be locked up in a non-appropriable form.

The second comer's advantage will be limited in another way too. The enterprise of copying is usually not costless; the second comer incurs certain expenses to accomplish the appropriation. For ordinary goods, this might include the expense of gathering information about the efforts of other producers, assessing which products and manufacturing techniques are most successful, and reverse engineering a product to determine how it is made. In the case of works of authorship, the costs of copying may be substantial (as with the cost of copying a book by quill pen or the cost of duplicating a sculptural form) or nearly costless (as with the cost of copying a digital file)—but in any case, the costs of copying must be less than the cost of independently creating a competing work²⁸ or the game would not be worth the candle. Thus, to determine the advantage the second comer gains with respect to the original producer we must subtract the second comer's copying expenses from the value of what has been appropriated.

From the standpoint of competitive advantage, the relevant factor is the *percentage* of the cost reduction, rather than its absolute value.²⁹ The percentage of the second comer's savings is the amount of its savings divided by the original producer's costs. Putting together the above considerations into a single equation, we find that the second comer's comparative advantage is:

$$\frac{A \cdot FC_{op} - CE_{sc}}{FC_{op} + VC_{op}},$$

where

A is the portion of the original producer's fixed costs that the second comer is able to appropriate ($0 < A < 1$);

FC_{op} is the original producer's fixed costs;

CE_{sc} is the second comer's copying expenses; and

28. A competing work might be one that is identical to the original, if it is not protected by copyright, or one that prospective purchasers view as a close substitute, if it is.

29. A one-dollar cost reduction in producing a car that sells for \$30,000 will give the producer no significant comparative advantage. The same cost reduction on a two-dollar item is significant enough to ruin the competition.

VC_{op} is the original producer's variable costs for some given quantity of production.³⁰

It follows that the second comer's comparative advantage will depend on several factors. First, the greater the proportion of the original producer's fixed costs that is appropriable (that is, the larger that A is), the greater the second comer's advantage. Second, the smaller the variable costs in proportion to fixed costs (VC_{op}/FC_{op}), the greater the second comer's advantage. This ratio will depend both on the nature of the productive activity (some types of production are inherently more capital-intensive than others) and on the quantity of the output (at higher levels of output fixed costs become of decreasing significance). Third, the smaller the second comer's copying expenses (CE_{sc}), the greater the second comer's advantage.

By considering the comparative magnitudes of these factors in connection with different sorts of productive activity, we can attempt to get some idea of the impact of free appropriability on the incentives experienced by creative authors and by producers of ordinary goods.

(a) *Appropriable Proportion of Fixed Costs*

The value of A is likely to be higher in connection with many products of intellectual activity than in connection with the production of ordinary goods. A second comer can potentially appropriate nearly all of the effort the original producer expended in creating a work of authorship as well as the knowledge that there is market demand for it.³¹ The value of A will depend in part upon the medium of expression. With some media, the second comer's copy is nearly a perfect substitute for the original. This is true of works in digital formats: music on CD, movies on DVD, digitized text, and computer programs. However, the copier may fail to appropriate ancillary aspects of the product's value, such as its packaging or technical support from the manufacturer. With other media, the production values are of greater significance to the value of the product. This is true, for example, of hardcover books (more durable and easier to carry around and read than a sheaf of 8½" x 11" photocopied pages) and items such as sculpture and paintings that cannot be closely duplicated at an acceptable price.³²

30. For the derivation of this expression, see Appendix A.

31. See J.H. Reichman, *Computer Programs as Applied Scientific Know-How: Implications of Copyright Protection for Commercialized University Research*, 42 VAND. L. REV. 639, 660 (1989) (observing that unlike traditional hard goods, an exemplar of a knowledge-based product (such as a computer program) "tends to bear its know-how on its face" and is therefore more copiable).

32. Some intangible elements of the value of a work of authorship cannot be appropriated at all. The value of an original painting or a limited-edition print signed and num-

In addition to the value lost by not being able to make a perfect copy in some media, the second comer leaves behind the benefits accruing to the producer by reason of the creative effort. For an individual creator, this might consist of skills that will enable her to create a better song, book, or artwork the next time she sets out to do so. For a collective endeavor, such as production of a movie or recording of a symphony, the nonappropriable value might be the skill needed to coordinate the creative efforts of a number of individuals.

With ordinary goods, a smaller proportion of the original producer's effort will often be appropriable.³³ As with works of authorship, the ordinary goods second comer appropriates the value of knowing the market response to the product. However, access to an exemplar of ordinary productive processes (a piece of furniture, a steel beam, an electronic device, a bushel of corn) in most cases does not enable the second comer to appropriate a high proportion of the value of the fixed costs that went into creating it. Close study of a steel beam may not reveal much about the process used to create it, nor does it reduce at all the second comer's expenses in acquiring and operating a blast furnace, a rolling mill, or other equipment needed to make the beam. Reverse engineering a product may or may not reveal much about how the product is made.³⁴ That knowledge may reduce the development expenses that go into the producer's fixed costs, but it does not eliminate them, and it does not obviate the need to invest in machinery, land, or other capital resources that are required for production. Moreover, the second comer's version is unlikely to be as close a substitute for the original as in the case of works of authorship, meaning that less of the value contributed by the original producer's fixed expenditures is appropriable.

It is quite possible for some components of the fixed costs associated with a particular product to be more appropriable than other components. For example, a book publisher may incur expenses for typesetting and editing a manuscript and for promoting the book. The promotional expenses are fully appropriable, assuming the second comer is addressing the same market as the original publisher.

bered by the artist may derive in substantial measure from the artist's personal involvement with the particular copy. This intangible value may be analogized to the branding element of an ordinary good that carries a valuable trademark. An exact duplicate of a Gucci bag, sans the "Gucci" imprint, is far less valuable than a true Gucci bag.

33. In the category of "ordinary goods" we should include works of authorship that are in the public domain, unprotected by copyright. Consider a classic work of literature whose copyright has expired. A publisher need not pay any royalties to the author, so the publisher's fixed costs will consist of the cost of preparing the text for printing. This cost is no more appropriable than is the expense of tooling up for production of any ordinary good.

34. Automobile manufacturers consider the knowledge gained from reverse engineering sufficiently valuable that they routinely slice up competitors' products to learn the secrets of their design and composition. See Carl Hoffman, *The Teardown Artists*, WIRE, Feb. 2006, at 136, available at http://www.wired.com/wired/archive/14.02/teardown_pr.html.

Typesetting costs may be viewed as nonappropriable, if the second comer finds it necessary to reset the type, or largely appropriable to the extent that a photographic reproduction serves as a substitute.³⁵

(b) *Ratio of Fixed Costs to Variable Costs*

It is difficult to generalize about the ratio of fixed to variable costs as between works of authorship and ordinary goods. For some works of authorship the variable costs are a relatively small fraction of the total (or average) costs. A commercial movie studio may spend tens of millions of dollars to produce and market a film and proportionately very little on duplicating the result on physical media. A second comer who is not constrained by copyright has an enormous cost advantage.

In other situations, however, the cost structure might be just the opposite. Consider an unknown rock-and-roll band that has just been signed by a record label. The contract may provide that the label pays very little to the band, and the costs of producing an album may be low. The lion's share of the label's costs may be in manufacturing, promotion, and distribution.³⁶ At the other extreme, we might consider an unsigned musician who produces his own music in a home studio and whose opportunity cost is very low. With small volumes of sales and CDs sold to end purchasers rather than through distributors, the (variable) costs of manufacturing and selling the disks may vastly exceed the fixed costs of creation. The creator in such a situation would have little to fear from second comers, regardless of the existence of copyright.

Ordinary goods, likewise, fall along a spectrum with respect to the ratio of fixed to variable costs. Fixed costs may be dominant, as in the case of a product that requires expensive tooling but has low costs for materials and production labor. At the other extreme, variable costs may dominate, as is the case with producing jewelry from precious metals and gems or building tract housing.

In general, the ratio of fixed to variable costs will depend greatly on the volume of units produced, because the more units are produced, the less the fixed costs per unit. Variable costs per unit may

35. For illustrations of the magnitudes of the various costs involved in book publishing, see generally ALBERT N. GRECO, *THE BOOK PUBLISHING INDUSTRY* 163-69 (2d ed. 2005).

36. Promotional expenses may be quite high. According to one estimate, marketing, promoting, and touring may cost a major record label between \$140,000 and \$350,000 for a single album. See Raymond Shih Ray Ku, *The Creative Destruction of Copyright: Napster and the New Economics of Digital Technology*, 69 U. CHI. L. REV. 263, 315 (2002) (citing Jon Healey, *CD Sticker Shock Accounting for Retail Sale Prices that Drive Song-Swapping Sites*, SAN JOSE MERCURY NEWS, Sept. 3, 2000, at 1D).

also decrease with greater volume, to the extent that economies of scale exist.

Thus, although it may be true more often than not that “the ratio of fixed to marginal costs is much higher for information than for other types of goods,”³⁷ this is not invariably the case.

(c) *Copying Expenses*

For most types of works of authorship, we would expect the costs of copying the content to be small in comparison with the costs of creating the work; that is, CE_{sc} is small compared to FC_{op} . At the limit, the cost of copying digitized materials may approach zero: making a copy of a word-processing document, a music file in .mp3 format, a graphic in .jpg or .gif format, or a movie encoded with the DVD-Video standard. Copying the design of an integrated circuit chip, while costly, is far less expensive than designing the chip in the first place.³⁸ Copying nondigital works may cost more. For example, making a high-quality lithographic reproduction of an artwork requires substantial skill and expense. In most contexts, however, it would seem that the cost of copying would be substantially less than the original producer’s cost of creation. In addition to the costs of actually making the copy, there may be costs for determining whether an item is worth copying or locating and obtaining an original to copy.

The cost of copying ordinary goods will vary dramatically depending on the nature of the item. Just as with works of authorship, what the second comer needs to copy is intellectual in origin, namely information that enables the second comer to avoid bearing some of the fixed costs borne by the original producer. Copying from competitors may involve various techniques.³⁹ Recommended methods include performing chemical analyses and other tests on the competitor’s products;⁴⁰ disassembling, weighing, and labeling each component part of a competitor’s product;⁴¹ taking a tour of the competitor’s

37. Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1053 (2005) (emphasis omitted).

38. H.R. REP. NO. 98-781, at 2 (1984), 1984 U.S.C.A.N. 5750, 5751 (“The development costs for a single new chip can reach \$100 million. . . . A competing firm can photograph a chip and its layers, and in several months and for a cost of less than \$50,000 duplicate the mask work of the innovating firm.”).

39. The science of figuring out what the competition is doing is called “competitive intelligence” or “industrial espionage,” depending on one’s point of view. See LARRY KAHANER, *COMPETITIVE INTELLIGENCE* 16 (1996); TIMOTHY W. POWELL, *ANALYZING YOUR COMPETITION* 18 (1993). There is even a professional society composed of those who engage in the activity. See Society of Competitive Intelligence Professionals, <http://www.scip.org> (last visited July 3, 2007).

40. See TONY REID, *LEGAL INDUSTRIAL ESPIONAGE* 11 (1985).

41. See Hoffman, *supra* note 34.

premises;⁴² looking through the competitor's trash;⁴³ focus-group testing the competitor's products;⁴⁴ and consulting public directories and regulatory filings.⁴⁵ This range of techniques implies a range of values of CE_{sc} .

D. Conclusion

As the foregoing discussion demonstrates, the need for legal rules designed to assure that authors will receive adequate economic rewards for their efforts and will therefore have an ex ante incentive to engage in creative activity is but a special case of the more general problem of enabling producers to capture some of the benefits of their activity that, in the absence of legally enforceable rights, would be lost as positive externalities. Producers of ordinary goods are enabled to internalize some of the positive externalities of their efforts through legal protection of trade secrets and patents, enforceability of confidentiality agreements, and protectability of trademarks. Producers also enjoy various degrees of "natural" protection against copying by second comers in the form of nonappropriability, high costs of copying, the first-mover advantage, and low ratios of fixed to variable costs. Copyright protection provides analogous benefits to authors, allowing them to internalize some (but not all) of the positive externalities they generate.

Underlining the conclusion that creative authorship is, from the standpoint of producer incentives, not fundamentally different from any other productive activity is the fact that one form of intellectual property protection, copyright, exists to promote the former, while other types, patent and trade secrecy, promote the latter. In addition, with creative authorship, what the second comer may profitably appropriate is not limited to the content of the copied item (words, sounds, images) but, as with other types of productive activity, includes ancillary intellectual spinoffs such as the existence of a market for a particular item.

The model developed above identifies the factors that determine how significantly the appropriability of the benefits generated by productive activity affects the incentives of producers of both ordinary goods and works of authorship. We cannot say categorically that appropriability is more of a problem for prospective authors than for other prospective producers; that depends on the values of the parameters identified in the model.

42. See RONALD L. MENDELL, *THE QUIET THREAT* 12-24 (2003).

43. See *id.* at 64.

44. See ALAN DUTKA, *COMPETITIVE INTELLIGENCE FOR THE COMPETITIVE EDGE* 52-54 (1999).

45. See POWELL, *supra* note 39, at 85-161.

III. USE OF TPMS CREATES NEGATIVE EXTERNALITIES

Having observed that authors and other producers face analogous difficulties due to the positive externalities resulting from their productive efforts, it is natural to inquire whether a corresponding analogy exists with respect to *negative* externalities.⁴⁶ It is very common for both productive and consumptive activities to have negative impacts on producers and consumers who have no ability to control those activities. Polluting emissions from a factory may cause acid rain that negatively affects the production of nearby farmers or smog that harms the health of consumers. One person's smoking may injure nonsmokers in the room.

As I have argued elsewhere, the use by publishers of TPMS to prevent unauthorized use of their copyrighted products imposes several types of costs on society.⁴⁷ My claim here is that some of these costs are appropriately viewed as negative externalities.

A. *The Social Costs of TPMS*

The most widely implemented types of TPMS are encryption-based technologies that either prevent users from making unauthorized copies or limit the devices that may be used to access a particular copy. A familiar example of the former is the Content Scramble System (CSS), which is implemented on commercially released movie DVDs. CSS makes it impossible to copy such a movie without the use of some technology that circumvents the TPM. An example of the latter type of protection is the tethering technology that prevents a user from installing Windows XP on more than one computer or from playing an .mp3 music file downloaded from iTunes on more than five computers.⁴⁸

46. Just as positive externalities are associated with public goods, so negative externalities are associated with public bads. A public bad is the converse of a public good: it is an activity causing harm, rather than benefit, that is both nonrival and nonexcludable. See Jody Freeman, *Extending Public Law Norms Through Privatization*, 116 HARV. L. REV. 1285, 1297 n.42 (2003) ("The flip side of the public goods problem is the public 'bads' problem—often referred to as the tragedy of the commons—caused by the absence of pricing mechanisms that enable cost internalization."). A public bad exists "when a large number of parties are affected negatively and simultaneously . . . by an action" and "[t]he nature of the phenomenon is such that there is no low-cost way to insulate and partition the affected individuals in the group from the negative effect." Karol Boudreaux & Bruce Yandle, *Public Bads and Public Nuisance: Common Law Remedies for Environmental Decline*, 14 FORDHAM ENVTL. L.J. 55, 59-60 (2003).

47. See John A. Rothchild, *Economic Analysis of Technological Protection Measures*, 84 OR. L. REV. 489, 500-14 (2005).

48. For a discussion of TPMS designed to protect music, movies, and books, see Besek, *supra* note 2, at 453-60.

In 1998, Congress bolstered the use of TPMs by enacting rules that make it illegal to circumvent TPMs.⁴⁹ Simplified somewhat, these anticircumvention rules prohibit three types of conduct. First, the rules prohibit circumventing a TPM that controls access to a copyrighted work.⁵⁰ Second, they prohibit trafficking in such circumvention technology if the technology does not serve any significant legitimate purpose.⁵¹ Third, they prohibit trafficking in a technology that allows copying of a work protected by a TPM, again if the technology serves no legitimate purpose.⁵²

The use of TPMs results in three types of harms affecting people who are not participants in any transaction involving a TPM-protected copy of a copyrighted work—harms that are therefore negative externalities.⁵³

First, use of TPMs results in *contraction of the public domain*.⁵⁴ The notional copyright “bargain” between authors and the public stipulates that authors are granted legally enforceable exclusive rights to exploit their creations in specified ways;⁵⁵ however, it also stipulates that these rights are subject to certain exceptions for the benefit of the public⁵⁶ and that the work is to become freely available to all upon expiration of the work’s term of protection.⁵⁷ The most significant limitations on the author’s exclusive rights are (1) the author has no right to control fair use of the work⁵⁸ and (2) the exclusive rights protect only the author’s *expression* but not the underlying *ideas*.⁵⁹ TPMs that prevent the copying of even small portions of a work interfere with the exercise of fair-use rights. TPMs that prevent unauthorized access to the author’s protected expression also prevent access to the author’s unprotected ideas. Access controls and tethering systems deny the public access to a work even after expiration of the copyright term.⁶⁰

49. The rules were enacted as part of the Digital Millennium Copyright Act, Pub. L. No. 105-304, § 103, 112 Stat. 2860, 2863-76 (1998).

50. 17 U.S.C. § 1201(a)(1)(A) (2000).

51. *Id.* § 1201(a)(2).

52. *Id.* § 1201(b)(1).

53. These harms are discussed at greater length in Rothchild, *supra* note 47, at 500-14.

54. *Id.* at 501-04.

55. 17 U.S.C. § 106 (2000).

56. *See* Rothchild, *supra* note 47, at 499.

57. 17 U.S.C. §§ 302-04 (2000) (establishing duration of copyright protection).

58. Rothchild, *supra* note 47, at 499, 501-03.

59. *Id.* at 499, 503.

60. *See Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies: Hearing Before the Copyright Office, Library of Congress, Docket No. RM 2005-11 (2005) [hereinafter Section 1201 Rulemaking]* (Comment of Jim Konop, Copyright Office, *Rulemaking on Exemptions from Prohibition on Circumvention of Technological Measures that Control Access to Copyrighted Works* (2006), available at <http://www.copyright.gov/1201/2006/comments/konop.pdf>) (Section 1201 prevents copying public-domain movies on DVD).

Second, use of tethering technologies can *reduce access* to creative works by eliminating the secondary market.⁶¹ The ready availability of used books, records, movie DVDs, and music CDs allows those who cannot afford the price of new items to purchase them used and allows purchasers of new items to reduce their effective cost by reselling them when they are no longer needed.⁶² In addition, libraries can make these materials temporarily available at no cost to borrowers. However, an item that is tethered to a particular user's machine cannot be lent by a library and cannot be sold to anybody else.⁶³

Third, TPMs may be implemented in a manner that *harms competition and innovation*.⁶⁴ Several manufacturers of ordinary consumer items, including printer toner cartridges and garage door openers, have attempted to stifle competitors by invoking the anticircumvention rules.⁶⁵ Their argument is based on the fact that, like many consumer goods, these items incorporate electronic components that use software code to control their operations.⁶⁶ Competing products that interface with these components must work around this code, giving rise to claims that the competitors are engaging in unlawful circumvention. The courts have not been very receptive to these arguments thus far, but under a new set of factual circumstances they might have more traction.⁶⁷ Use of TPMs may also interfere with innovation by making difficult or impossible certain types of encryption research and reverse engineering.⁶⁸

B. TPMs and Externalities

These societal harms constitute negative externalities of the publishers' use of TPMs. Consider the sale of a copy of a software application protected with a tethering restriction that prevents it from being used on any computer other than the one on which it is first loaded. The presence of the TPM has effects not only on the consumer who purchased the software but also on third parties. For one thing, the tethering restriction makes it impossible to sell the copy on the secondary market (unless it is sold together with the computer on

61. Rothchild, *supra* note 47, at 504-05.

62. *Id.*

63. *Id.*

64. *Id.* at 507-13.

65. *See, e.g.,* Lexmark Int'l, Inc. v. Static Control Components, Inc., 387 F.3d 522, 529 (6th Cir. 2004) (involving computer chips in toner cartridges); Chamberlain Group, Inc. v. Skylink Techs., Inc., 381 F.3d 1178, 1183 (Fed. Cir. 2004) (involving garage door openers).

66. *See* Zohar Efroni, *A Momentary Lapse of Reason: Digital Copyright, the DMCA and a Dose of Common Sense*, 28 COLUM. J.L. & ARTS 249, 295 (2005) (noting "the widespread use of consumer products that contain one or several computer programs responsible for the operation of products in which they are embedded").

67. *See* Rothchild, *supra* note 47, at 513.

68. *See* Samuelson & Scotchmer, *supra* note 14, at 1647 (describing "the chilling effects of the DMCA on encryption and computer security research").

which it was originally installed).⁶⁹ Since the tethering restriction means that used copies of Windows XP are unavailable for purchase, a person who buys a new PC cannot save money by equipping it with a superseded but still serviceable copy of Windows XP obtained at a garage sale. Furthermore, the tethering restriction amounts to a permanent limitation on the usability of that copy, preventing access to the work it contains even beyond expiration of the copyright. The important point here is that the preference of impecunious computer users for cheap used copies of software and the interest of society in populating the public domain with usable copies are not factored into the publisher's decision whether to protect its products with TPMs or into the purchaser's decision of how much to pay for it. The publisher's decision whether to implement TPMs is based solely on considerations of maximizing its profits. The full social costs of the decision to implement TPMs are not factored into the publisher's cost function.⁷⁰ As a result, the publisher implements more TPMs than would be socially optimal.

As another example, consider the societal effects of anticopy technologies. To the extent that a copyrighted work is distributed only in formats that are copy-protected, fair-use copying is eliminated.⁷¹ Suppose, for example, that the major record labels began releasing their recordings exclusively on CDs equipped with an anticopy TPM,⁷² as is

69. The features of a tethering TPM are determined by the individual publisher that deploys it. For example, the tethering system accompanying Windows XP, which Microsoft refers to as "product activation," is designed so that it requires reactivation if the user replaces a certain number of components of her computer, and reactivation is permitted only by Microsoft's leave. See Microsoft, Windows XP Product Activation (2002), <http://www.microsoft.com/windowsxp/evaluation/features/activation.mspx> ("If you overhaul your computer by replacing a substantial number of hardware components, it may appear to be a different PC. You may have to reactivate Windows XP."). The End User License Agreement accompanying Windows XP explains that the user's copy of the software can only be used on the computer with which the user obtained the software. See, e.g., Microsoft Corporation, Microsoft Windows XP Home Edition (Retail) End-User License Agreement for Microsoft Software (June 1, 2004), available at <http://www.microsoft.com/windowsxp/home/eula.mspx>. Therefore, the product-activation technology presumably prevents a copy of Windows XP from being used on a new computer that the user buys.

70. Some of the social costs of a tethering restriction may be factored into the publisher's implementation decision through a reduction in the price that purchasers are willing to pay: a purchaser should be willing to pay more for an untethered copy, which he expects to be able to resell on the secondary market, than for a tethered copy, which cannot be resold. But there are other societal effects that are not brought home to the publisher. For example, society may have an interest in widespread availability of products of creative authorship among those who cannot afford to pay the full price, an interest not shared by publishers or purchasers.

71. See 17 U.S.C. § 107 (2000) (fair use). Fair-use copying might be permissible for personal noncommercial use, to enable performances permitted under 17 U.S.C. § 110(1) (2000) (exemption of certain performances and displays), or for a variety of other purposes. See *id.* §§ 107-22.

72. The four major labels control about 72% of the recorded music market. See Paul Williams, *EMI Ponders Next Move*, MUSIC WEEK, May 13, 2006, at 1 (2004 figures). The

currently the case with movies on DVDs.⁷³ No fair-use copying of popular music would then be possible. For some purposes, copying would still be possible by exploiting the “analog hole”: playing the CD on one machine and making a recording of the output using a microphone attached to an audio cassette recorder, a video camcorder, or a microphone plugged into a computer. But such workarounds will not always be available. The result would be an impoverished version of fair use,⁷⁴ a circumstance that has prompted calls for an exception to the anticircumvention rules to allow such copying.⁷⁵ However, society’s losses resulting from the impoverishment of fair use are of no concern to the publisher, and such costs do not factor into its decision whether to implement the TPM.

Consider a third scenario. Suppose that manufacturers of ordinary consumer goods containing electronic components succeed in avoiding the holdings of two high-profile cases⁷⁶ that disapproved of the invocation of the anticircumvention rules in a manner that could interfere with competition, either by redesigning their products⁷⁷ or

labels are experimenting with anticopy TPMs. In 2005, Sony BMG released large quantities of CDs equipped with anticopy technology, leading to a debacle when it was revealed that playing the disks in a computer’s CD drive resulted in undisclosed modifications to the computer that introduced a serious security hole. See Robert McMillan, *Settlement Ends Sony Rootkit Case*, INFOWORLD DAILY NEWS, May 23, 2006, available at http://www.infoworld.com/article/06/05/23/78581_HNsonyrootkitsettlement_1.html. EMI is testing a different anticopy technology, while Warner and Universal are still on the sidelines. See Brian Garrity & Susan Butler, *Copy Protection’s Future Unclear*, BILLBOARD, Jan. 14, 2006. It remains to be seen whether the major labels will push ahead with implementation of TPMs throughout their product lines.

73. Anticopy technology called the Content Scramble System is currently widely employed on commercially released movies on DVD, making it impossible to engage in fair-use copying of DVDs without specialized hardware or software. The best-known provider of such software went out of business after battling the movie industry in court. See *321 Studios v. Metro Goldwyn Mayer Studios, Inc.*, 307 F. Supp. 2d 1085 (N.D. Cal. 2004); *Paramount Pictures Corp. v. 321 Studios*, No. 03-CV-8970, 2004 WL 402756 (S.D.N.Y. 2004); *321 Studios Ends Operations*, N.Y. TIMES, Aug. 5, 2004, at C6.

74. See R. Anthony Reese, *Will Merging Access Controls and Rights Controls Undermine the Structure of Anticircumvention Law?*, 18 BERKELEY TECH. L.J. 619, 653 (2003).

75. In *Section 1201 Rulemaking*, *supra* note 60, several commenters proposed an exception that would allow fair-use copying of portions of movie DVDs and music CDs. See *Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies: Hearing Before the Copyright Office, Library of Congress*, Docket No. RM 2005-11 (2005) (Comments of the Library Copyright Alliance and the Music Library Association; Comments of Peter Decherney, Assistant Professor at the University of Pennsylvania’s Cinema Studies Program; Michael Delli Carpini, Professor and Annenberg Dean; and Katherine Sender, Assistant Professor at the University of Pennsylvania’s Annenberg School of Communication; and Comment of Jeff Fessler), available at http://www.copyright.gov/1201/2006/comments/decherney_upenn.pdf.

76. *Lexmark Int’l, Inc. v. Static Control Components, Inc.*, 387 F.3d 522 (6th Cir. 2004); *Chamberlain Group, Inc. v. Skylink Techs., Inc.*, 381 F.3d 1178 (Fed. Cir. 2004).

77. In *Lexmark*, a manufacturer of printer toner cartridges containing a chip designed to prevent its printers from accepting cartridges made by competing manufacturers argued that a supplier of cloned chips was trafficking in devices that allowed access to copyrighted software code in the printer. 387 F.3d at 529. The court denied the claim on the ground

by contractually limiting their customers' rights to use their products in connection with products made by third parties.⁷⁸ As other commentators have noted, neither case rules out the possibility that the anticircumvention rules might be used to stifle competition.⁷⁹ If the rules were so interpreted, manufacturers could broadly eliminate competition from aftermarket manufacturers.⁸⁰ The harm to society that would result from this dearth of competition would not be factored into the manufacturers' decisions whether to implement the TPMs—quite the contrary.

that the code in the printer was freely accessible to anyone in possession of the printer, so that the chip did not really serve as an access control. *See id.* at 546. A manufacturer might be able to avoid this outcome simply by encrypting the code in the printer.

78. In *Chamberlain*, the manufacturer of a garage door opener system charged that compatible remote controls manufactured by a competitor were devices that circumvented a frequently changed code designed to control access to a computer program that activated the garage door opener motor. 381 F.3d at 1183. The court denied the claim, based on a narrow reading of the anticircumvention provisions, according to which there could be no actionable trafficking in the absence of an act that circumvents an access control. *Id.* at 1203-04. The court held that circumvention would occur only if the access was without the copyright owner's authorization—a circumstance not present under the facts of the case because consumers who owned the garage door openers were authorized to engage in access of the computer program as necessary to operate the opener. *Id.*; *see also* *Storage Tech. Corp. v. Custom Hardware Eng'g & Consulting, Inc.*, 421 F.3d 1307, 1318 (Fed. Cir. 2005) (discussing *Chamberlain*). A manufacturer might avoid this outcome by selling its products subject to a contractual restriction against using an unauthorized device to access code contained within its products. *See* Jacqueline Lipton, *The Law of Unintended Consequences: The Digital Millennium Copyright Act and Interoperability*, 62 WASH. & LEE L. REV. 487, 513 (2005). The *Chamberlain* court expressly declined to decide this point. 381 F.3d. at 1202 n.17. However, in other contexts courts have been willing to enforce contractual limitations of statutory user rights. *See* *Davidson & Assocs. v. Jung*, 422 F.3d 630, 639 (8th Cir. 2005) (contractual waiver of reverse engineering right); *Bowers v. Baystate Techs., Inc.*, 320 F.3d 1317, 1325-26 (Fed. Cir. 2003) (same).

79. *See* Dan L. Burk, *Legal and Technical Standards in Digital Rights Management Technology*, 74 FORDHAM L. REV. 537, 567 (2005) ("It remains unclear how robust these particular results will be."); Marcus Howell, Note, *The Misapplication of the DMCA to the Aftermarket*, 11 B.U. J. SCI. & TECH. L. 128, 145 (2005) ("Although both circuit courts have ruled in favor of the aftermarket manufacturer, neither case conclusively holds that aftermarket manufacturers are free from DMCA liability."). Some commenters have likewise noted threats to competition posed by the anticircumvention rules. *See Section 1201 Rulemaking*, *supra* note 58 (Comment of Jonathan R. Newman and Robert Pinkerton, available at http://www.copyright.gov/1201/2006/comments/granick_wirelessalliance.pdf) (mobile telephone manufacturers invoking Section 1201 to prevent use of their phones on competing networks).

80. It has been noted that this could lead to a world in which car repairs could be accomplished only by buying replacement parts from the original equipment manufacturer, with lower-priced aftermarket suppliers put out of business. *See Lexmark*, 387 F.3d at 552 (Merritt, J., concurring) ("If we were to adopt Lexmark's reading of the statute, manufacturers could potentially create monopolies for replacement parts simply by using similar, but more creative, lock-out codes. Automobile manufacturers, for example, could control the entire market of replacement parts for their vehicles by including lock-out chips."); Daniel C. Higgs, Note, *Lexmark International, Inc. v. Static Control Components, Inc. & Chamberlain Group, Inc. v. Skylink Technologies, Inc.: The DMCA and Durable Goods Aftermarkets*, 19 BERKELEY TECH. L.J. 59, 77 (2004); Lance C. McCardle, Comment, *Despite Congress's Good Intentions, the DMCA's Anti-Circumvention Provisions Produce a Bad Result—A Means to Create Monopolies*, 50 LOY. L. REV. 997, 1021 (2004).

IV. REGULATORY RESPONSE TO EXTERNALITIES

The discussion in Part II showed that the process of creative authorship gives rise to *positive* externalities: benefits that, in the absence of any legal rules preventing it, may be appropriated by third parties without the creator's authorization. This appropriability was seen to be a special case of a more general phenomenon, in which all kinds of productive activity yield benefits that may be appropriated by third parties. The result of this uncompensated appropriation of value may be an undersupply of productive efforts, including both creative authorship and production of ordinary goods, since producers are not rewarded with the full social value that flows from their efforts. The law responds with assignments of rights (copyright, patents, trade secrecy, trademark) that allow the producer to limit—to an extent that is determined by public policy—the appropriability of the value created by its efforts.

The discussion in Part III showed that publishers' use of TPMs gives rise to *negative* externalities: societal harms that, in the absence of any legal rules to the contrary, are not factored into the publisher's decision whether to implement TPMs. The result is an oversupply of TPMs, since the publishers are insulated from the full social costs of this choice of productive technique.

Just as appropriability of the fruits of creative authorship was seen to be an aspect of the more general phenomenon of appropriability of the spinoffs of productive activity, so too externalization of costs through use of TPMs may be viewed as an aspect of the more general problem of externalization of the costs of productive activity. The paradigmatic externalization of costs of production is pollution. A factory releases pollutants into the air, which harms the health of individuals living downwind or releases pollutants into a lake and reduces the catch of fishermen. The company that owns the factory does not experience the harms to health or fishing yields and so does not factor the costs of those harms into its decision whether to implement less polluting, but more expensive, production methods. As a result, the factory owner decides to pollute, even if the pollution could be eliminated at a cost less than the value of the harms that the pollution causes. The decision to pollute is economically inefficient.

An analogy may thus be drawn between a publisher's use of TPMs and a manufacturer's use of polluting manufacturing technologies. Both are activities that impose costs upon third parties, which the profit-maximizing producer will be disinclined to factor into its choice of productive methods. It follows that, for the same reasons that regulators have established rules and incentives aimed at reducing producers' output of pollution, regulators should intervene to reduce publishers' output of TPMs.

Note that the goal of regulatory intervention is not to *eliminate* the activity that gives rise to negative externalities but only to reduce that activity to the efficient level. Thus, the goal of environmental policy is not to eliminate all polluting activities—which could only be done by banning automobiles, ending the production of electricity, and generally calling all industrial activity to a halt; the goal is rather to cause polluters to invest in pollution controls up to the point where additional controls would yield no net societal benefit. In the same way, my proposal does not aim at eliminating use of TPMs, but only at reducing use of TPMs to the efficient level.

In considering possible regulatory responses to the inefficient overuse of TPMs, we may seek guidance from the types of regulatory efforts that have been made to prevent inefficient overproduction of pollution. The advantages and disadvantages of each of these approaches, as applied to internalize the social costs of TPMs, are canvassed in the following.

A. *Traditional Command and Control*

Following the traditional command-and-control approach, the government would determine the optimal deployment of TPMs by each publisher with respect to each product and would require publishers to abide by those limitations or face the threat of legal sanction. The regulator's goal is to minimize the sum of the harms caused by productive activity and the costs of preventing those harms.⁸¹ This can be accomplished by compelling the producer to introduce preventative measures just up to the point where the gains to society from the prevention equal the costs to the producer of engaging in prevention.⁸² Both overinvestment and underinvestment in prevention are deviations from optimality: the former by resulting in outlays for prevention that are not justified by their benefits, the latter by continuing to produce externalized harms that could have been prevented at a cost lower than that experienced by the victims of the harms.

In the case of pollution, prevention costs consist of expenditures the producer must incur to eliminate the external harms caused by its pollution (or some portion of them) while maintaining the same level of productive output.⁸³ By analogy, the "output" attributable to

81. See Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 724 (1996) ("[W]e take the social goal to be the minimization of the sum of harm and prevention costs.").

82. See HAL R. VARIAN, *INTERMEDIATE MICROECONOMICS* 578 (5th ed. 1999).

83. Alternatively, the producer might choose to reduce pollution by reducing its level of productive activity, if doing so would be less costly (taking into account the forgone profits on forgone production) than maintaining the same level of production while installing pollution controls.

TPMs is a reduction in unauthorized use of the work of authorship that the TPM protects. Thus, prevention costs for publishers consist of what it would cost publishers to maintain the limits on unauthorized use brought about by TPMs, using alternative methods that do not result in externalized harms.⁸⁴ Such alternative methods might include, for example, an aggressive program of enforcement of copyrights.⁸⁵

Formulation of rules about TPM usage thus requires that the government regulator have information about both the magnitude of the externalized harms resulting from deployment of TPMs and the costs that publishers would incur to prevent unauthorized use through other means. Both of these types of information are likely to be difficult and expensive for the regulator to obtain. We might expect that publishers, which have a strong incentive to discover and implement the most cost-effective methods for preventing unauthorized uses of their products, would have better information as to their own costs than is readily available to regulators.⁸⁶ If that is the case, then a purely regulatory approach in effect wastes informational resources.⁸⁷ In addition, the administrative cost of determining the right level of TPMs would be very large, and this must be accounted for as a component of the cost of prevention.

Accordingly, the regulator should consider approaches that incorporate market mechanisms to take maximum advantage of information in the hands of private parties.

84. The relevant cost here is the *increased* cost to the publisher of using alternative methods rather than TPMs, since deployment of TPMs is not costless. We can presume that the alternative methods cost more for a given effect; otherwise publishers would be using them in favor of TPMs.

85. In 2003, the trade association of the record labels, the Recording Industry Association of America, launched such a litigation strategy against those who share .mp3 music files without the labels' authorization. As of March 2007, the industry had sued about 18,000 individuals. See Hiawatha Bray, *Record Firms Crack Down on Campuses*, BOSTON GLOBE, Mar. 8, 2007, at D1. Another approach is to place contractual restrictions on uses that may be made of copyrighted materials. Some courts have upheld such contractual restrictions against a challenge that they are preempted by the Copyright Act. See, e.g., *Wrench LLC v. Taco Bell Corp.*, 256 F.3d 446, 459 (6th Cir. 2001) (holding that Copyright Act did not preempt contract); *ProCD, Inc. v. Zeidenberg*, 86 F.3d 1447, 1453, 1455 (7th Cir. 1996) (same); *eScholar, LLC v. Otis Educ. Sys., Inc.*, 387 F.Supp.2d 329, 331-33 (S.D.N.Y. 2005) (same). Depending on their content, such restrictions might or might not entail negative externalities.

86. For the plausibility of that assumption in the general case, see Kaplow & Shavell, *supra* note 81, at 725 n.36 (assuming that injurers know their prevention costs better than the state).

87. See Eric Kades, *Preserving a Precious Resource: Rationalizing the Use of Antibiotics*, 99 NW. U. L. REV. 611, 637 (2005); Kaplow & Shavell, *supra* note 81, at 725-27. In view of the value of harnessing the informational resources of private parties, what accounts for the continued existence of command-and-control regulation? One possibility is that incentives-based approaches may involve monitoring costs that outweigh their informational advantages. See Kenneth R. Richards, *Framing Environmental Policy Instrument Choice*, 10 DUKE ENVTL. L. & POL'Y F. 221, 256-59 (2000).

B. Coasean Bargaining

The most market-oriented regulatory response is for the regulator to refrain from any direct regulation, aiming instead to create conditions that make it easier for private parties to negotiate efficient outcomes. This approach derives from the well-known Coase Theorem, which states that, under a certain set of idealized conditions, bargaining among affected parties will bring about the efficient level of production of externalities, regardless of the distribution of property rights.⁸⁸ In the pollution example, if the factory owner has an absolute legal right to pollute, downwind residents will bargain with the owner and pay it a sum of money to implement the efficient level of pollution control—that is, the level such that the cost of reducing pollution further would exceed the benefits to the residents. If, on the other hand, the residents have an absolute right to clean air, the factory owner will pay them a sum of money for permission to engage in that same, efficient level of pollution.⁸⁹

Coasean bargaining may be effective when there are only a few interested parties, the parties have good information about the relevant costs and benefits, and the costs of bargaining are low, but these conditions are absent from most real-world situations. In the case of the factory creating air pollution, there are many parties involved (everyone living downwind from the factory), which gives rise to a collective action problem in which individuals have an incentive to avoid paying their fair share of the pollution-reduction costs.⁹⁰ It is costly to engage in negotiations involving so many participants. Furthermore, it is difficult for any individual to calculate the monetary value of the harm he experiences due to the pollution.

For similar reasons, we cannot count on Coasean bargaining to reduce the implementation of TPMs to an efficient level. Those who experience the externalized harms of TPMs are numerous and scattered. They include people whose fair-use access to copyrighted works is impaired and those who are deprived of the benefits of a secondary market in copies of goods in digital formats. They may include anyone who experiences higher costs for consumer goods or reduced selection due to anticompetitive applications of TPMs. Bargaining involving so many individuals, as well as a multiplicity of publishers, would be prohibitively expensive. It would also be impossible for individuals to engage in rational bargaining, since few could place a monetary value on the detriments they experience from the use of TPMs in third-party transactions. Furthermore, many of those

88. R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

89. For discussion of the idea of an efficient level of pollution, see VARIAN, *supra* note 82, at 576-78.

90. See MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION* (1965).

harmed by TPMs are not presently available to engage in bargaining: they belong to future generations that may experience the detriments of a contracted public domain and reduced innovation and competition.⁹¹

This conclusion, that Coasean bargaining is not likely to be effective in bringing about an efficient level of production of *negative* externalities through implementation of technological protection measures, is paralleled by the unquestioned premise that such bargaining will not yield the efficient level of authors' capture of the *positive* externalities of their creative efforts. If Coasean bargaining were feasible in this context, there would be no need for copyright, patent, or trade secret protection.

Book authors, for example, could be expected to bargain with their (prospective) readers to obtain compensation sufficient to motivate their authorial efforts. An author could offer a prospectus for a new book on the open market and invite interested members of the public to pay him money in an amount representing the utility that each expects to enjoy from reading the book. In determining how much to contribute, each member of the public would need to take into account not only the expected value of the book to him personally but also the present value to him of the book's availability to his children and later descendants, who are unable to enter subscriptions themselves.

If the author received enough such contributions to make it worth his while to write the book, then he would do so. If not, then he would not write the book and could either keep the money⁹² or return it to the subscribers, as he calculated would best promote his interests.⁹³ With either outcome, the result is efficient. If the book is written, that indicates that the social benefit from writing the book exceeds the author's opportunity cost. If the book is not written, that is because society values the author's services more highly if directed to some activity other than writing the book. Copyright protection would be superfluous.⁹⁴

91. Eric Kades notes an analogous intertemporal externality in the context of overuse of antibiotics, resulting in accelerated bacterial resistance and less effective medication in the future. See Kades, *supra* note 87, at 627 ("[T]he very use of antibiotics imposes an external cost on later potential consumers.").

92. There would be no unfairness in this, since after all the subscribers were contributing amounts based on the *possibility* that a book would be written, and they got what they paid for, in the same sense that purchasers of losing lottery tickets paid for the possibility of winning a large sum of money.

93. He might choose to return the money if he thought that doing so would increase the total quantity of subscriptions to his next proposed book by an amount exceeding what he could have retained from the first subscription.

94. Bestselling author Stephen King tried something similar a few years ago. King began releasing chapters of a new novel, called *The Plant*, in monthly installments, for download from the Web according to an honor system: those who downloaded were asked to pay King a dollar for each chapter. David D. Kirkpatrick, *A Stephen King Online Horror*

In the same way, a prospective inventor could offer the public the opportunity to subscribe to his inventive efforts. Inventions that society valued highly enough would get invented, and others would not. There would be no need for patents, eliminating a significant claim on society's resources.⁹⁵

With trade secret protection the bidding would go in the other direction. Yum! Brands, Inc. would pay each member of the public whatever he required to refrain from making competitive use of the recipe for the eleven herbs and spices that distinguish Kentucky Fried Chicken from its imitators. If the total price was too high for Yum to stomach, that would simply mean that secrecy of the recipe is worth less to Yum than its free dissemination is worth to the public. Yum's profits would drop, but fried chicken lovers would gain in an amount that more than compensates.

The Coasean bargaining hypothesized in the preceding paragraphs is unlikely to come about. The transaction costs entailed by all that bargaining would swamp the subscriptions that could result from it. Individuals in the copyright and patent scenarios would be tempted to free ride: each would reason that if he withheld his own contribution the book would still get written, so nobody would contribute.⁹⁶ In the trade secret scenario there would be the problem of holdouts: many individuals would want to charge the trade secret owner a high price, reasoning that their own agreement was essential to the continued value of the secret, with the result that the total demanded would outstrip the secret's value.

Widespread recognition of the limits of Coasean bargaining in this context has resulted in government intervention in the market in the form of copyright, patent, and trade secret protection. For the same reasons, we should not expect Coasean bargaining to bring about the efficient level of TPM use by publishers.

C. Pigouvian Taxes

Another widely implemented approach to correcting production externalities is to impose a tax on the producer that is calibrated to give the producer an incentive to reduce to an efficient level the

Tale Turns into a Mini-Disaster, N.Y. TIMES, Nov. 29, 2000, at C1. King declared that he would keep writing and releasing chapters as long as at least 75% of downloaders paid the dollar. *Id.* By the fifth installment, only 46% of downloaders paid the fee. *Id.* Accordingly, as promised, King put the project on hold. *See id.*

95. Mark Lemley estimates that the processing of patent applications in the U.S. Patent and Trademark Office costs more than \$4 billion annually. Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1499 (2001).

96. The failure of Stephen King's serialized, downloadable novel, *supra* note 94, might perhaps be attributable to free ridership. King is after all one of the most successful novelists of recent decades, and *The Plant* might have been a success if copyright and excludability had been available to prevent free ridership.

quantity of social costs resulting from its activity.⁹⁷ This approach, which relies on marketplace incentives to a greater extent than does straightforward regulation but to a lesser extent than does Coasean bargaining, is sometimes called a Pigouvian tax, after the economist Arthur Pigou, who first proposed it.⁹⁸ An unregulated producer will rationally set its pollution emissions at a level such that the marginal benefit from increasing pollution emissions is zero.⁹⁹ Because the producer does not take account of the harms that its pollution causes to others, the level of pollution emitted will be higher than the socially optimal level. When a tax per unit of pollution is applied, the producer's net marginal gain from increasing pollution emissions will be reduced by the amount of the tax at any given level of production; conversely, the cost to the producer of controlling emissions will be reduced by the amount of tax that the producer saves for the pollution that is abated. If the tax is set at the correct level, the rational producer will choose to emit pollution¹⁰⁰ at the socially optimal level.¹⁰¹

The same approach may be applied to induce publishers to reduce their implementation of TPMs to the socially optimal level. Since publishers are not currently required to take any cognizance of the harms that their use of TPMs imposes on third parties, they produce more than the socially optimal level of TPMs. A tax at the appropriate level would motivate publishers to reduce their output of TPMs to the socially optimal quantity. As with the example of pollution, the goal is not to *eliminate* the use of TPMs; doing so would be inefficient, since by hypothesis a reduction below the socially optimal level harms the publisher more than it benefits society. The goal is rather to minimize the sum of the cost of replacing TPMs with methods that do not create negative externalities and the externalized harms that remain.¹⁰²

97. Examples of such taxes in the context of pollution control include those on ozone-depleting chemicals, 26 U.S.C. §§ 4681-82 (2000), and gas-guzzling vehicles, 26 U.S.C. § 4064 (2000). See Jay P. Kesan & Rajiv C. Shah, *Shaping Code*, 18 HARV. J.L. & TECH. 319, 344 n.127 (2005). For a skeptical assessment of the use of taxes to affect producer and consumer behavior, see generally Eric M. Zolt, *Deterrence Via Taxation: A Critical Analysis of Tax Penalty Provisions*, 37 UCLA L. REV. 343 (1989).

98. See ARTHUR PIGOU, *THE ECONOMICS OF WELFARE* (4th ed. 1962).

99. The premise of this approach is that at some level of pollution emissions, the marginal benefit to the producer of increasing emissions begins to decrease monotonically. That is, switching to production methods that result in the creation of more pollution yields continually lesser benefits, until at some point there is no more net benefit to be gained by increasing pollution. See VARIAN, *supra* note 82, at 578.

100. Pigouvian taxes have been proposed as a response to externalities in other contexts not involving pollution. See Kades, *supra* note 87, at 638-39 (proposing tax to control overuse of antibiotics).

101. For a graphical illustration of the theory underlying Pigouvian taxes, see Appendix B.

102. See VARIAN, *supra* note 82.

A TPM tax has the advantage of taking account of the different costs for alternatives faced by different publishers. With command-and-control, each publisher must reduce its TPM usage to the level specified by the regulator, regardless of its costs in doing so. With a TPM tax, publishers facing higher alternative costs (for example, those that experience unauthorized use by a large number of small users, making litigation more expensive than it is for publishers that are faced with a smaller number of large users) will find it economically advantageous to engage in relatively little TPM reduction, while those facing lower alternative costs will engage in more TPM reduction.¹⁰³ If the TPM tax is set at the proper level, the result is the same overall reduction in TPMs at a lower total cost to society.¹⁰⁴

The principal difficulty with this approach is that the regulator is likely to lack accurate information about the externalized harm resulting from TPMs. However, modifying incentives through taxation has an advantage over command-and-control regulation in that it at least harnesses the producer's presumptively better information about its own costs: it is the publisher, not the regulator, that decides what level of TPMs to implement, taking into account the TPM tax and the costs of alternatives to TPMs.¹⁰⁵

Moreover, uncertainty about empirical inputs is endemic to all forms of regulation, including existing applications of Pigouvian taxes.¹⁰⁶ The "gas guzzler" tax is an example of an effort by Congress to modify producer and consumer behavior through Pigouvian taxes that is based on impressionistic rather than rigorously empirical inputs.¹⁰⁷ As enacted in 1978, the provision imposed a set of excise taxes on manufacturers of automobiles that fall below specified fuel economy standards.¹⁰⁸ For model years 1986 and later,¹⁰⁹ the tax was zero for cars with a fuel economy of at least 22.5 miles per gallon, rising in steps to \$3,850 for each car produced that was rated at less than 12.5 mpg.¹¹⁰ The legislative history of the provision does not dis-

103. The larger the range of avoidance costs among different firms, the larger the potential efficiency gain from an incentive-based as compared to a command-and-control approach. See Richards, *supra* note 87, at 255-56.

104. See JOHN M. LEVY, ESSENTIAL MICROECONOMICS FOR PUBLIC POLICY ANALYSIS 180-81 (1995).

105. See *supra* note 87 and accompanying text.

106. See LEVY, *supra* note 104, at 180-81.

107. See Energy Tax Act of 1978, Pub. L. No. 95-618, §201, 92 Stat. 3174 (codified as amended in scattered sections of 26 U.S.C.).

108. *Id.*

109. Different sets of rates applied to model years 1980-85. *Id.* § 201(a).

110. The full table of taxes was as follows:

At least 22.5	\$0
At least 21.5 but less than 22.5	500
At least 20.5 but less than 21.5	650
At least 19.5 but less than 20.5	850
At least 18.5 but less than 19.5	1,050

close any econometric justification for the setting of these tax rates; that is, there is no stated empirical basis from which to conclude that that the selected tax rates will depress demand for low-fuel-economy cars to the “correct” level.¹¹¹ Given the scientific uncertainties concerning the harms resulting from increased consumption of gasoline and the difficulty in monetizing harms such as increased vulnerability of the economy to foreign supply interruptions, we could hardly expect a purely analytical approach to setting the excise tax level. Underlining the empirical uncertainty is the fact that in the 1990 amendment of the “gas guzzler” tax, Congress simply *doubled* each of the 1978 tax amounts.¹¹² Like the establishment of the original set of tax levels in 1978, the doubling of the tax schedule in 1990 reflected a *political* judgment based on impressionistic factors rather than hard-edged econometrics.

An analogous lack of empirical grounding underlies Congress’s calibration of the level of legal protection applying to creative authorship. A truly scientific regime of intellectual property protection would be based on empirical determinations of the value resulting from creative authorship that is appropriable by third parties and would be calibrated to allow that value (but no more) to be retained by the authors. But the life of intellectual property protection has not been logic: it has been experience.¹¹³ The empirical data needed for such a scientific approach have never been assembled and probably never could be.¹¹⁴ Legal protection of copyrights and patents sprang

At least 17.5 but less than 18.5	1,300
At least 16.5 but less than 17.5	1,500
At least 15.5 but less than 16.5	1,850
At least 14.5 but less than 15.5	2,250
At least 13.5 but less than 14.5	2,700
At least 12.5 but less than 13.5	3,200
Less than 12.5	3,850

Id.

111. From an economic standpoint, the correct levels of excise taxes are those which internalize all of the incremental external harms (such as harm to the environment in the form of increased air pollution, global warming, and oil spills; harm to future generations through depletion of nonrenewable fossil fuels; and additional military expenditures needed to insure a supply of foreign oil) resulting from use of low-fuel-economy cars. As is always the case, both underdeterrence and overdeterrence of an activity that has both beneficial and harmful consequences results in an overall loss to society.

112. Omnibus Budget Reconciliation Act of 1990, Pub. L. No. 101-508, 104 Stat. 1338, § 11216(a).

113. This of course paraphrases the famous Holmesian epigram. OLIVER WENDELL HOLMES, JR., *THE COMMON LAW* 1 (1881) (“The life of the law has not been logic; it has been experience.”).

114. See Abraham Bell & Gideon Parchomovsky, *A Theory of Property*, 90 CORNELL L. REV. 531, 563 (2005) (“[I]t is difficult to imagine empirical studies that would accurately identify the precise tradeoff necessary to achieve the optimal level of property protection.”); Neil Weinstock Netanel, *Copyright and a Democratic Civil Society*, 106 YALE L.J. 283, 369 (1996) (“[I]t is difficult, if not impossible, to determine with any degree of precision the

from a conviction that works of authorship and inventions would be underproduced if authors and inventors were not enabled to capture some of the value they created that would otherwise be freely appropriable,¹¹⁵ but the drafters of the Statute of Anne,¹¹⁶ the Venetian Law of 1474,¹¹⁷ the federal patent¹¹⁸ and copyright¹¹⁹ statutes in the 1790s, and their successor enactments did not rely upon econometric modeling to determine the correct level of protection. Levels of protection have instead been set through the interplay of political forces.

The same is true of the levies on recording equipment and blank media established by the Audio Home Recording Act (AHRA).¹²⁰ The levies, amounting to two percent of the price of recording equipment and three percent of the price of blank media,¹²¹ are paid by manufacturers and importers into a fund that is distributed to musicians, songwriters, performers, and others involved in making musical recordings.¹²² The rationale for the levy system is that it compensates the recipients for the loss of income that presumptively results from the use of digital audio recording devices to make unauthorized copies of musical recordings.¹²³ Consistent with this rationale, the royalty rates should be set at a level that generates a sum equivalent to the music industry's lost income.

term of copyright that would lead to optimum support for creative autonomy, while still allowing for sufficient user access.”).

115. Providing incentives to create has always been the dominant justification for copyright and patent protection in Anglo-American law, as is evident from the wording of the Intellectual Property Clause itself: “To promote the Progress of Science and useful Arts” U.S. CONST., art. I, § 8, cl. 8. A moral-rights basis for copyright coexists with the instrumentalist rationale, see William Patry, *The Failure of the American Copyright System: Protecting the Idle Rich*, 72 NOTRE DAME L. REV. 907, 911 (1997), but has never been the driving force behind copyright legislation. See Irah Donner, *The Copyright Clause of the U.S. Constitution: Why Did the Framers Include It with Unanimous Approval?*, 36 AM. J. LEGAL HIST. 361, 369-73 (1992) (discussing the motivation behind the enactment of state copyright laws in the 1780s).

116. Statute of Anne, 8 Ann., c. 19, 8 (1710) (Eng.).

117. The Venetian Law of 1474, generally regarded as the first patent law, is discussed in Peter K. Yu, *Currents and Crosscurrents in the International Intellectual Property Regime*, 38 LOY. L.A. L. REV. 323, 330-32 (2005).

118. Patent Act of 1793, ch. 11, 1 Stat. 318.

119. Act of May 31, 1790, ch. 15, 1 Stat. 124.

120. 17 U.S.C. §§ 1001-10 (2000).

121. The devices and media within the scope of the levy are defined, roughly speaking, to include those devices that are designed primarily for use by individuals in making digital copies of musical recordings. *Id.* §§ 1001(3), -(4)(A) (definitions of “digital audio recording device” and “digital audio recording medium”). The immediate target of the levy system was digital audio tape technology, which at the time of enactment of the AHRA was just beginning to enter the market.

122. *Id.* § 1004 (stating royalty payment rates); *id.* § 1006 (allocating royalty payments among several classes of recipients).

123. H.R. REP. NO. 102-780, pt. 1, at 56 (1992) (“Enactment . . . will ensure that all affected rights owners and beneficiaries will be compensated for the copying of their works on digital audio recording media . . .”).

But the data needed to derive this sum would be difficult or impossible to obtain. It would require determining how much unauthorized copying of recorded music occurs in private homes and how much of that copying would have been converted into purchases of commercial recordings if the recording technology had been unavailable. A Senate report refers to “[n]umerous reports” that “seek to quantify the exact effect home taping has upon the music industry.”¹²⁴ The reports that it mentions, however, state only broad estimates as to the extent of unauthorized taping and do not provide any basis for determining the level of the music industry’s lost income.

In fact, the royalty rates that are included in the statute derive not from any econometric study but from an agreement between representatives of the music industry and representatives of the consumer electronics industry. In 1990, songwriters and music publishers filed a lawsuit against Sony Corp., a manufacturer of DAT recorders, claiming that provision of the devices would constitute contributory copyright infringement.¹²⁵ A year later the parties arrived at a settlement, embodying a compromise agreement that “was incorporated into a legislative proposal and introduced in the Senate and the House.”¹²⁶ Included within that compromise was a schedule of royalty rates, which is identical to the rates as enacted.¹²⁷

Thus, the AHRA royalty rates were set by political compromise, as was the case with the gas-guzzler tax and as has always been the case in setting the level of protection provided by intellectual property laws.¹²⁸ The same procedure can be used to set the level of the TPM tax. It is unlikely that such a procedure will arrive at a tax that results in the optimal deployment of TPMs, but then neither does the current level of the tax—zero—yield that result.

124. S. REP. NO. 102-294, at 34 (1992).

125. See Gary S. Lutzker, Note, *DAT's All Folks: Cahn v. Sony and the Audio Home Recording Act of 1991—Merrie Melodies or Looney Tunes?*, 11 CARDOZO ARTS & ENT. L.J. 145, 164-70 (1992) (discussing *Cahn v. Sony Corp.*, No. 90 Civ. 4537 (S.D.N.Y. July 11, 1991)).

126. S. REP. NO. 102-294, at 33 (1992); see also H.R. REP. NO. 102-780, pt. 1, at 19 (1992) (the “compromise is embodied in the [proposed] legislation.”).

127. Compare H.R. REP. NO. 102-873, pt. 1, at 29-30 (1992), with 17 U.S.C. § 1004.

128. Several commentators have proposed the imposition of a levy to compensate copyright owners for revenues lost as a result of peer-to-peer file sharing. Under one such proposal, the amount of the levy would be arrived at through political compromise. See Neil Weinstock Netanel, *Impose a Noncommercial Use Levy to Allow Free Peer-to-Peer File Sharing*, 17 HARV. J.L. & TECH. 1, 44 (2003) (“The amount of the [levy] would be determined (and periodically adjusted) through negotiations between associations representing the industries upon which the levy is imposed and associations representing holders of rights in different categories of works.”). Other proposals are vague about how the amount of the levy would be determined. See Ku, *supra* note 36, at 312-14; Jessica Litman, *Sharing and Stealing*, 27 HASTINGS COMM. & ENT. L.J. 1, 40-42 (2004).

D. Cap and Trade

Another regulatory response to externalities that might be considered as a means of controlling TPM usage is a system of tradable permits allowing the holder to engage in the regulated activity, often referred to as “cap and trade.”¹²⁹ This approach had its origin in the context of environmental regulation. The system is conceptually very simple—consisting of (1) a legal prohibition on engaging in the regulated activity except as provided in a permit assigned to the entity that engages in the activity; (2) an initial allocation to regulated entities of permits allowing them to engage in a certain quantity of the regulated activity; and (3) a provision for the transferability of the permits, allowing regulated entities to buy and sell permits in a market.¹³⁰

The principal advantage offered by the system is that (at least in theory) it brings about the desired level of the regulated activity at a lower social cost than other systems of regulation. It does this by taking advantage of the fact that some entities can reduce their level of the regulated activity at a lower cost than other entities. Transferability of the allowances enables a shifting of the desired conduct to entities that can engage in it at the lowest cost.¹³¹

A well-established implementation of the cap-and-trade system is the acid rain reduction program, created by the Clean Air Act¹³² and administered by the U.S. Environmental Protection Agency.¹³³ The program is designed to reduce the quantity of sulfur dioxide (SO₂) emitted by utilities in the generation of electricity.¹³⁴ Each year, the EPA assigns to each generating unit a quantity of allowances permitting it to emit a certain amount of SO₂ during that year.¹³⁵ A utility that expects to emit more SO₂ than it is allowed may come into compliance either by reducing its emissions or by buying the right to emit more than its allowance. Conversely, a utility that emits less than its allowance may either relax its emission-control efforts or may sell the right to emit the unneeded portion of its allowance.¹³⁶ If an over-emitting utility would have to pay more to reduce its emis-

129. See James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 617-18 (2000).

130. *Id.*

131. See Jeffrey M. Hirsh, *Emission Allowance Trading Under the Clean Air Act: A Model for Future Environmental Regulations?*, 7 N.Y.U. ENVTL. L.J. 352, 354-55 (1999).

132. 42 U.S.C. § 7651 (2000).

133. The EPA's regulations are at 40 C.F.R. 72-79 (2006).

134. 42 U.S.C. § 7651. The program also aims at reduction of nitrogen oxide emissions, but not through a system of tradable allowances.

135. The total quantity of allowances will decline from 9.5 million in 2004 to 8.95 million in 2010, each allowance permitting discharge of one ton of SO₂. See ENVTL. PROT. AGENCY, ACID RAIN PROGRAM 2004 PROGRESS REPORT 4-5 [hereinafter ACID RAIN PROGRESS REPORT], available at <http://www.epa.gov/airmarkets/progress/docs/2004report.pdf>.

136. See Hirsh, *supra* note 131, at 354.

sions by a ton than an under-emitting utility would gain through relaxing its emissions control by the same amount, then both utilities can benefit from a transfer of a one-ton permit.¹³⁷ The transfer also results in a social benefit, since by hypothesis the emission reduction will be accomplished through a lower expenditure of resources than if the over-emitting utility was required to reduce its emissions.

An analogous system of tradable allowances could be applied to publishers using TPMs. The regulator would begin by setting an aggregate TPM budget—that is, determining what quantity of allowances for TPM-generated negative externalities would be allocated to publishers. Establishing a valid metric would be the first hurdle. Without a metric, it would be impossible for the regulator to specify what types of TPM usage an allowance allows or to assess a publisher's compliance with the limitations created by the allowance system. The premise of a cap-and-trade system is that the aggregate output of the regulated activity is unchanged by the transfer of allowances from one regulated entity to another. The regulator must therefore have a criterion for determining whether the entity acquiring an allowance engages in the same quantity of the regulated activity as the original holder of the allowance was allowed.

In the present context, identifying an adequate metric for TPMs would be quite difficult.¹³⁸ The regulator would in principle have to determine the economic value of the externalized harm resulting from any given use of a TPM. The magnitude of that harm would vary not only with the type of TPM (for example, tethering versus anticopy technologies) but also with the content of the TPM-protected work. For example, a tethering control on a tax-preparation software program might create less harm (through elimination of a secondary market) than the same control on a word-processing program, since the former has value to users only during a limited time period while the latter may have value indefinitely.

137. The price at which the allowance changes hands depends on the market. For example, suppose that Utility A must reduce its emissions by one ton of SO₂ and that Utility B currently emits one ton less than it is allowed. To reduce its emissions by that one ton, Utility A would have to install pollution-control equipment costing \$1,000. If it chose to emit an additional ton, Utility B would save \$500 in pollution-control costs. Under this scenario, both utilities would be made better off by Utility B's sale of a one-ton permit to Utility A at some price between \$500 and \$1,000. In a well-functioning market, the price will depend on the aggregate supply and demand of the permits. Trading of allowances is active. In 2004, 7.5 million allowances were transferred between economically unrelated parties. See ACID RAIN PROGRESS REPORT, *supra* note 135, at 6-8.

138. I have previously suggested that for purposes of analysis a metric could be developed through operation of a "shadow market" that measures consumer antipathy to particular TPM implementations. See Rothchild, *supra* note 47, at 518 n.107. But this methodology would fail to capture the externalized harms from TPM use that, by definition, are not of concern to the user of a TPM-protected item.

However, difficulty in identifying an appropriate metric is not unique to this context. The same problem surfaces when devising cap-and-trade programs to control environmental pollutants. For example, acreage is the simplest metric to employ in measuring wetlands, but depending on the policy objective in preserving wetlands, one acre is not necessarily the equivalent of another. Thus, a cap-and-trade program that uses acreage as the metric will not necessarily preserve the environmental benefits of wetlands at which the program is aimed.¹³⁹ Even where the regulated activity is fungible in nature, there may be nonfungibilities along the dimensions of time and space that a given metric fails to account for adequately.¹⁴⁰ Thus, even though a ton of SO₂ is physically the same no matter which utility plant emitted it, using tons of SO₂ as the metric for the acid rain program disregards the consequences of concentrating emissions at particular times or in particular locations.

In the face of these difficulties, we could not hope to identify and implement a metric for TPM externalities that perfectly captures the externalized effects of TPM usage. But perfection is an unrealistic goal for regulation of any sort. It may be possible to devise a cap-and-trade program for TPMs that, like the regime of legal protection for intellectual property, is based on a combination of econometrics, politics, estimation, and conjecture, without any pretense of perfection.

The effect of a well-functioning cap-and-trade program for TPMs would be to shift TPM usage away from publishers that get relatively little benefit from TPMs and toward publishers that get a relatively large benefit. Those that benefit relatively little (on a per-unit-of-external-harm basis) are better off selling their allowances and forgoing use of TPMs, while other publishers are better off buying allowances so that they can use more TPMs.

V. CONCLUSION

In this Article I have argued that in the absence of any regulatory limits on the use of TPMs, profit-maximizing publishers will implement TPMs at an inefficiently high level. Regulatory action aimed at making publishers take into account some of the externalized harms caused by TPMs is justified on the basis of two analogies. First, public policy as embodied in the legal regimes of intellectual property protection allows authors, inventors, and producers generally to internalize some of the positive externalities resulting from their ef-

139. See Salzman & Ruhl, *supra* note 129, at 631 (“If our principal objective in wetlands protection is conservation of open space, then acres may be an adequate currency for a wetlands [environmental trading market]. If the goal is conservation and delivery of services, then acres fare poorly.”).

140. *Id.* at 638-42.

forts; requiring publishers to internalize some of the negative externalities of TPMs seems equally justified. Second, public policy requires other classes of entities generating negative externalities—in particular, polluters—to internalize some of the resulting costs; consistency calls for placing the same requirement on publishers.

Of the several possible regulatory approaches I consider, traditional command-and-control regulation is not the best choice because it fails to take advantage of information held by market participants, and Coasean bargaining is impractical due to the large number of interested parties and consequent high bargaining costs. Pigouvian taxes and cap-and-trade both do a better job of incorporating marketplace intelligence. There is no clear basis for preferring one over the other. In the absence of any more definitive criterion, I propose a cap-and-trade program as the more market-oriented of the two. Each of the suggested approaches has its drawbacks, but that is not a reason for abandoning the project. In the real world, perfect regulation is as rare as a perfectly effective TPM.

APPENDIX A

The equation in Part II(C)(2) is derived as follows:

A producer's average total cost (ATC) consists of the total cost of manufacturing a given quantity of output divided by that quantity. The total cost of manufacturing (TC) is the sum of two components: the producer's fixed cost (FC) and its total variable cost (VC). Thus,

$$TC(q) = FC + VC(q),$$

where q represents the quantity of output.

If we represent the original producer's fixed costs as FC_{op} , then the amount of these costs that the second comer is able to avoid is

$$A \cdot FC_{op},$$

where $0 < A < 1$.

We can now compare the total costs of the original producer with those of the second comer. The original producer's total cost is

$$TC_{op} = FC_{op} + VC_{op}.$$

The advantage the second comer gains by his copying consists of the value it is able to appropriate minus what it costs to accomplish the appropriation, namely

$$A \cdot FC_{op} - CE_{sc},$$

where CE_{sc} is the second comer's copying expenses.

If we assume that the original producer and the second comer experience identical variable costs (that is, $VC_{op} = VC_{sc}$), then this expression also represents the second comer's comparative advantage:

$$\begin{aligned} TC_{op} - TC_{sc} &= (FC_{op} + VC_{op}) - (FC_{sc} + VC_{sc}) \\ &= (FC_{op} + VC_{op}) - (FC_{op} - [A \cdot FC_{op} - CE_{sc}] + VC_{sc}) \\ &= A \cdot FC_{op} - CE_{sc}. \end{aligned}$$

The percentage of the second comer's savings is the amount of those savings divided by the original producer's costs, or

$$\frac{A \cdot FC_{op} - CE_{sc}}{FC_{op} + VC_{op}}.$$

APPENDIX B

The use of taxes to correct misallocations of resources resulting from externalities may be illustrated graphically. In Figure 1, line MB_p is the marginal benefit that a producer obtains as it shifts to increasingly polluting production methods. The quantity of pollution that is optimal for the producer is q , where the marginal benefit is zero—increasing the level of pollution beyond q means incurring costs that exceed benefits, and polluting at a level less than q means forgoing some net benefits. Line MC_v shows the marginal cost to victims of the pollution at different levels of pollution. The socially optimal level of pollution is q' , which is less than q . At this level, the marginal cost to the producer of reducing pollution equals the marginal benefit to the victims. The producer can be induced to reduce its pollution emissions to q' by imposition of a tax in the amount of t . A tax at that level shifts the producer's marginal benefit curve from MB_p to MB'_p , which makes q' the optimal level of pollution for both the producer and society.

FIGURE 1

