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Antitrust for Patent Pools: A Century of Policy Evolution

Richard J. Gilbert*

I. Introduction

On June 26, 1997, the Department of Justice (“DOJ”) issued the first in a series of business review letters dealing with antitrust risks posed by patent pooling arrangements. The first letter responded to a request by the MPEG LA group¹ in connection with the group’s intention to pool and jointly license patents necessary to comply with the MPEG-2 standard.² MPEG-2 is a digital technology for video compression. Nine different entities owned patents that were essential to use the MPEG technology. The MPEG group proposed a jointly owned agent (“MPEG LA”) that would license the essential patents as a single package. On December 16, 1998 and June 10, 1999, the Antitrust Division issued similar business review letters in connection with the Digital Versatile Disc (“DVD”) technology.³ The letters responded to proposals to offer package licenses for patents necessary to manufacture DVDs and players in compliance with the DVD-ROM and DVD-video formats.

The DOJ reacted favorably to both the MPEG and DVD proposals. These proposals included the following competitive safeguards:

1. Limitation of the portfolio to technically essential patents which, by definition, are not competitive with each other.
2. Portfolio patents are clearly identified and can be licensed individually as well as in a package.
3. Issue of worldwide non-exclusive licenses.
4. Licensee liability for royalties conditioned on actual use of the patents.

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¹ MPEG stands for Moving Picture Experts Group.

² Letter from Joel I. Klein, Assistant Attorney General, U.S. Department of Justice, to Garrard R. Beeney, Sullivan & Cromwell (June 26, 1997).

³ Letter from Joel I. Klein, Assistant Attorney General, U.S. Department of Justice, to Garrard R. Beeney, Sullivan & Cromwell (Dec. 16, 1998); Letter from Joel I. Klein, Assistant Attorney General, U.S. Department of Justice, to Carey R. Ramos, Paul, Weiss, Rifkind, Wharton & Garrison (June 10, 1999).

5. Freedom of licensees to develop and use alternative technologies.
6. Requirement that licensees grant back non-exclusive, non-discriminatory licenses to use patents that are essential to comply with the technology.

The DOJ business review letters provide a template for patent pooling arrangements that should not run afoul of the antitrust laws.⁴ The letters embody a new thinking in economics and law and contrast sharply with early judicial opinions about the legality of patent pooling arrangements. Section II of this paper reviews legal jurisprudence dealing with patent pooling arrangements. This historical survey traces the changes that have occurred in courts' deference to intellectual property and in their recognition of efficiencies and potential costs from the combination of firms' patent portfolios through pooling or cross-licensing. The first major case dealing with patent combinations and antitrust law was *E. Bement & Sons v. National Harrow Co.*,⁵ decided just over 100 years ago. Economics was not a party to that opinion and was generally secluded from legal opinions in this area until much later.

Section II explores how the analysis provided in these historical case opinions corresponds to the analytical methodology described in the DOJ/FTC *Antitrust Guidelines for the Licensing of Intellectual Property*.⁶ The cases motivate simple economic models that provide guidance about the costs and benefits of certain types of pooling arrangements. Section III illustrates how economic factors have influenced courts' evaluations of pooling arrangements by developing a quantitative index of the competitive issues raised in these cases. The results indicate that the legal evaluation of most cases involving patent pools and cross-licensing arrangements has not hinged on the competitive relationships of the patents involved in the arrangements. The most decisive

⁴ The DOJ responses were not without controversy. See, e.g., Steve C. Carlson, *Note: Patent Pools and the Antitrust Dilemma*, 1999 YALE J. ON REG. 359, 399 (Antitrust agencies should not adopt a per se rule of legality for the pooling of blocking patents and must carefully delineate the permissible scope of broader pools.)

⁵ 186 U.S. 70 (1902).

⁶ Department of Justice & Federal Trade Commission, *Antitrust Guidelines for the Licensing of Intellectual Property* (Apr. 5, 1995), reprinted in 4 Trade Reg. Rep. (CCH) par. 13,132, available at <http://www.usdoj.gov/atr/public/guidelines/ipguide.htm> [hereinafter DOJ/FTC Intellectual Property Guidelines].

factor in courts' determinations of whether patent pooling arrangements have violated the antitrust laws has been restrictive licensing terms.

Section IV attempts to draw conclusions for antitrust enforcement from the history of patent pooling cases and from the economic analysis. The economic analysis suggests that restrictive licensing terms should not necessarily raise competition concerns if patents are not substitutes for each other. However, the cases reveal that many unlawful patent pooling and cross-licensing arrangements were actually cartel agreements thinly disguised as patent licenses. Such shams should not escape antitrust condemnation even if the patents involved in the arrangement are not substitutes. Section IV notes that the social return from challenges to weak patents is much higher than the private return and ends with a recommendation that antitrust agencies become more proactive in this area.

II. A brief history of patent pools

The DOJ business review letters for the MPEG-LA and DVD patent pools reflect legal and economic analysis that is the product of many decades of changing thought. In the early years of patents and antitrust, the view was that patentees had unbridled rights to assign, exchange, or combine their intellectual property rights. Courts soon recognized that patents were not exempt from the antitrust laws. However, it was not until recently that courts' analysis of patent pooling and cross-licensing arrangements approached the standards expressed in the DOJ business review letters.

A. Intellectual Property Reigns Supreme: *E. Bement & Sons v. National Harrow Co.*⁷

The U.S. Supreme Court decided *E. Bement & Sons v. National Harrow Co.* in 1902. After suing each other for patent infringement, six different firms assigned eighty-five patents dealing with float spring tooth harrows to National Harrow.⁸ Bement was a licensee. The pool grew to twenty-two firms accounting for over ninety percent of all

⁷ 186 U.S. 70 (1902).

⁸ A harrow is an agricultural device for spreading crop residue on fields, usually before planting.

manufacturing and sales of float spring tooth harrows in the United States.⁹ Each firm was required to adhere to uniform price schedules for the sale of all products manufactured under the National Harrow license. The pool set uniform license terms that fixed prices for licensed products, required that the licensee make or sell only the licensed products, and obligated licensee not to challenge the patents and to defend the patents if challenged by others.

The Supreme Court did not engage in a detailed analysis of the antitrust implications of the National Harrow pool. In particular, the Court did not inquire as to whether the patents included in the pool were actually blocking or perhaps covered technologies that were substitutes for each other.¹⁰ The Court held that the licensing terms were lawful, even though they fixed prices for licensed products and prohibited the manufacture or sale of unlicensed products. The Court reasoned that the pool was legal because:

[T]he general rule is absolute freedom in the use or sale of rights under the patent laws of the United States. The very object of these laws is monopoly, and the rule is, with few exceptions, that any conditions which are not in their very nature illegal with regard to this kind of property, imposed by the patentee and agreed to by the licensee for the right to manufacture or use or sell the article, will be upheld by the courts. The fact that the conditions in the contracts keep up the monopoly or fix prices does not render them illegal.¹¹

The themes expressed by the Court in *National Harrow* are that: (1) patent laws trump antitrust laws; (2) pooling arrangements confer benefits by avoiding costly litigation over patent scope and validity¹²; and (3) licensing terms that fix prices are not unlawful because patentees have the right to specify the prices at which their products are sold.¹³

⁹ See Willard K. Tom, Licensing and Antitrust: Common Goals and Uncommon Problems, Address at the American Conference Institute Ninth National Conference on Licensing Intellectual Property (Oct. 12, 1998), available at <http://www.ftc.gov/speeches/other/aciipub.htm>.

¹⁰ Blocking patents have overlapping claims such that the invention claimed in one patent cannot be practiced without infringing the claims of the other patent, and visa versa. See Carlson, *supra* note 4.

¹¹ E. Bement & Sons v. Nat'l Harrow, Co., 186 U.S. 70, 91 (1902).

¹² "Suits for infringements and for injunction had been frequent, and it was desirable to prevent them in the future." *Id.* at 93.

¹³ The provision in regard to the price at which the licensee would sell the article manufactured under the license was also an appropriate and reasonable condition. It

B. The Dawn of Antitrust: *Standard Sanitary Manufacturing v. United States*

Ten years after the *National Harrow* decision, the Supreme Court apparently recognized that it had gone too far in its support of the rights of patentees and did an about-face in *Standard Sanitary Manufacturing v. United States*.¹⁴ In that case, the Court upheld the breakup of a joint licensing arrangement for patents relating to an enameling process for sanitary ironware. The licensing arrangements established a standard royalty for the licensed patents, fixed discounts for product prices,¹⁵ and prohibited the marketing of inferior “seconds.”¹⁶

On its face, the Standard Sanitary pooling arrangement was similar to that in *National Harrow*, yet the Court held that the Standard Sanitary pool violated the antitrust laws. In some respects, the licensing terms in *Standard Sanitary* were less onerous than those in *National Harrow*. It does not appear that Standard Sanitary imposed an obligation on licensees to defend the licensed patents, as in *National Harrow*. In *National Harrow*, licensees were prevented from using non-licensed harrows. Standard Sanitary obligated members of the pool to license only the approved products, which it defended by appealing to the benefits from quality assurance.

As in *National Harrow*, the Court did not explicitly consider whether the patents involved in the Standard Sanitary licensing arrangement were blocking, complementary, or substitutes for each other. Interestingly, the Court did report that two of the three key patents involved in the licensing arrangement infringed the third patent. This suggests that the pool eliminated blocking positions and in that respect was potentially pro-competitive. Yet this fact received essentially no weight in the Court’s antitrust evaluation.

tended to keep up the price of the implements manufactured and sold, but that was only recognizing the nature of the property dealt in, and providing for its value so far as possible. This the parties were legally entitled to do. The owner of a patented article can, of course, charge such price as he may choose, and the owner of a patent may assign it, or sell the right to manufacture and sell the article patented, upon the condition that the assignee shall charge a certain amount for such article.

Id. at 93.

¹⁴ 226 U.S. 20 (1912).

¹⁵ “[The licensing agreement] fixed royalties of \$5 per day for each furnace, subject to a diminution of like amount for furnaces shut down for more than six consecutive working days. It fixed preferential discounts from the regular selling prices, confining them only to sales by the manufacturers to jobbers.” *Id.* at 44.

¹⁶ “‘First and foremost’ it was to be agreed that no ‘seconds’ should be marketed.” *Id.* at 41.

C. Efficiencies Defense for Patent Pools: Complementary Patent Rights

Two decades later, the Supreme Court specifically addressed the issue of blocking patents in its review of *Standard Oil Co. v. United States*.¹⁷ In this case the Court reversed a district court finding that Standard Oil of Indiana and others had created an illegal patent pool to combine patents related to gasoline cracking, a key process in the refining of crude oil into gasoline. The focus of this analysis was on whether the cross-licensing of blocking patents violated the antitrust laws. Patents “A” and “B” are in a blocking relationship if the practice of each patent would infringe the other in the absence of a license.¹⁸ Patents “A” and “B” are in a one-way blocking relationship if the practice of “B” requires a license from “A,” but “A” does not infringe “B.” This typically corresponds to a situation where “B” improves “A” in some capacity (or “A” may cover a research tool or some other process that is necessary to produce a product covered by “B”). Patents that are one-way or two-way blocking are complementary, in the sense that an increase in the price of one patent (or a reduction in its availability) reduces the value of the other patent. To complete the taxonomy, patents “A” and “B” are substitutes for each other if they cover products or processes that can be made or exploited using either patented technology. Patents “A” and “B” are independent if they are neither substitutes nor complements.¹⁹

The Court found that the licensing agreement in *Standard Oil* contained none of the terms held to violate the antitrust laws in *Standard Sanitary*. In particular, the licensing terms did not restrict the freedom of the defendants individually to issue licenses under their own patents and did not impose any restrictions upon the quantity of gasoline to be produced; upon the price, terms, or conditions of sale; or upon the territory in which sales might be made. “The only restraint thus charged is that necessarily arising

¹⁷ *Standard Oil Co. (Indiana) v. United States*, 33 F. 2d 617 (D.C. Ill. 1929), *rev'd*, 283 U.S. 163 (1931).

¹⁸ See Tom, *supra* note 9.

¹⁹ For a discussion of blocking and complementary and substitute patents, see R.J. Gilbert & W.K. Tom, *Is Innovation King at the Antitrust Agencies? The Intellectual Property Guidelines Five Years Later*, 69 ANTITRUST L.J. 1 (2001); Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*, 16 J. ECON. PERSP. 131 (2002); and Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting*, in 1 INNOVATION POLICY AND THE ECONOMY 119 (Adam B. Jaffe et al. eds., 2001).

out of the making and effect of the provisions for cross-licensing and for division of royalties.”²⁰

The Court disagreed with the complaint by the DOJ that the cross-licensing agreement, which provided for joint setting and division of royalties, eliminated competition and tended to raise prices. Instead, the Court focused on the benefits of a cross-licensing arrangement for blocking patents. The Court concluded that none of the patents involved in the pool was fundamental,²¹ but that each of the defendants had developed a cracking technology that arguably infringed other defendants’ patents.²² Most of the patents in the *Standard Oil* pooling arrangement were improvements upon other inventions. The basic inventions could block the use of the improvements, but the improvements did not prevent the use of the basic inventions. That is, the patents were one-way blocking.

The Supreme Court emphasized the benefits of cross-licensing of blocking and complementary patents in the *Standard Oil* pooling arrangement. Yet, the Court did not perform a detailed evaluation of whether all of the patents involved in the pool were actually blocking or complementary, or whether some might have been substitutes for each other. Instead, the Court took comfort in the observation that the pool did not fix product prices or limit the use of non-licensed technologies. Furthermore, the Court noted that cracked gasoline accounted for only twenty-six percent of all gasoline sold and that the pool members accounted for only fifty-five percent of all U.S. cracking capacity. The Court found that these numbers supported its conclusion that the pool was unlikely to harm competition, despite the fact that the collective market share of the pool participants was almost certainly large enough to permit the exercise of market power (and in any case should not shield an agreement to fix royalties if the patents were truly substitutes).

²⁰ 283 U.S. at 170.

²¹ “[T]he phenomenon of cracking was not controlled by any fundamental patent.” *Id.* at 167.

²² Each of [the defendants] secured numerous patents covering its particular cracking process. Beginning in 1920, conflict developed among the four companies concerning the validity, scope, and ownership of issued patents. One infringement suit was begun; cross-notice of infringement, antecedent to other suits, were given; and interferences were declared on pending applications in the Patent Office. The primary defendants assert that it was these difficulties which led to their executing the three principal agreements which the United States attacks; and that their sole object was to avoid litigation and losses incident to conflicting patents.

Id. at 167-68.

The Supreme Court returned to the issue of cross-licenses for one-way blocking patents in *United States v. Line Material Co.*²³ The Southern States Equipment Corporation held a dominant patent on a particular type of circuit protection device.²⁴ Southern's patent blocked a subservient patent issued a few months later and assigned to the Line Material Company. The patent held by Line Material improved on the basic patent held by Southern, and the Court recognized that a cross-license between Southern and Line Material would be necessary for either company to exploit the technology inherent in both patents.²⁵ This was a classic one-way blocking situation.

Southern and Line Material entered into a cross-licensing agreement whereby Southern made Line Material the exclusive licensor of Southern's dominant patent. The agreement gave Line Material the power to fix prices for devices that embodied both patents. The Court held that this power to fix prices under both patents was anticompetitive:

By the patentees' agreement the dominant . . . and the subservient . . . patents were combined to fix prices. In the absence of patent or other statutory authorization, a contract to fix or maintain prices in interstate commerce has long been recognized as illegal per se under the Sherman Act.²⁶

The Court emphasized that cross-licensing to promote efficient production is not unlawful (as it had concluded in the *Standard Oil* case). "There is nothing unlawful in the requirement that a licensee should pay a royalty to compensate the patentee for the invention and the use of the patent. The unlawful element is the use of the control that such cross-licensing gives to fix prices."²⁷

The key distinction between *Standard Oil* and *Line Material* is that the cross-licensing arrangements in the former did not explicitly fix prices for gasoline made with the licensed technology, although the *Standard Oil* cross-licenses did specify royalties, which of course have an impact on product prices.

²³ 333 U. S. 287 (1948).

²⁴ More specifically, Southern held a patent covering a dropout fuse cutout with double jointed hinge construction. *Id.* at 290.

²⁵ "Only when both patents could be lawfully used by a single maker could the public or the patentees obtain the full benefit of the efficiency and economy of the inventions." *Id.* at 291.

²⁶ *Id.* at 307.

²⁷ *Id.* at 315.

In *Baker-Cammack Hosiery Mills, Inc. v. Davis Co.*,²⁸ the Fourth Circuit Court of Appeals held that a combination of patents related to elastic-top, self-supporting hosiery and methods for producing it did not violate the antitrust laws, noting that the licenses at issue did not include anticompetitive restrictions. In particular, the court concluded that the licenses “contained no restrictions as [to] the quantity of goods to be produced, or the price to be charged, or the territory in which they might be sold by the licensee.”²⁹

The court in *Baker-Cammack* inquired whether the patents were substitutes or complements, noting that:

[T]here is testimony to the effect that stockings may be made either according to the Davis or the Getaz method, some mills using one and some the other. But it was held by the District Court, and the evidence supports the holding, that the patents are complementary rather than competitive.³⁰

The discussion in the opinion is consistent with the patents being one-way complements. That is, it is possible to make hosiery that embodied only one of the patents, but there was a demand for products that used all of the licensed patents. Thus, in this case, the court was not troubled by the possibility of one-way complements, and it was the absence of restrictions in the licenses that swayed its decision

The court reached a similar conclusion in *Carpet Seaming Tape Licensing Corp. v. Best Seam Inc.*³¹ The appellant Carpet Seaming had acquired several patents that covered hot-melt adhesives to join carpet seams. A lower court found that the combination was unlawful. The appellate court reversed the finding, noting that the lower court ignored the possibility that one of the patents “may well have blocked” the others.³² The facts in *Carpet Seaming* were similar to those in *Line Material*, where the license gave one of the patentees the power to set royalties for both products. Nonetheless, the court’s decision reflected a confident view that, as of 1980, the amalgamation of one-way blocking patents did not violate the antitrust laws.

Economic theory supports the conclusion that pooling of two-way blocking patents is pro-competitive. Suppose a total of N patents is essential to practice a

²⁸ 181 F.2d 550 (4th Cir. 1950).

²⁹ *Id.* at 569.

³⁰ *Id.* at 570.

³¹ 616 F.2d 1133 (9th Cir. 1980).

³² The appellate court did not assert this as a fact.

technology, meaning that each of the N patents is sufficient to block the use of the technology. Demand for the technology depends on its price, which in turn depends on the total royalties charged for use of all of the patents. Suppose royalties are charged on a per-unit basis. This would be the case if the royalty is based on sales or is calculated as a percentage of the revenues generated using the technology. Let R be the total price and r_i the royalty rate for the i^{th} patent. The total royalty required to practice a technology for which the N patents is essential is the sum of all of the individual royalties: $R = \sum r_i$. As an illustration, suppose that the demand for the licensed technology is a linear function of the total royalty: $D(R) = A - bR$. The total revenue that a pool would earn by licensing the N essential technologies is $R \cdot D(R)$. The total royalty that would maximize the pool's revenue is the monopoly price $R^m = \frac{A}{2b}$.³³

In contrast, acting independently, each of the N patentees would choose a royalty r_i to maximize its own licensing revenue: $r_i \cdot D(R)$. Let R_{-i} be the sum of the royalties charged by all of the $N-1$ technology rights holders other than i . The demand for a license from the i^{th} patentee is the residual demand $(A - bR_{-i}) - br_i$, which takes into account the royalties charged by the other rights holders. If the licensor believes that its royalty rate has no effect on the royalties charges by the $N-1$ other rights holders, then its profit-maximizing royalty is $r_i^* = \frac{A - bR_{-i}}{2b}$. This is the monopoly price for its residual demand.

The patentees are identical, so the profit-maximizing royalty r_i^* is the same for all patentees (r) and $R_{-i} = (N-1)r$. Consequently, $r^* = \frac{A}{(N+1)b}$. The total royalty required to

license all of the N complementary technologies is $R^* = Nr^* = \frac{NA}{(N+1)b}$.³⁴

³³ See D. CARLTON & J. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 96 (1999).

³⁴ This derivation is mathematically equivalent to the standard Nash-Cournot oligopoly problem with the prices charged by the other patentees taking the place of quantities in the Nash-Cournot model. See *id.* at 188-91. Shapiro derives a similar result for the case of constant elasticity demand. See Shapiro, *supra* note 19, at 150. J. Lerner and J. Tirole generalize the result to examine the competitive effects of pooling patents that are imperfect complements. See JOSH LERNER & JEAN TIROLE, EFFICIENT PATENT POOLS (Nat'l Bureau of Econ. Research, Working Paper No. w9175, Sept. 2002) (finding that pools are more likely to be welfare-enhancing if patents are more complementary), available at <http://www.nber.org/papers/w9175>.

This result is a special case of the “double monopoly” problem encountered when manufacturers and distributors each add a markup to a good.³⁵ The manufacturer and distributor are in a complementary relationship that is similar to the relationship of licensors of essential patents. Acting independently, each patentee ignores the effect of its royalty on the licensing revenues of other patentees. However, the demand for licenses depends on the total royalties charged by all the licensees. Thus, the failure to coordinate royalty rates for essential patents can result in total royalties that exceed the royalty that a pool would charge to maximize its licensing revenue.

Figure 1 compares R^* and R^m for different numbers of complementary technologies, N . For $N > 1$, the total royalty with independent licensing exceeds the pooled royalty. The difference increases with N , and as N becomes large, the total royalty approaches the value that eliminates all demand for the technology. These results are in part a consequence of the assumption of per-unit royalties. However, even with fixed fees for the licensed technologies, independent licensing can cause coordination difficulties that can result in failures to obtain all of the licenses necessary to use the technology.

As in the case with two-way blocking patents, the “double monopoly” problem also can emerge with independent licensing of one-way blocking patents. In *Line Material*, if Southern had licensed its patent at a uniform per-unit royalty, Line Material would have added its own margin to the price of the final product. As a consequence, the price of the final product could have exceeded the profit-maximizing price with joint royalty-setting. Cooperative determination of royalties by Southern and Line Material would be a way to avoid the double monopoly problem and could result in lower prices for the final product.

However, the pooling of one-way blocking patents can raise additional competitive concerns that are unlikely to arise with the pooling of two-way blocking patents. Limited competition can occur with one-way blocking patents and, under some conditions, this can result in lower prices than would obtain if the companies cooperated in setting a royalty for the final product. Consider the following simple model. All consumers have a willingness to pay for one unit of the good that is equal to the good’s value (or quality), which is known to all consumers. Firm 1 (e.g., Southern) has a

³⁵ See CARLTON & PERLOFF, *supra* note 33, at 398.

dominant patent that it can exploit to produce a product with value v_1 . Firm 2 (e.g., Line Material) has a subservient patent which, when used with Firm 1's technology, can produce a product with a higher value $v_2 > v_1$. To keep the analysis simple, assume that there are no costs of producing, licensing, or selling the products. If the firms compete, each firm chooses a price under the assumption that its price does not affect the price chosen by the other firm.³⁶

If the firms choose royalties cooperatively, Firm 1 would license Firm 2, which would license the higher quality product at the royalty v_2 . This way the firms maximize profit, consumers purchase the higher quality good, and the firms choose how to divide the spoils. In terms of total economic welfare (profits plus consumer surplus), this is the best possible outcome in this market, although the benefits go entirely to the firms. Consumers earn no surplus because the price is equal to their maximum willingness to pay for the good.

If the firms do not cooperate, Firm 1 can either choose not to license Firm 2, or it can offer a license at a royalty, R . With no licensing, Firm 2 cannot compete because its product would infringe Firm 1's patent. In this case, only Firm 1 can offer a product, which it can sell at its monopoly price v_1 . This outcome is inferior to the cooperative outcome because the higher quality good is not produced.

A second alternative is that Firm 1 can license its dominant patent to Firm 2 and withdraw from the market. In this case, only Firm 2 offers a product, which it would sell at the monopoly price v_2 . Firm 1 can extract the monopoly revenue by charging a royalty $R = v_2$. The outcome is the same as in the cooperative case. The outcomes are identical because we have assumed that demand for the final product is inelastic for all prices up to the product's quality. Firm 1 can capture all of the value with its royalty and Firm 2 has no incentive to add an additional margin to the product price. With elastic demand, Firm 2 would add a margin to Firm 1's royalty and the double monopoly problem would emerge.

³⁶ This is also known as the Nash-Bertrand pricing assumption. See JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 210 (1997).

A third alternative is that Firm 1 can license its dominant patent to Firm 2, but not withdraw from the market.³⁷ Firm 1 offers its product at a price P_1 and licenses Firm 2 with a royalty R . Firm 2 offers the improved product at a price P_2 , and consumers purchase from the firm that offers the best net value. This is Firm 1 if $v_1 - P_1 > v_2 - P_2$, and Firm 2 if the opposite is true. The royalty establishes a floor on Firm 2's price. Therefore, Firm 1 could capture the entire market by choosing a price slightly below $R - (v_2 - v_1)$, provided this is positive. In this case, only the lower quality product is sold, which lowers total economic welfare (profits plus consumer surplus) relative to the case with cooperative royalties. However, consumers benefit from the potential competition from the higher quality product, which holds down the price that Firm 1 can charge. Consumers earn a surplus of $v_1 - [R - (v_2 - v_1)] = v_2 - R$ on each unit.³⁸

This simple example demonstrates that consumers may prefer a judicial rule that forbids firms from jointly determining a royalty for improved products, as the Court did in *Line Material*. Competition between the firms, whether actual or potential, holds down prices. Consumers can be better off with this competition even if it prevents a higher quality good from being sold. Although consumers may be better off, this outcome may not, in fact, ever materialize. The owner of an improvement patent may be loath to license a dominant patent from a firm that can sell a substitute product with a lower cost structure, reasoning that the licensor will undercut its sales. The potential licensee may demand a non-compete agreement, although antitrust authorities could object to that arrangement under the same principles that guided the Court's decision in *Line Material*. Alternatively, the licensor could correctly reason that a sale of its own product would be costly because it would deny the firm the opportunity to collect royalties from the licensee, so that the royalty R is an effective cost for both firms. If both firms compete with marginal cost R , by the same reasoning as above, the higher quality product will win the market at a price slightly below $R + (v_2 - v_1)$, and the firm with the lower quality

³⁷ Withdrawal from the market may require a commitment, which may fail for different reasons. See, e.g., Patrick Rey & Jean Tirole, A Primer on Foreclosure (Jul. 16, 2003) (unpublished manuscript), available at <http://www.idei.asso.fr/Commun/Articles/Tirole/primer20030716.pdf> (seller is disadvantaged if it cannot commit to outputs).

³⁸ This discussion is based on Richard J. Gilbert & Michael H. Riordan, Product Improvement and Technological Tying in a Winner-Take-All Market (Dec. 2003) (unpublished manuscript), available at <http://elsa.berkeley.edu/users/gilbert/wp/gilbert-riordan-final.pdf>. See also Joseph Farrell & Michael L. Katz, *Innovation, Rent Extraction, and Integration in Systems Markets*, 48 J. INDUS. ECON. 413 (2000).

product will collect royalties from the licensee's sales. Consumers will earn a surplus of $v_2 - [R + (v_2 - v_1)] = v_1 - R$ on each unit.³⁹

If the owner of the dominant patent correctly viewed royalties as an opportunity cost, the licensee would make all the sales with the improved product, the licensor would collect a royalty of R per unit, and the market price would be $R + (v_2 - v_1)$. The licensor could compare this outcome to the one in which it refuses to license. Then it could sell the unimproved product and earn v_1 on each sale. Licensing is the better outcome for the firm with the dominant patent if $R > v_1$. Total economic welfare is higher with licensing because that allows the better product to be sold.

Returning to the *Line Material* case, consumers would have been worse off if Southern and Line Material pooled their patents and cooperated to set the final product, compared to an alternative scenario in which Southern licensed its patent to Line Material *and* competed with Line Material by selling circuit breakers that did not benefit from Line Material's patented improvements. However, if Southern and Line Material could not pool their patents, Southern may have refused to license its patent to Line Material. Then Southern's monopoly price would extract all of the consumer benefits and total economic welfare would be harmed relative to the case in which the companies pool their patents because the higher quality product could not be sold without infringing Southern's dominant patent. Alternatively, Southern could license its patent to Line Material and choose not to sell a competing circuit breaker, either by agreement with Line Material or because Southern reaches the conclusion that royalties from Line Material are more valuable than its own sales. If Southern does not compete, either by agreement with Line Material or by following its own interests, the outcome is no better than what would have obtained if they had pooled their patents and cooperated to set the final product. In addition, in a more general model with elastic demand, pooling can avoid the double monopoly problem that can emerge with independent royalty determination.

³⁹ Note that consumers are worse off than they would be in the case where the licensor ignores its licensing revenues and competes more aggressively for sales. In that case, consumer surplus is $v_2 - R$ on each unit. See Gilbert & Riordan, *supra* note 38.

D. Patent Pool as Cartelmeister: Vertical Restraints in Patent Licenses

The Hartford-Empire pool, which combined patented technologies related to the manufacture of glassware, is one of the largest patent pools in the history of antitrust and intellectual property litigation.⁴⁰ In 1942, a district court held that the pool violated the antitrust laws. The patents combined in the Hartford-Empire pool had been the property of several firms, including Hartford-Fairmont, Empire, Corning, Thatcher, Ball, and Owens. By 1938, the pool controlled more than 600 patents that covered products and processes used to manufacture ninety-four percent of the glassware in the United States.⁴¹ The pool issued licenses under the patents to glass manufacturers with terms that limited the types of products that the licensees could produce and, in some cases, limited the quantities that could be produced with the licensed technologies. In addition, Hartford cooperated with an industry association (the Glass Container Association of America, whose members produced most of the glass containers sold in the United States) to discourage outsiders from increasing production of glassware and to prevent newcomers from entering the field. The court found that the association assigned production quotas to its members and that they and Hartford were zealous in seeing that the quotas were observed.

The intensity of interference litigation that preceded the formation of the Hartford-Empire pool suggests that at least some of these patents were blocking. However, it also appeared that many of the patents covered substitute technologies. For example, the pool included patents that covered two types of feeding machines: gob and suction feeders. The court noted evidence to the effect that a goal of the pool was to prevent competition between these two technologies.⁴²

The Supreme Court's condemnation of the Hartford-Empire pool reached beyond the elimination of competition between substitute technologies. The district court had

⁴⁰ *Hartford-Empire Co. v. United States*, 46 F. Supp. 541 (N.D. Ohio 1942), *modified by* 323 U.S. 386 (1945).

⁴¹ The patents covered glass feeding and forming machines, and lehrs (furnaces used to anneal glass).

⁴² It is not clear whether that competition was actual or potential. The evidence stated: "We [pool members] recognize that there is a distinct field for each of these processes. It would seem then to be the proper thing to let the two processes go along side by side and each develop the proper field as the demand from the industry would naturally work it out. But, of course, we both also recognize that it would be unfortunate to have this parallel development of the two processes reach a stage where competition between the two became generally destructive and unstabilized." *Hartford-Empire*, 46 F. Supp. at 561.

focused on the intent of the parties to dominate the glass manufacture industry.⁴³ The Hartford-Empire pool did embrace most of the technology necessary for glass manufacture and the evidence shows the intent of the pool members to control the development of the industry for glass manufacture. However, the district court failed to distinguish the pooling of substitute and complementary patents and held that joint determination of royalties was unlawful because it tended to control prices without regard to whether the patented technologies were substitutes for each other:

Certainly the power to control price rests in the hands of Hartford to increase the license fees and royalties charged its licensees at any time that it desires. The result of this, of course, is an increase in the charge to the public for the output of the glass making machines. Dominance over the entire industry is today so complete that at any time within the choice of Hartford and Owens prices to the consumer of glassware may arbitrarily be raised beyond all reason. To say that such dominance is a benevolent one, if true, is beside the point. The antitrust laws frown upon such control whether it be benevolent or whether it be vicious, for the power of domination is the evil at which the laws are directed.⁴⁴

The power to control royalties necessarily influences product prices. The court did clearly distinguish control of product prices from the control of royalties in *Hartford-Empire* and other patent pooling cases. Whether such control is anticompetitive hinges on whether it affects products or technologies that are substitutes for each other. High royalties push product prices higher, but are not, by themselves, anticompetitive. It is the joint determination of royalties for substitute technologies that should raise antitrust concerns. While such concerns appear justified in the *Hartford-Empire* case, the court did not articulate them clearly.

In 1945, the Supreme Court affirmed the district court's finding that the members of the Hartford-Empire patent pool had, over a period of years, regulated and suppressed competition in the use of glassmaking machinery and had employed their joint patent position to allocate fields of manufacture and to maintain prices of unpatented glassware.⁴⁵ The appeal focused on remedies, which included royalty-free licensing of

⁴³ "The primary purpose underlying the alliance was not merely to settle legitimate conflicts, Patent Office interferences or litigation in the courts, in the interest of efficient operation of the patents. The primary purpose was to achieve domination of the industry." *Id.* at 619.

⁴⁴ *Id.*

⁴⁵ *Hartford-Empire Co. v. United States*, 323 U.S. 386 (1945).

the patents in the pool. The Court ruled that royalty-free compulsory licensing was excessive, noting:

Hartford has reduced all of its royalties to a uniform scale and has waived and abolished and agreed to waive and abolish all restrictions and limitations in its outstanding leases so that every licensee shall be at liberty to use the machinery for the manufacture of any kind or quantity of glassware comprehended within the decree. Moreover, if licenses or assignments by any one of the corporate defendants to any other still contain any offensive provision, such provision can, by appropriate injunction, be cancelled, so that the owner of each patent will have unrestricted freedom to use and to license, and every licensee equally with every other will be free of restriction as to the use of the leased or licensed machinery, method or process, or the articles manufactured thereon or thereunder.⁴⁶

Stripped of the restricted licenses, the Court found that the Hartford-Empire patent pool was legal and that the pool should be allowed to charge royalties for its patented technologies. However the Court failed to consider the competitive implications of combining substitute patents. If a pool combines technologies that are substitutes for each other and sets prices for these competing technologies, it has a potentially anticompetitive effect. This concern exists without regard to any further restrictions that the pool imposes on licensees.

The allegation in the *Hartford-Empire* case was that the pool members used field-of-use restricted licenses to orchestrate an industry-wide price-fixing agreement. In *United States v. National Lead Co.*,⁴⁷ the complaint was that National Lead and other worldwide producers of titanium dioxide (a pigment used in paints and other products) used geographically restricted licenses to raise product prices. National Lead settled conflicting patent claims with foreign producers by agreeing to cross-license existing patents and all future patents and to exchange technical information related to the manufacture of titanium dioxide pigments.

The first license was between National Lead and TAS, a Norwegian company. The cross-license gave National Lead the exclusive right to manufacture, use, and sell every invention or improvement related to titanium dioxide within North America. In return, National Lead granted TAS exclusive rights to manufacture, use, and sell its titanium products outside of North and South America. Several subsequent contracts

⁴⁶ *Id.* at 414.

⁴⁷ 63 F. Supp. 513 (S.D.N.Y. 1945), *aff'd*, 332 U.S. 319 (1947).

between National Lead and other foreign companies replicated this model. Essentially, National Lead and these other companies agreed to cross-license existing and future patents and to exchange technical information, with each retaining exclusive rights to manufacture and sell titanium dioxide products in its relevant territory.

The case also challenged licensing arrangements between National Lead, DuPont, and foreign producers. These contracts differed from National Lead's other agreements with foreign producers of titanium dioxide because DuPont did not explicitly agree to limit its manufacture, use, and sale of titanium dioxide products to North America. Nonetheless, the court concluded that DuPont had implicitly agreed not to compete in foreign markets and, consequently, was a participant in a worldwide cartel.

The contract between National Lead and DuPont did not divide the U.S. market for titanium dioxide, and by all indications the domestic market was highly competitive. The contract settled their conflicting patent claims and called for the exchange of all future patents and know-how related to titanium dioxide processes and products. The cross-license between National Lead and DuPont was non-exclusive and, in 1940, DuPont terminated the exchange of technical information with National Lead.

The court ruled that the contracts that allocated exclusive territories among National Lead and other companies violated the antitrust laws. The court also concluded that the contract between DuPont and National Lead was anticompetitive. The court ruled that the agreement to license present and future patents and to share know-how contributed to a patent thicket that created a barrier to new entry and allowed DuPont and National Lead to control the domestic industry for titanium dioxide products.

How would this decision stand up to the analytical framework in the *Intellectual Property Guidelines*? The first question, of course, is whether the patented technologies were substitutes for each other. The court did not explicitly address this question. The fact that the patents covered different processes to manufacture titanium dioxide suggests a considerable probability that they were substitutes for each other. This is not at all certain, because a patent relating to one process could still block the use of a different process. Furthermore, the processes might have been only weak substitutes if they had very different cost characteristics or if they required specialized inputs that were not available to both firms.

I will assume, for purposes of illustration, that the patented technologies were substitutes. The competitive consequences of combining substitute patents depend upon the structure of royalties. Royalty-free cross-licensing of substitute process technologies, in the absence of other restrictions or agreements, is likely to be pro-competitive. Suppose there are two patented processes, which enable production at marginal costs c_1 and c_2 respectively. Royalty-free cross-licensing allows each firm to operate with the lower of the two marginal costs: $c = \min [c_1, c_2]$. This enhances economic efficiency by lowering firms' actual costs. It also results in lower prices to the extent that these lower costs are passed on to consumers.⁴⁸

The assignment of exclusive territories, as in National Lead's agreements with foreign producers, raises competition concerns. Exclusive territories allow each supplier to charge the monopoly price given its marginal cost c , $p_i^m(c)$, which may exceed the price that would occur with no licensing and no territorial restrictions. Even in this case, licensing could increase total economic surplus, particularly if high transportation costs would have limited worldwide competition in the absence of the license.

The domestic licensing agreement between National Lead and DuPont is another matter. That agreement did not assign exclusive territories in the United States. In fact, the record indicates that there was vigorous competition between National Lead and DuPont for domestic consumers. Nonetheless, the court held that this agreement violated the antitrust laws. The court noted:

Here are two competing producers who, at the time their agreement is made, between them control 100% of the commerce in titanium products in the United States. They agree not only to settle their conflicting patent claims—which presumably they may do under the Gasoline Cracking case—but they agree to exchange all future patents, patent applications and know-how. Though these exchanges are not on an exclusive basis, is it not clear, however, that the capacity of such a combination to dominate the market is vastly increased, that the capacity for the exclusion of outsiders from the industry is multiplied?⁴⁹

⁴⁸ In most static models of oligopoly pricing, a reduction in a firm's marginal cost does not increase, and often decreases, the firm's profit-maximizing price. In dynamic oligopoly models, a cost reduction that makes firms more symmetric can make it easier for them to sustain higher prices. See XAVIER VIVES, OLIGOPOLY PRICING: OLD IDEAS AND NEW TOOLS (1999).

⁴⁹ *Nat'l Lead Co.*, 63 F. Supp. at 531.

The court found that National Lead and DuPont maintained a duopoly by controlling and limiting access to present and future technology. Although both National Lead and DuPont licensed patents to other U.S. producers, the court was not convinced that their terms provided reasonable access to titanium dioxide technology. National Lead's license required adherence to the exclusive territory assignments with foreign suppliers and DuPont imposed limits on the quantities that its licensees could produce.

The central antitrust concern is whether the license agreement between National Lead and DuPont limited competition that would have existed in its absence. Patentees are not obligated to license their technologies to others. Although it is possible that the agreement between National Lead and DuPont would have made it more difficult for third parties to negotiate licenses for titanium dioxide technologies, the cross-license was not exclusive, so in principle both National Lead and DuPont were free to license technologies to others. In fact, both did so, though on terms that did not satisfy the court. While it is possible that the cross-license might have raised entry barriers, it is not clear that it actually had such an effect.

The National Lead-DuPont agreement may have had an effect on innovation incentives. By agreeing to cross-license all future as well as present patents, the agreement could have reduced research and development incentives by allowing each firm to free-ride on discoveries made by others. Furthermore, the agreement could have contributed to price coordination by equalizing the firms' technological capabilities, therefore making it less likely that one of the firms would deviate from an implicitly collusive price. However, these effects would have to be balanced against the pro-competitive benefits from sharing present technology and know-how.

In 1947, the Supreme Court affirmed the lower court's key findings and remedies pertaining to the National Lead patent agreements. In particular, the Court upheld the lower court's requirement that National Lead and DuPont license their patents at reasonable and non-discriminatory rates, and denied the government's request for royalty-free compulsory licenses. As in *Hartford-Empire*, after the parties removed the vertical restrictions in their licenses, the Court allowed them to cross-license their patents and set royalties, without investigating whether the patents were truly substitutes for each other.

Patents were also used to coordinate an industry cartel in *United States v. United States Gypsum Co.*, decided by the Supreme Court in 1948.⁵⁰ United States Gypsum was the largest manufacturer of gypsum board, a common construction material, in the eastern United States. The complaint alleged that United States Gypsum entered into a network of patent licensing agreements intended to fix the price of patented gypsum board, eliminate the production of unpatented board, regulate the distribution of patented board, and stabilize the price of unpatented plaster.

United States Gypsum purchased and acquired through its own development efforts significant patents covering the manufacture of gypsum board, and offered licenses to other gypsum suppliers under its patents. These licenses contained a provision that United States Gypsum would fix the minimum price at which the licensee sold gypsum products embodying the patents.

Gypsum did not appear to raise the issue of whether the agreements pooled patents that were substitutes or complements. The agreements involved the understanding that United States Gypsum would set prices for patented board under an agreement for a single patent, and that licensees would refrain from producing unpatented board. When the patent expired, the parties substituted another patent as the lynchpin for their agreements.

Gypsum raised the issue whether patent licenses can reach downstream to control product prices. For unpatented articles, this is vertical price-fixing, which has long been held unlawful in the United States.⁵¹ The legality of vertical pricing fixing for products made under a patent license is less clear, as the *General Electric* case suggested that this can be a lawful exercise of the ability of a patentee to assign licenses to others.⁵²

The Court focused on a provision in the patent licensing agreements for payment of royalties on the production of unpatented board as indicative of an agreement not to manufacture unpatented board. In addition, the Court found evidence that there was an understanding, if not a formal agreement, that only patented board would be sold. Thus,

⁵⁰ 333 U.S. 364 (1948).

⁵¹ Recent legal decisions have cast some doubt on the per se illegality of vertical price-fixing. *See, e.g., State Oil Co. v. Khan*, 118 S. Ct. 275 (1997) (vertical maximum price-fixing is not a per se antitrust violation and instead is to be evaluated under the rule of reason).

⁵² *United States v. Gen. Elec. Co.*, 272 U.S. 476 (1926).

Gypsum presented the concern that patents were being used as a facilitating device to limit the production of unpatented products. That is, the patent license appeared to be a sham to control product prices. To the extent that the licensing agreements in *Gypsum* raised product prices by limiting the production of unpatented gypsum board, they harmed competition that would have occurred in the absence of the license. Therefore, the agreements would have been found anticompetitive under the analytical approach in the *Intellectual Property Guidelines*.

The Supreme Court followed similar logic in *United States v. New Wrinkle, Inc.*⁵³ As in *Gypsum*, the allegation was that patent licenses were being used to orchestrate the fixing of downstream prices. In this case, the product was wrinkle finishes, defined as enamels, varnishes, and paints that produce a hard, wrinkled surface on metal or other materials. Two companies held conflicting patent rights on processes to produce wrinkle finishes. They agreed to assign their patents to the New Wrinkle Company, which they created for this purpose.

New Wrinkle granted licenses to all of the major manufacturers of wrinkle finishes. These licenses specified the minimum prices, discounts, and terms at which wrinkle finish products could be sold, including products sold by the original patentees. In addition, the contracts provided for a royalty to be paid to New Wrinkle. The Court held that both the combination and the license terms were anticompetitive:

[T]wo or more patentees in the same patent field may [not] legally combine their valid patent monopolies to secure mutual benefits for themselves through contractual agreements between themselves and other licensees, for control of the sale price of the patented devices.⁵⁴

As for the license terms, the Court appeared to hold that they, alone, were anticompetitive. Quoting *Gypsum*, the Court said:

Industry-wide license agreements, entered into with knowledge on the part of licensor and licensees of the adherence of others, with the control over prices and methods of distribution through the agreements and the bulletins, were sufficient to establish a prima facie case of conspiracy.⁵⁵

⁵³ 342 U.S. 371 (1952).

⁵⁴ *Id.* at 379 (quoting *United States v. Line Material Co.*, 333 U.S. 287, 305 (1948)).

⁵⁵ *Id.* (citing *United States v. United States Gypsum Co.*, 333 U.S. 364, 389 (1948)).

The license terms, as discussed above in *Gypsum*, raise issues of vertical price fixing. A question is whether *United States v. General Electric*, which permitted a licensor to set prices for its licensed products, creates an exception to the general prohibition on vertical price fixing.⁵⁶ The Supreme Court cases clearly reject such an exception when the contracts control prices for an entire industry.⁵⁷

However, the Court erred in its conclusion that the combination of patent rights involved in the formation of New Wrinkle was itself anticompetitive. According to the Court, each company claimed it controlled the basic patents on wrinkle finish and that the other's patents were subservient to its own. That is, there was at least the allegation of blocking patents. If so, it is unlikely that the combination of patents created additional market power. A caveat, however, is that a combination of blocking patents might make it more difficult for a firm to "invent around" the patents, decreasing competition. Without combining blocking patents, a firm could conceivably license one company's patents and invent around the patents of another company. When a single company controls both companies' patents, a firm has to either license or invent around all of the patents to become a competitor.

A recurring theme in U.S. antitrust cases involving patent pools and cross-licensing agreements is that the legality of the arrangements hinges more on the restraints that the parties impose on licensees than on the competitive relationship of the patents in the arrangement. This conclusion is evident in *Cutter Laboratories, Inc. v. Lyophile-Cryochem Corporation*.⁵⁸ In that case, two firms owned patents for freeze-dried drugs, which they combined in a separate company. The court held that the combination was lawful, emphasizing that there was no evidence of restrictive licensing practices and that the new company issued licenses on reasonable and non-discriminatory terms. Absent restrictive licensing practices, the court found that the combination did not allow the patentees to do any more than what they could have done by themselves, that is, issue

⁵⁶ *United States v. Gen. Elec. Co.*, 272 U.S. 476 (1926).

⁵⁷ An odd aspect of *New Wrinkle* is that the license royalties were a small fraction of the minimum prices fixed by the contracts. The royalty was five cents per gallon, compared to \$2.45 to \$4 per gallon for the finished product. *Id.* at 375, 380. Although the original patent owners were also producers, they did not appear to dominate the industry (there were more than 200 producers of wrinkle finishes). *Id.* at 374. Thus the original patent owners appeared to appropriate only a small share of the profits they made possible through the conspiracy.

⁵⁸ 179 F.2d 80, 92-94 (9th Cir. 1949).

licenses to others. The court visited the question of whether the parties held competing patent rights. It concluded the parties did not because they were not actual competitors.⁵⁹ However, the parties could have held patent rights that were substitutes for each other, even if the parties themselves were not competitors.

A lower court decision in *King v. Anthony Pools, Inc.*⁶⁰ essentially ignored the crucial issue of the competitive relationship of patents involved in a pooling or cross-licensing arrangement and focused yet again on whether the licenses imposed vertical restraints on licensees. There the court concluded that “[t]he pooling of patents and cross-licensing which are open equally to the public on the same terms do not fall within the [Sherman Act] interdiction.”⁶¹ The court did not investigate whether the patents at issue were substitutes or complements, but was instead satisfied by the observation that licenses were available to anyone “on a small fee basis.”⁶²

*United States v. Holophane Co.*⁶³ is another case in which a lower court did not make an explicit study of the extent to which agreements actually limited competition that would have occurred in their absence. The case involved a tight network of agreements between manufacturers of prismatic glassware, which allocated different worldwide territories to different companies. On their face, the agreements appear to be nothing more than an anticompetitive division of the world market, and that is what the court concluded. However, the companies may have owned patents that would have blocked each other as well as others from making, using, or selling the licensed products.

Similarly, in *United States v. Associated Patents*,⁶⁴ a lower court stuck down an agreement among manufacturers of machine tools in which the manufacturers pooled their existing and future patents and then granted companies exclusive rights to manufacture particular types of machines. The Department of Justice successfully argued that these fields of use restrictions created a cartel and were anticompetitive. The court did not make a detailed analysis of whether the patents at issue were complementary or substitutes. The record suggests, but does not conclusively show, that both types were

⁵⁹ The court noted that one of the parties specialized in the manufacture of freeze-drying apparatus and the other in the manufacture and sale of freeze-dried drugs.

⁶⁰ 202 F. Supp. 426 (S.D. Cal. 1962).

⁶¹ *Id.* at 429.

⁶² *Id.*

⁶³ 119 F. Supp. 114 (S.D. Ohio 1954).

⁶⁴ 134 F. Supp. 74 (E.D. Mich. 1955).

involved in the licensing agreements. In addition, the DOJ alleged, and the record supported, that the members of the pools refused to license their patents to other actual and potential competitors.

Finally, in the *Duplan*⁶⁵ case, a federal court considered the competitive issues raised by restraints in licensing agreements independently from those raised by the overlapping nature of the patent claims. The case involved a series of agreements for processes used to manufacture synthetic filament yarns. The complaint challenged the agreements as anticompetitive vertical restraints of trade. Allegations included unlawful grant-backs, price-fixing, and tying. The court dismissed all of the vertical allegations. However, the court concluded that the agreements were unlawful because they gave the patentees “the power to fix and maintain prices in the form of royalties which they . . . exercised thereafter.”⁶⁶ A key element in this conclusion was the court’s finding that the validity of the patents was dubious. The court concluded that “[t]he . . . patents in suit were known . . . to be weak and, as [the parties] had been advised by highly . . . qualified counsel, they were confident that these patents could be invalidated.”⁶⁷ Hence the court concluded that a primary purpose of the patent agreements was to protect the parties from challenges to the validity of their patents, which, if successful, would have made it impossible for the parties to fix product prices.⁶⁸

While combinations of complementary patents may not be anticompetitive, it is difficult to assess whether patents are clearly substitutes or complements, and they may have elements of both. For example, the argument that one firm’s patent blocks another’s fails if the patent is invalid or non-infringing. Consequently, the assessment of complementarities necessary entails an assessment of patent scope and validity. Similarly, agreements among patentees could harm competition through a collective refusal to deal with actual and potential competitors. A refusal to license firms that are not parties to a pooling or cross-licensing agreement may not be sustainable without

⁶⁵ *Duplan Corp. v. Deering Milliken, Inc.*, 444 F. Supp 648 (D.S.C. 1977).

⁶⁶ *Id.* at 686.

⁶⁷ *Id.*

⁶⁸ *Id.* at 682 (“[T]he dominant purpose of the March 31, 1964, agreement, as reflected in the statements and conduct of the participants both before and after that date and in the terms of the agreement itself, was anti-competitive, that purpose being to preserve and enhance the interdependent royalty programs of [the parties] which a trial of the pending litigation might well have destroyed.”).

collective action. Without a collective agreement, firms conceivably could acquire patent rights by negotiating with individual patentees, or by acquiring some patent rights and inventing around others. Thus, an agreement to impose vertical restraints can have anticompetitive consequences, even when that agreement is among firms that are not actual competitors.

Lastly, a unilateral grant of a license that is limited to a particular territory or field of use is unlikely to attract antitrust scrutiny.⁶⁹ Similarly, grants of geographic- or field of use-restricted licenses by owners of two-way blocking patents also should not raise antitrust concerns. If patents are two-way blocking, then no licensee could compete without a license from all those who own complementary intellectual property rights. Therefore, an agreement to impose licensing restrictions would not harm competition that would have occurred in the absence of the license.

E. Allocating Patents to Strengthen Intellectual Property Rights

Several patent pooling cases challenge conduct that was designed to strengthen the abilities of the pool members to exercise their otherwise lawful patent rights. The conduct could involve licensing agreements that allocate patent rights to parties who are best positioned to challenge firms that infringe those rights, or it could involve an agreement to jointly defend challenges to patent scope and validity. Another example is an agreement not to issue licenses for individual patents. These are examples of conduct that is otherwise within the rights of each patentee. Each patentee can choose to sue for infringement, to defend its patents, or not to license a particular patent. The common feature of these cases is the agreement among members of a patent pool or cross-licensing agreement to engage in or prohibit these activities.

The Supreme Court case *United States v. Singer Manufacturing*⁷⁰ offers an example of the first type of agreement, where patents are allocated to those best able to enforce them. Singer and European companies cross-licensed and jointly defended patents related to multicam zigzag sewing machines (sewing machines capable of

⁶⁹ See DOJ/FTC Intellectual Property Guidelines, *supra* note 6, at 20, 736 (Example 1).

⁷⁰ 374 U.S. 174 (1963).

automatically performing various functional and ornamental stitch patterns). In 1959, Singer was the largest seller of multicam zigzag sewing machines in the United States, accounting for about sixty-one percent of domestic sales. Japanese and European companies accounted for approximately twenty-three and sixteen percent of domestic sales, respectively.

The record indicated that Singer and Vigorelli, an Italian company, held patents on multicam zigzag sewing machines that were mutually blocking.⁷¹ Singer and Vigorelli settled their claims by entering into a nonexclusive worldwide royalty-free cross-license in 1955. Later, Singer learned that Gegauf, a Swiss company, held a dominant patent on multicam zigzag machines with a priority date nine days earlier than Singer's patent filing date in the United States. Gegauf had a royalty-free cross-license with Vigorelli that was similar to the Singer-Vigorelli agreement.

Singer entered into licensing negotiations with Gegauf under the assumption that Gegauf's patent was valid, and Singer would only be able to limit the scope of Gegauf's claims.⁷² That is, Gegauf held a dominant patent that would block Singer, and Singer's patent would block Gegauf from pursuing certain applications or improvements. The situation paralleled the one-way blocking relationships in *Standard Oil* and *Line Material*. While Singer's bargaining position was not particularly strong, it used Gegauf's concern about competition from the Japanese as a lever in its negotiations. Singer and Gegauf concluded that failure to enter into a cross-licensing agreement would result in a protracted period of litigation that would compromise each company's ability to deal with emerging competition from the Japanese. According to the Court,

Singer in the discussions worked upon these Gegauf fears of Japanese competition "because one of the strong points" of its argument was that an agreement should be made "in order to fight against this Japanese

⁷¹ "Singer concluded that Vigorelli had on file applications covering its machine in the various patent offices in the world and that the Singer design would infringe." *Id.* at 177. Singer also believed that a "reissued patent would dominate the Vigorelli machine as well as a Japanese one introduced into the United States in September 1954 by Brother International Corporation. Thereafter Singer concluded that litigation would result between it and Vigorelli unless a cross-licensing agreement could be made, and this was effected on November 17, 1955." *Id.*

⁷² "The setting for this meeting was that Gegauf had a dominant Swiss patent with applications in Germany, Italy, and the United States all prior to Singer. In addition, Singer's counsel had examined Gegauf's Swiss patent and advised that it was valid." *Id.* at 179.

competition in their building a machine that in any way reads on the patents of ourselves and of [Gegauf] which are in conflict.”⁷³

Singer concluded a cross-licensing agreement with the European companies. The terms of the agreement provided that each party would vigorously defend its patent rights in its relevant territory.⁷⁴ In addition, the parties agreed not to contest each other’s patents.

The Supreme Court summarized the central competitive issue as follows:

What is claimed here is that Singer engaged in a series of transactions with Gegauf and Vigorelli for an illegal purpose, i.e., to rid itself and Gegauf, together, perhaps, with Vigorelli, of infringements by their common competitors, the Japanese manufacturers. The Government claims that in this respect there were an identity of purpose among the parties and actions pursuant thereto that in law amount to a combination or conspiracy violative of the Sherman Act.⁷⁵

The Court emphasized that it was not illegal for a patentee to acquire a patent to exclude competitors and to enforce that patent. Rather, it was the concerted action by Singer, Gegauf, and Vigorelli to cross-license patents in order to limit foreign competition that was illegal.

How does *Singer* hold up to an economic analysis, applying the *Intellectual Property Guidelines*? The key question is whether the cross-licensing agreements prevented competition that would have occurred in their absence. Without an agreement, it is unlikely that any (lawful) competition could have occurred, because the evidence suggests that the machines produced by Singer and the European manufacturers were mutually infringing. A cross-licensing arrangement was *necessary* for (lawful) competition to occur in multicam zigzag sewing machines. Furthermore, the cross-license did not enable Singer, Gegauf, and Vigorelli to accomplish more than they would have been entitled to do without the cross-license. Each could have asserted its patent rights against competition from others. The cross-licensing arrangement simply made this easier to accomplish.

⁷³ *Id.* (quoting *United States v. Singer Mfg. Co.*, 205 F. Supp. 394, 413 (D.C.N.Y. 1962)).

⁷⁴ “[E]ach undertakes, in accordance with the laws and regulations of the Patent Office concerned, to facilitate the allowance in any country of claims as broad as possible, as regards the subject matter of the patents and patent applications referred to above.” *Id.* at 180.

⁷⁵ *Id.* at 189.

It is likely that the cross-licensing agreement had an impact on competition in the environment of relatively weak patent rights that existed in the 1960s. Patents were relatively difficult to enforce at that time and large damage awards were less frequent.⁷⁶ The cross-license allowed Singer and the European firms to shore up their patent defense against Japanese competitors. In today's patent environment, it is less likely that a similar agreement would have any significant effect on competition. Each firm could enforce its own patents and seek damages for infringement on its own.

*Mason City v. Clapper*⁷⁷ is an example of the second type of agreement, agreeing to jointly defend patent challenges. A district court held unlawful an agreement between two patentees that provided for a joint defense fund and gave each of the patentees veto power over the grant of licenses. The patents appeared to be complementary patents, covering cab enclosure devices for tractors. Before the patents were issued, there were extensive discussions between the parties concerning the royalties they would charge, the licensing terms, and which firms they would license. The court concluded that the high degree of coordination between the patentees and in particular the joint defense fund and the veto power over licenses were an unlawful extension of the patent grant. However, the record supports the conclusion that the patents were complementary, in which case the benefits from coordination could outweigh the risks to competition.

*United States v. Krasnov*⁷⁸ presented a set of facts similar to those in *Mason City*. *Krasnov* involved an agreement to cross-license patents for ready-made furniture slip covers. The parties to the agreement were two firms that accounted for most of the sales of slip covers in the United States. As in *Mason City*, the agreement provided for a joint patent defense fund and gave each patentee veto power over the grant of licenses. The complaint contained other allegations of anticompetitive conduct, including fixing product prices, aggressive patent enforcement, and sales below cost. In addition, the record suggests that the firms had doubts about the validity of their patents and that the

⁷⁶ Only one of the twenty largest patent damages awards from 1980 to 2001 occurred before 1990. See FTI Consulting Company, Top Damage Awards for U.S. Patent Infringement, at http://www.fticonsulting.com/ip/presentations/ip_chart/slide0001_files/slide0026.htm. John Turner reports that the number of damage awards for patent infringement in excess of \$1 million has increased dramatically since 1975. John L. Turner, *Bayh-Dole to Festo: The New Economics of Patent Law* (Sept. 2001) (unpublished working paper, on file with author).

⁷⁷ *Mason City Tent & Awning Co. v. Clapper*, 144 F. Supp. 754 (W.D. Miss. 1956).

⁷⁸ 143 F. Supp 184 (E.D. Pa 1956), *aff'd per curiam* 355 U.S. 5 (1957).

patents covered products that were partial substitutes. The firms chose to combine their patents (and fix prices) rather than run the risks associated with a patent challenge (which also included the risk that other firms could enter the industry if the patents were found to be invalid). Unsurprisingly, the court held that the cross-licensing agreement in *Krasnov* was illegal.

What are the economic consequences of a joint defense agreement? The benefits and costs depend on many factors including, of course, the litigation resources of the patentees. The economic consequences also depend on whether patents are blocking or substitutes. Suppose a pool contains two patents and consider separately the case of essential (two-way blocking) and substitute patents. If a patent is found to be invalid, the technology it covers can be practiced by anyone at marginal cost. As a simplification, assume competition would drive price down to marginal cost, assumed to be zero. If both patents are essential, the profit-maximizing royalty is R^m if at least one patent is held to be valid, because the owner of the surviving patent can charge the monopoly price for its use. If the patents are substitutes, the profit-maximizing royalty is R^m only if both patents are held to be valid, because an invalid patent can be practiced at zero cost.

Assume that in the absence of cooperation, the first patent, if challenged, would be found to be valid with probability p_1 and the second patent, if challenged, would be found to be valid with probability p_2 . If the two patentees cooperate in a patent defense, I assume the probability that each patent would be found to be valid is the average of the probabilities for both patents. This implies that the probability of prevailing in patent litigation depends only on litigation effort, and a joint defense allocates litigation resources equally to both patents. Under these assumptions, which are admittedly highly simplified and special, cooperation changes the probability that each patent would be found valid to $p = (p_1 + p_2) / 2$. Without loss of generality, let $p_1 = p - a$ and $p_2 = p + a$, for some number a . This formulation simplifies the comparison of expected royalties with and without a joint defense.

If the two patents are substitutes, the royalty is R^m only if both patents are found to be valid, and it is zero otherwise. The probability that both patents survive a challenge is $p_1 p_2$. Consequently, the expected royalty is $R = p_1 p_2 R^m = (p^2 - a^2) R^m$ if the patentees

do not coordinate a joint defense and $R = p^2 R^m$ if they do coordinate. If the two patents are essential, the royalty is R^m if either patent is found to be valid. The royalty is zero only if both patents are held to be invalid, which occurs with probability $(1-p_1)(1-p_2)$. The probability that at least one patent would be found valid is $1 - (1-p_1)(1-p_2)$. Consequently, if the patents are essential, the expected royalty is $R = (1 - (1-p_1)(1-p_2))R^m$
 $= (2p - p^2 + a^2)R^m$ if the patentees do not coordinate a joint defense and $R = (2p - p^2)R^m$ with a joint defense.

Under these assumptions, cooperation in the defense of weak patents increases expected royalties if the patents are substitutes and decreases expected royalties if the patents are complements. The reason for this result is that when patents are substitutes, a weak patent is a threat to every patent, because it would extinguish everyone's royalties if held invalid. Thus, patentees have an interest in shoring up the defense of weak patents for substitute technologies. With blocking patents, the opposite holds. Royalties are preserved as long as one patent survives. Thus, it pays to focus defenses where patents are strong, rather than average defenses over all patents. Of course, other factors, such as economies of scope in litigation, could justify a joint defense of complementary patents. But in this very simple model, a joint defense agreement among patentees is profit-maximizing only if the patents are substitutes.

III. Scoring the courts

The cases reviewed above reflect the history of legal jurisprudence with respect to the antitrust risks posed by patent pooling and cross-licensing arrangements. Over time the courts' concerns with different types of pooling and cross-licensing arrangements have ebbed and flowed from considerable deference to intellectual property rights (as reflected in *National Harrow*) to considerable hostility (e.g. *Line Material*). As an indication of how legal standards in this area have changed over time, and how they may correspond to economic concerns, I have constructed a simple index of competitive hazards that patent pools and cross-licensing arrangements may pose. There are three general types of hazards: (i) the competitive relationship of the patents in the pool or

cross-licensing arrangement; (ii) the presence of vertical restrictions in licensing terms that affect competition related to the patented products or processes; and (iii) agreements not to license the patents and to cooperate in the defense of the patents.

With respect to the first hazard, as discussed above, the patents may be complements, or substitutes, or neither. If they are complements, they may be essential to use the technology, which would mean that the patents are two-way blocking. Or a patent may cover a technology that improves upon another technology (or makes it useful, as in an application of a research tool). These are one-way blocking patents. Two-way blocking patents typically do not raise concerns about harm to competition (if they are truly blocking and valid patents) because competition cannot occur without licenses to use all essential patents. One-way blocking patents can raise competitive concerns, but as discussed above in the context of *Line Material*, these concerns are likely to be modest. Substitute patents raise competitive concerns if pooling or cross-licensing arrangements jointly determine royalties, or have that effect. As discussed above in the context of the license agreement in *National Lead*, for titanium dioxide, royalty-free cross-licensing of substitute patents can raise concerns about harm to competition by lowering incentives for research and development or by facilitating collusion. Otherwise, royalty-free cross-licensing is not likely to harm competition and can be pro-competitive by increasing access to efficient technologies.

Combinations of weak patents can have competitive effects that are similar in important respects to the competitive effects from combinations of substitute patents. A patent may be weak because it is likely to be held either invalid or not infringed by a competitive product or process. An invalid patent cannot lawfully exclude competition. Additionally, a patent cannot lawfully exclude competition in a technology that is not covered by the patent. Therefore, if a pooling or cross-licensing arrangement shields weak patents from challenge (either by explicit agreement or because pooling erodes incentives to challenge patents), the effect is to exclude competition that should otherwise occur. Combinations of substitute patents directly prevent competition that should have occurred. Protection of weak patents is significant if the patents would have been found invalid or not infringed in the absence of the protection.

With respect to the second hazard, vertical restrictions in licensing terms, the record of legal decisions in patent pooling and cross-licensing cases indicates considerable hostility to arrangements that fix downstream prices. Agreements that directly fix prices for unpatented products raise traditional antitrust concerns. Additionally, a patent or pooling arrangement can have the effect of fixing downstream prices by reducing competition among firms that license a patented product or process. This can be accomplished by the assignment of exclusive territories in which firms may operate or by the assignment of exclusive fields for which a patented process or product may be used. Alternatively, a licensing arrangement can reduce competition by limiting the use of unpatented products that are substitutes for the licensed technologies.

Lastly, the third hazard, collective refusals to license patents on an individual basis, can harm competition in some instances. If the participants in a patent pool are free to license their patents individually, this could make it easier for firms to negotiate patent licenses. In addition, firms may be able to license a subset of patents and invent around others.⁷⁹ However, unilateral licensing can also have undesirable consequences. It can encourage hold-outs that interfere with the packaging of patents that are essential to practice a technology.⁸⁰ Also, it can make it more difficult for a pool to arrive at profit-maximizing royalties.⁸¹

Similarly, the joint defense of challenges to patent scope and validity can have competitive consequences, although the effects are generally unclear. As discussed above, joint patent defense may be more useful when patents are substitutes. Thus, the presence of a joint defense agreement may suggest that the parties have substitute patents. However, this evidence is not likely to be reliable as there are other reasons why firms may choose a joint patent defense strategy.

For illustrative purposes, I have “scored” the competitive effects of patent pooling decisions by assigning a numerical weight to the various factors described above. For each case discussed in Section II above, I determine which competitive factors are

⁷⁹ See John H. Barton, *Patents and Antitrust: A Rethinking in Light of Patent Breadth and Sequential Innovation*, 65 ANTITRUST L.J. 449 (1997) for a discussion of the implications of refusals to license intellectual property.

⁸⁰ For example, each patentee may insist that it gets at least as much from joint licensing as it can get in an individual license. But the sum of individual royalties may exceed the profit-maximizing royalty.

⁸¹ Individual licensing imposes a mixed bundling condition on the royalties that a pool may charge. Under some (perhaps very special) conditions, this may not be optimal for the pool.

present as characterized by the court and then sum all the weights to obtain a “competitive hazards score.” The weights are subjective. If one factor has a higher weight than another, this merely indicates a reasonable concern that the former has a greater potential for competitive harm than the latter.⁸² The weights are listed in Table 1 below.

Table 1. Competitive Factors and Weights

<u>Factor</u>	<u>Weight</u>
Substitutes:	
with joint royalty-setting	+4
with royalty-free cross-licensing	0
Not Known:	+2
Complements	+1
Blocking	0
Weak patents	+2
Fix downstream prices or impose exclusive territories or fields of use	+2
Restrict the use of alternative products or processes	+2
Prevent unilateral licensing	+1
Require joint defense	+1

The single factor that receives the greatest weight in Table 1 is the combining of substitute patents with joint determination of royalties. The presence of this factor in a patent pooling arrangement receives a score of “4.” An example is the Hartford-Empire

⁸² Lerner, Strojwas, and Tirole apply ordinal weights to assess whether patent pools promote licensing and innovation. *See* Josh Lerner, Marcin Strojwas, & Jean Tirole, The Structure and Performance of Patent Pools: Empirical Evidence 19 (Jan. 11, 2003) (unpublished working paper), *available at* <http://www.idei.asso.fr/Commun/Conferences/Internet/Janvier2003/Papiers/Tirole2.pdf> .

pool, which combined and jointly determined royalties for alternative processes to manufacture glassware.

In contrast, if a pool combines blocking patents (patents that cannot be practiced without infringing another patent), the presence of this factor receives a score of “0.” This reflects the conclusion that combinations of blocking patents do not create market power. The cross-licensing of substitutes without joint royalty-setting also receives a score of “0” because such combinations expand the technologies available to the firms involved in the cross-license without enabling the firms to raise prices. Combinations of complementary patents (one-way blocking patents) receive a weight of “1” for the presence of this factor. This reflects the conclusion that such arrangements present only a moderate risk of harm to competition.

Table 1 assigns scores of “1” or “2” to factors that do not relate directly to the degree of substitutability of the licensed technologies, but may nonetheless affect the ability to raise prices and harm competition. For example, the existence of weak patents in a pooling arrangement receives a score of “2.” The justification for a moderate score of “2” is that such patents may or may not be valid or infringed.⁸³ Licensing terms that restrict the use of alternative products or processes also receive a score of “2.” Such exclusivity arrangements may or may not harm competition, depending on particular circumstances.⁸⁴ Table 1 also assigns a score of “2” to arrangements that fix downstream prices or impose exclusive territories or fields of use. The rationale for the moderate weight of “2” is that such vertical restraints need not harm competition in every instance.⁸⁵ Furthermore, many cases did not distinguish between the joint determination of downstream prices and the setting of high royalties that indirectly raised downstream

⁸³ Importantly, in the cases reviewed in this paper, a finding that a pooling arrangement involves weak patents is merely dictum. The cases do not report a legal determination that the patents are invalid or not infringed.

⁸⁴ “Such restraints may anticompetitively foreclose access to, or increase competitors’ costs of obtaining, important inputs, or facilitate coordination to raise price or reduce output, but they also may have procompetitive effects.” DOJ/FTC Intellectual Property Guidelines, *supra* note 6, at §4.1.2. *See also* Ilya R. Segal & Michael D. Whinston, *Exclusive Contracts and Protection of Investments*, 31 RAND J. ECON 603-33 (2000); Richard Gilbert & Carl Shapiro, *Antitrust Issues in the Licensing of Intellectual Property: The Nine No-No's Meet the Nineties*, 1997 *Brookings Papers: Microeconomics* 283-336 (1997); and Richard Gilbert, *Exclusive Dealing, Preferential Dealing, and Dynamic Efficiency*, 16 REV. INDUS. ORG. 167-84 (2000).

⁸⁵ *See, e.g.*, Patrick Rey & Jean Tirole, *The Logic of Vertical Restraints*, 76 AMER. ECON. REV. 921-39 (1986) (Explaining that anticompetitive restraints such as exclusive territories and resale price maintenance may or may not be socially desirable.).

prices. The former practice raises concerns about the creation of market power through vertical price-fixing. The latter practice does not create market power if the patents are not substitutes.

Table 1 assigns a weight of “1” if a patent pooling arrangement prevents unilateral licensing or requires a joint defense for challenged patents. These practices could conceivably harm competition. However, in other instances they may have little or no adverse impact, and could even be pro-competitive in some situations.

Table 2 lists each of the patent pooling arrangements reviewed in this paper and records whether each of the competitive factors identified in Table 1 above was present. If the competitive factor was present, it is recorded as a “Y” in Table 2. Each factor that was present receives the numerical score from Table 1 above. If the case description reveals that a particular competitive factor was not present, this is recorded as a “N” in Table 2. In some cases it is relatively straightforward to determine whether a particular competitive factor was present in a pooling arrangement. For example, case opinions are often explicit about whether licensing terms prohibited the use of alternative products or processes. In other cases the determination of the presence of a competitive factor is much more difficult. Several case opinions did not specifically address whether the patents involved in the pooling arrangement were substitutes for each or whether they were complements. Where case opinions fail to address this competitive relationship, Table 2 assigns “Not Known” to this competitive factor. This category receives a competitive weight of “2” in Table 2, midway between “0” if the patents are blocking and “4” if they are substitutes with joint royalty-setting. Similarly, a “?” in Table 2 indicates that the case opinion is silent about the presence or absence of this competitive factor. These entries receive a score equal to one-half of the weight that would be assigned if this factor were present in the case.

The total competitive hazard score for each case is the sum of the weights for all of the competitive factors that are present in the case. For example, *National Harrow* has a total competitive hazard score of “8.” This is the sum of weights assigned to the various licensing restrictions that were present in the case, and the weight of “2” for the competitive relationships of the patents, which is not identified in the case opinion. *Standard Oil* has a total competitive hazard score of “1,” because the only competitive

factor identified by the Supreme Court in that case is the combination of complementary patents.

Figure 2 shows the total competitive hazard scores for the patent pool and cross-licensing cases reviewed in this paper. The figure groups the cases into different time periods. In each time period, Figure 2 reports the average competitive hazard score for those cases that were held to violate the antitrust laws and for those for which the court found no antitrust violation. With the exception of the period from 1900 to 1929, there is a trend toward larger competitive hazard scores for cases that were held to violate the antitrust laws and low numbers for those cases that passed antitrust review, which suggests a correspondence between legal outcomes and economic arguments. The period 1900-1929 includes only two cases, both of which included many of the factors identified in Table 1 that raise competitive concerns. The outcomes were very different; the Supreme Court concluded that there was no antitrust violation in *National Harrow* and reached the opposite conclusion in *Standard Sanitary*.

Figure 2 aggregates the competitive hazard scores for a total of twenty cases, twelve of which were held to violate the antitrust laws and ten of which did not. For those cases that were held to violate the antitrust laws, the average competitive hazard score was 4.8. For those cases in which the courts found no antitrust violation, the average competitive hazard score was 2.6. The difference is only weakly significant.⁸⁶

Figures 3 and 4 explore further the relationship of the determination of antitrust liability in these cases to the competitive factors in Table 1. Figure 3 reports only the scores that are related to the degree of substitutability of the patents involved in the pooling arrangements; that is, whether the patents were substitutes, complements, or blocking. The figure shows essentially no relationship between cases that violated the antitrust laws and those that did not with respect to the degree of patent substitutability. The average score for the cases that were held to violate the antitrust laws is 1.9. For those cases that passed antitrust review, the average score is 1.7. The difference is not statistically significant. There is no apparent relationship between the degree of substitutability of the patents and the outcomes of the antitrust cases.

⁸⁶ A two-tailed t-test rejects equality of means at the six-percent level.

Figure 4 examines the correlation of case outcomes with the remaining competitive factors, which are primarily the restrictions that were present in the licensing arrangements. We call this the “downstream effects index.” If we exclude the two cases that occurred in the early years of the Sherman Act, there is a clear relationship between the downstream effects index and the outcomes of the antitrust cases. Cases that were held to violate the antitrust laws tended to have much larger scores for downstream competitive effects than cases that were not held to violate the antitrust laws. The average index for cases that passed antitrust review is 0.90. For those that did not, the average score is 2.8.⁸⁷ Excluding the two cases in the early years of the Sherman Act, the average score is 0.3 for cases that passed antitrust review and 2.6 for those that did not. Statistically, the difference in the two means is highly significant.

A clear pattern emerges from this analysis. Beginning with *Standard Sanitary*, the decisive factor in the antitrust review of patent pooling arrangements was the presence of restrictive licensing terms. Economically, restrictive licensing terms can be anticompetitive, and their existence may indicate a objective to control market prices that extends considerably beyond the desire to obtain revenues for patent licenses. However, an economic analysis of the antitrust risk posed by a patent pooling arrangement should look first to whether the patents involved in the arrangement are substitutes or complements. The courts have only rarely done this.

IV. When should enforcement agencies challenge pools?

From an economic perspective, the competitive relationships between patents should be a particularly important factor in assessing whether a pooling or cross-licensing arrangement harms competition. Yet the cases do not indicate that the courts have placed a great deal of weight on this factor. Why not? And, was this incorrect as a matter of competition policy? Furthermore, what factors should courts rely on to assess the competitive risks of patent pools and cross-licensing arrangements?

⁸⁷ The difference is significant at the two-percent level using a two-tailed t-test.

It is not at all clear that the courts have erred in their verdicts on pooling and cross-licensing arrangements. In some cases, the license terms have imposed vertical price fixing, which typically arouses antitrust concerns. Other arrangements have been shams, in which firms agree to abide by restrictive licensing terms as a means to cartelize an industry. In cases such as *Gypsum* the patent was incidental to a larger purpose, which was to impose downstream restraints that eliminated competition.

The dilemma in patent pooling and cross-licensing cases is to determine when licensing terms cross the line between the exploitation of the patent and the cartelization of an industry. This is no easy task and ultimately entails an assessment of the reasonableness of vertical restraints.⁸⁸ The *Intellectual Property Guidelines* note that: “Field-of-use, territorial, and other limitations on intellectual property licenses may serve procompetitive ends by allowing the licensor to exploit its property as efficiently and effectively as possible.”⁸⁹ But these vertical restrictions can go too far if they limit competition that would have occurred in the absence of the license. When pooling and cross-licensing agreements impose extensive vertical restraints, courts should question whether they limit competition that would have occurred in their absence. If they limit competition, these vertical restrictions should be condemned unless they offer compensating benefits.

More broadly, any case in which patents are combined raises the concern that the combination protects patents from challenges to scope and validity. A patent allows its owner to exclude competition as a reward for innovative effort. The social costs of exclusion have little offsetting social benefit for innovation if the patent is not valid or has very limited scope. Figure 5 illustrates both the social costs of patent protection and the private benefit from challenging a weak patent. The patent allows its owner to exclude competition and charge a price P^m . If the patent is proved to be invalid or not infringed, additional competition will occur and the price will fall to P^c . If the challenger is a potential competitor, the payoff is a share of the profits with competition, which is the area defined by the rectangle $cP^c ed$. The total consumer benefit from a successful

⁸⁸ Andewelt describes a structured approach to evaluate competitive issues raised by patent pools. See Roger B. Andewelt, *Analysis of Patent Pools Under the Antitrust Laws*, 53 ANTITRUST L. J. 611 (1984).

⁸⁹ See DOJ/FTC Intellectual Property Guidelines, *supra* note 6, at § 2.3.

challenge to patent scope or validity is $P^c P^m$ *ae*. The increase in total economic welfare (consumer surplus plus profits) is *baed*.

Although there may be much to gain from challenging a weak patent, the incentive for a private party to challenge a patent is typically less than societal gain from defeating an invalid patent because, if the party is not a consumer, it does not benefit from the reduction in price. Often, the parties to a patent agreement are the ones who would have an incentive to challenge patents owned by the other parties, and patent pools or cross-licensing agreements are often preceded by vigorous patent litigation.⁹⁰

It is conceivable that a consumer who accounts for a large share of the purchases of a patented product could have a private return from challenging a patent that exceeds the social return, providing an incentive to challenge the patent that exceeds the total social benefit.⁹¹ However, in most cases the private benefits would have to be shared with others, so any one firm or consumer (in the absence of coordination) would have too little incentive to mount a challenge.⁹²

The incentive to challenge patents is particularly low if patents are blocking. Placing one patent in the public domain does not necessarily have a large impact on total royalties if there are other, valid patents that can block the use of a technology. Eliminating patents that serve as a barrier to competition requires removal of all patents that may block the use of a technology. Consider the following example, which assumes that a patent pool combines a large number of patents, each of which is capable of blocking the use of the other patents in the pool. Definitions:

N = Number of patents

q = Probability that a single patent would be held invalid or not infringed if challenged

C = Net present social value of reduction in price from competition

E = Net present social value of efficiencies from combining patents

⁹⁰ This was the case in *Hartford-Empire v. United States*, 323 U.S. 386 (1945). Patent litigation often precedes cross-licensing in the semiconductor industry. See, e.g., Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995*, 32 RAND J. ECON. 101-28 (2001), and Shapiro, *supra* note 19.

⁹¹ For example, a consumer may not take into account losses that a finding of invalidity would impose on firms that supply substitute products.

⁹² This discussion ignores incentive effects for research and development. The presumption is that research and development incentives are not harmed by challenges to patent scope or validity.

For example, in Figure 5, the net present social value of the reduction in price from competition is the present value of the area *baed*. The efficiencies from combining patents are savings in costs or other benefits (such as facilitating the adoption of a new technology) that the patent pool achieves and that would not occur without the pool. Alternatively, *E* may be interpreted as benefits from the combination that would be lost if all of the patents are found to be invalid or not infringed.⁹³

By assumption, any one of the patents is sufficient to block competition if it survives a challenge to its scope or validity; that is, all patents have to fail a challenge for competition to occur. The probability that this happens is q^N . If competition occurs, this example assumes that it delivers a net present value of *C*. Thus the expected benefit from challenges to the validity or scope of all the patents is $q^N C$. Society benefits from a challenge to a combination of all of the patents if $q^N C > E$, or if $q^N > E/C$.

It is obvious that q^N falls rapidly with *N* for any reasonable value of *q*. The probability that all of the patents are invalid or not infringed must be very high for q^N to be a large number when *N* is large. This is illustrated in Figure 6. Thus, if *N* is large, then small benefits from a patent combination are enough to make a challenge undesirable, provided these benefits are specific to the survival of at least one of the patents.⁹⁴

The point is that the social benefits from challenging patent scope or validity may be small if the number of blocking patents is large. Society benefits from challenging patent scope or validity only if *all* the patents are found to be invalid or not infringed. This occurs with probability q^N , which is small when *N* is large. Furthermore, the social value is likely to exceed the private value from a challenge. When there is a large number of patents, each of which can block the use of a technology, the private incentive to challenge weak patents can be very small unless the parties can coordinate a challenge to all of the patents.

The wedge between the social and private values from overturning patents provides a justification for public agencies, such as antitrust enforcers, to challenge weak

⁹³ In this example, the social value from the reduction in price would include any benefits from the elimination of double marginalization. Hence that benefit would not be included in the efficiencies calculation.

⁹⁴ If the benefits would exist whether or not the patents are valid, then a patent challenge would be desirable if $P^N > 0$. This is always true. However, this simple example omits other factors, such as the cost of litigating the patents.

patents. Even if a combination includes many blocking patents, the benefits from challenging patent validity or scope could be high if there is correlation among the patents with respect to scope or validity.

V. Concluding Remarks

A review of antitrust cases dealing with patent pooling arrangements provides a history of the evolution of legal analysis in this area. In the earliest case, *National Harrow*, the Supreme Court deferred entirely to the rights of patentees to combine and license their patents. The Court recognized the dangers of this approach in its next pooling case, *Standard Sanitary*. Over time, the courts have wavered in their tolerance for combinations of patents. Economic analysis suggests that a key determinant in the legality of a patent pooling arrangement is the competitive relationship of the patents in the pool. This review shows that courts have paid little attention to this factor. Instead, courts have focused on the extent of licensing restraints on downstream products and processes that use the licensed technologies. Patent pooling cases that courts have concluded violate the antitrust laws tend to have had extensive downstream restraints.

As an economic matter, the existence of downstream restraints does not necessarily imply that a pooling arrangement is anticompetitive. The restraints would require the usual rule of reason evaluation to assess competitive impacts if the patents at issue are not substitutes for each other. When the patents are substitutes, the pool presents the risk that it increases royalties by eliminating competition among licensors. This risk is present without regard to the prevalence of restrictive licensing terms. There is no simple prescription to determine when a patent pooling arrangement is anticompetitive. A recommendation of this paper is that antitrust evaluations should begin with a study of the competitive relationships of the patents involved in the pool. Unfortunately, this is not a simple task. In some instances, antitrust authorities may anticipate that a challenge to a patent pool is unlikely to be efficient. If the pool combines many patents, each of which can block the use of a technology, a challenge to the pool is not likely to affect prices unless all of the blocking patents are shown to be invalid or not infringed. The probability of such a finding is likely to be very small when the number of independent blocking

patents is large.

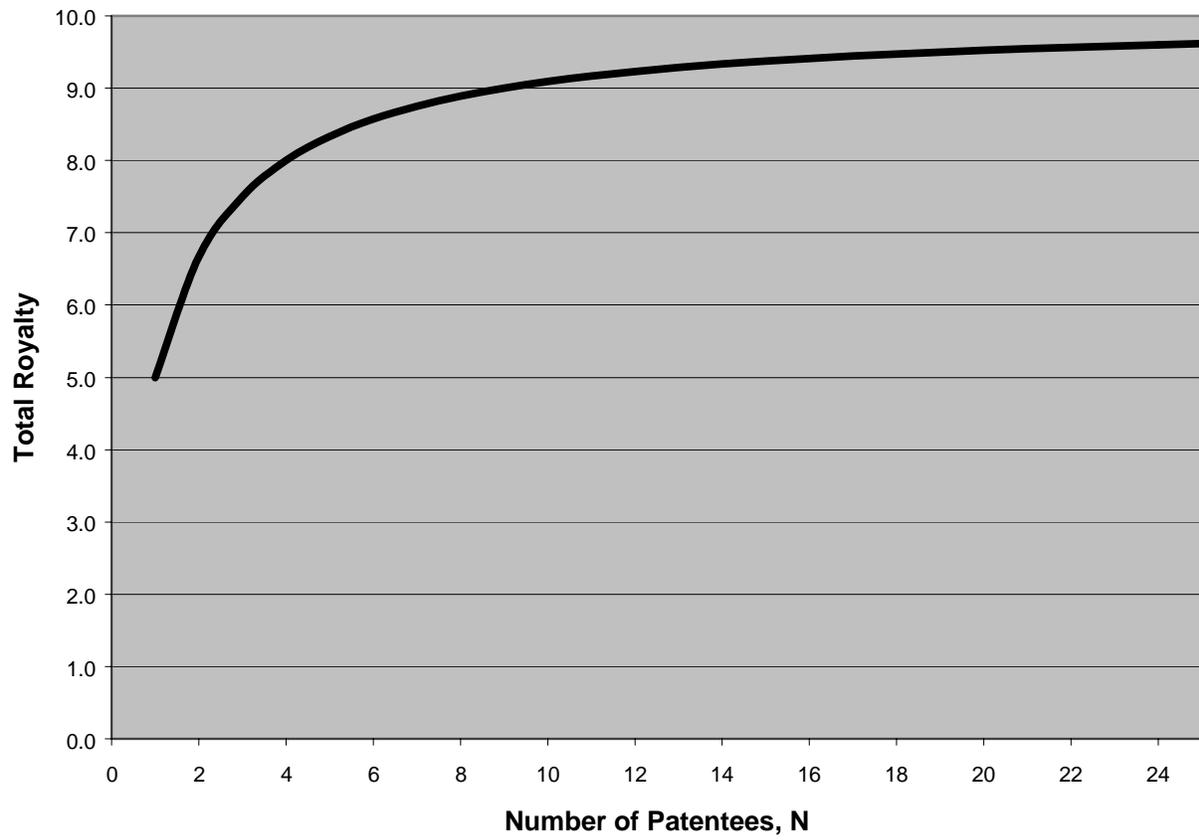


Figure 1. Total Royalty with N independent and Blocking Patentees

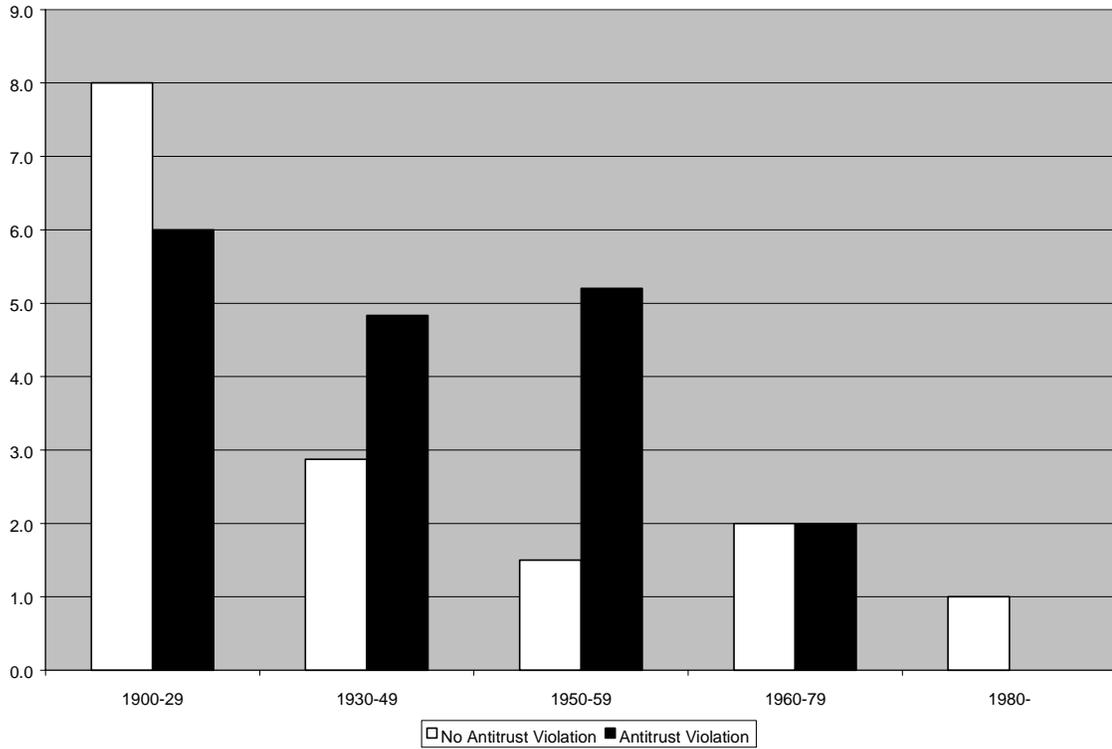


Figure 2. Patent Pooling Cases Competitive Hazard Index (lower is “better”)

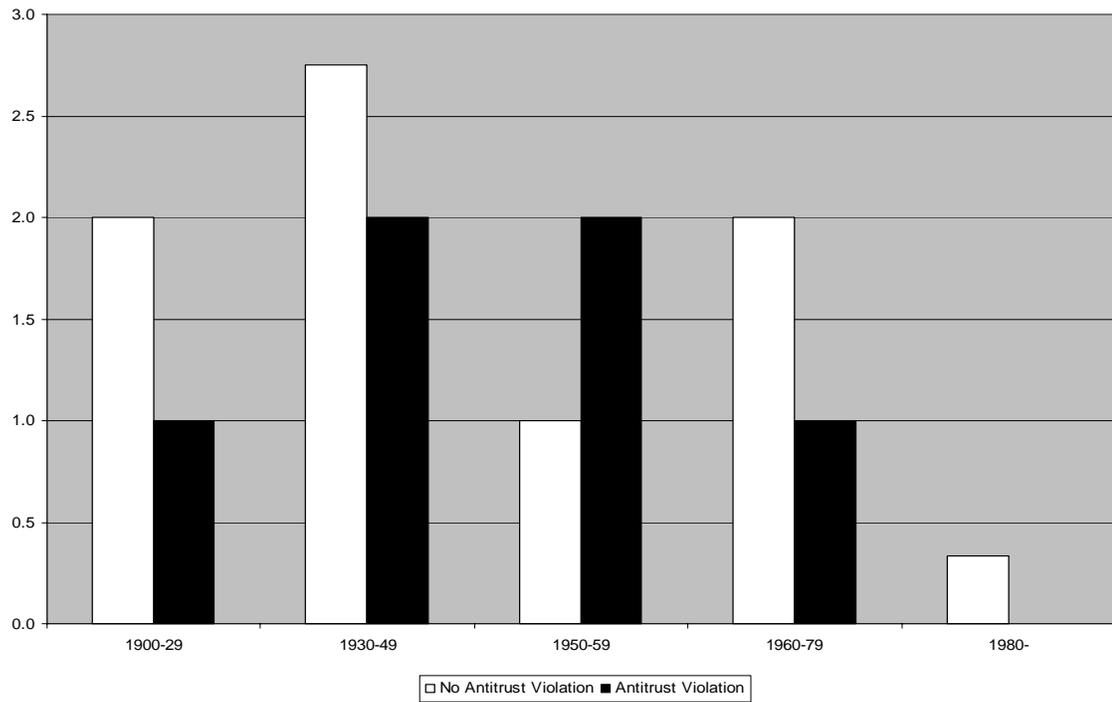


Figure 3. Patent Pooling Cases Patent Substitution Index (lower is “better”)

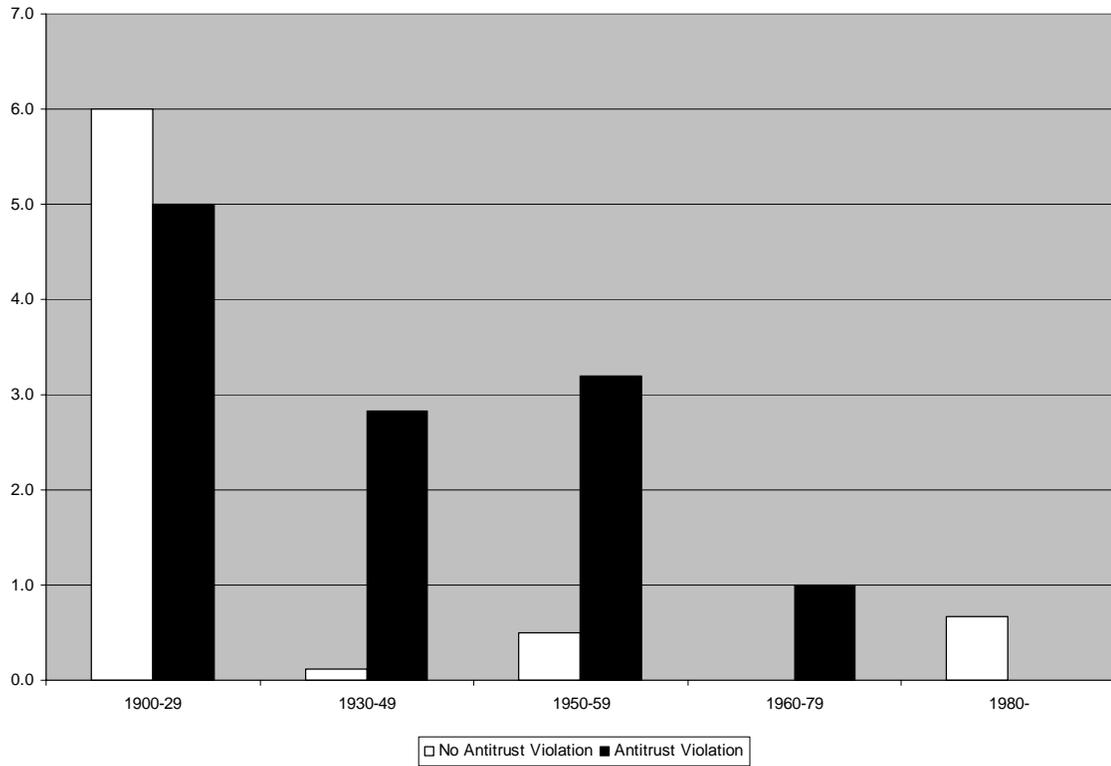


Figure 4. Patent Pooling Cases Downstream Effects Index (lower is “better”)

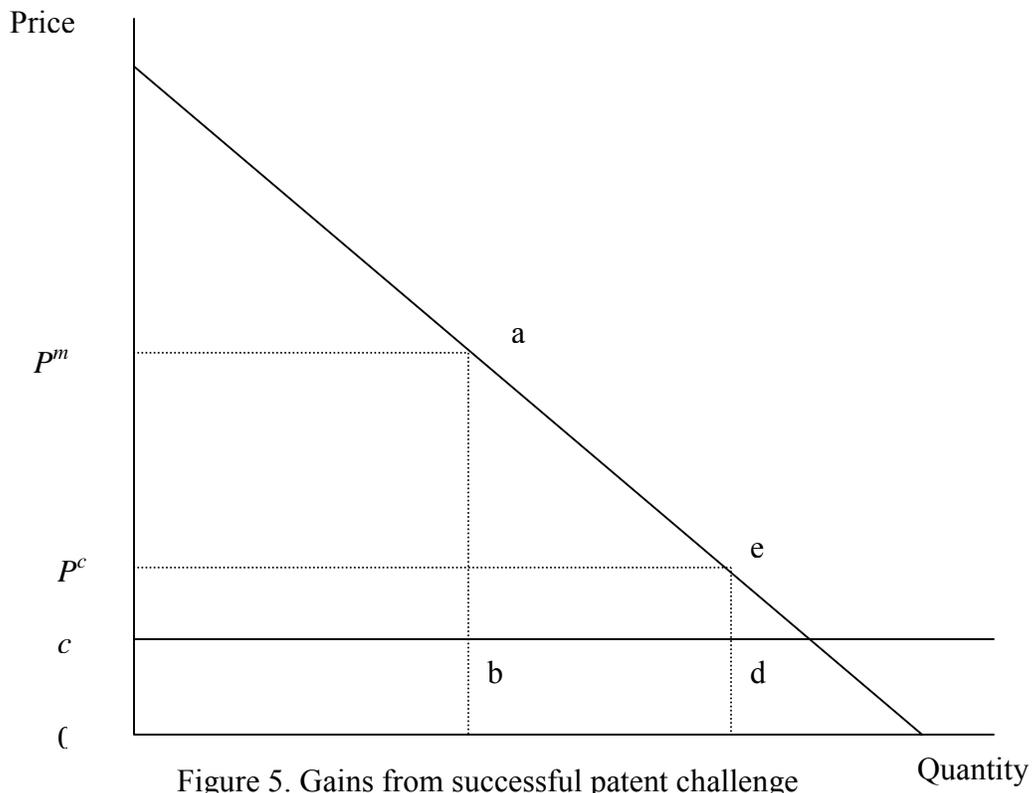


Figure 5. Gains from successful patent challenge

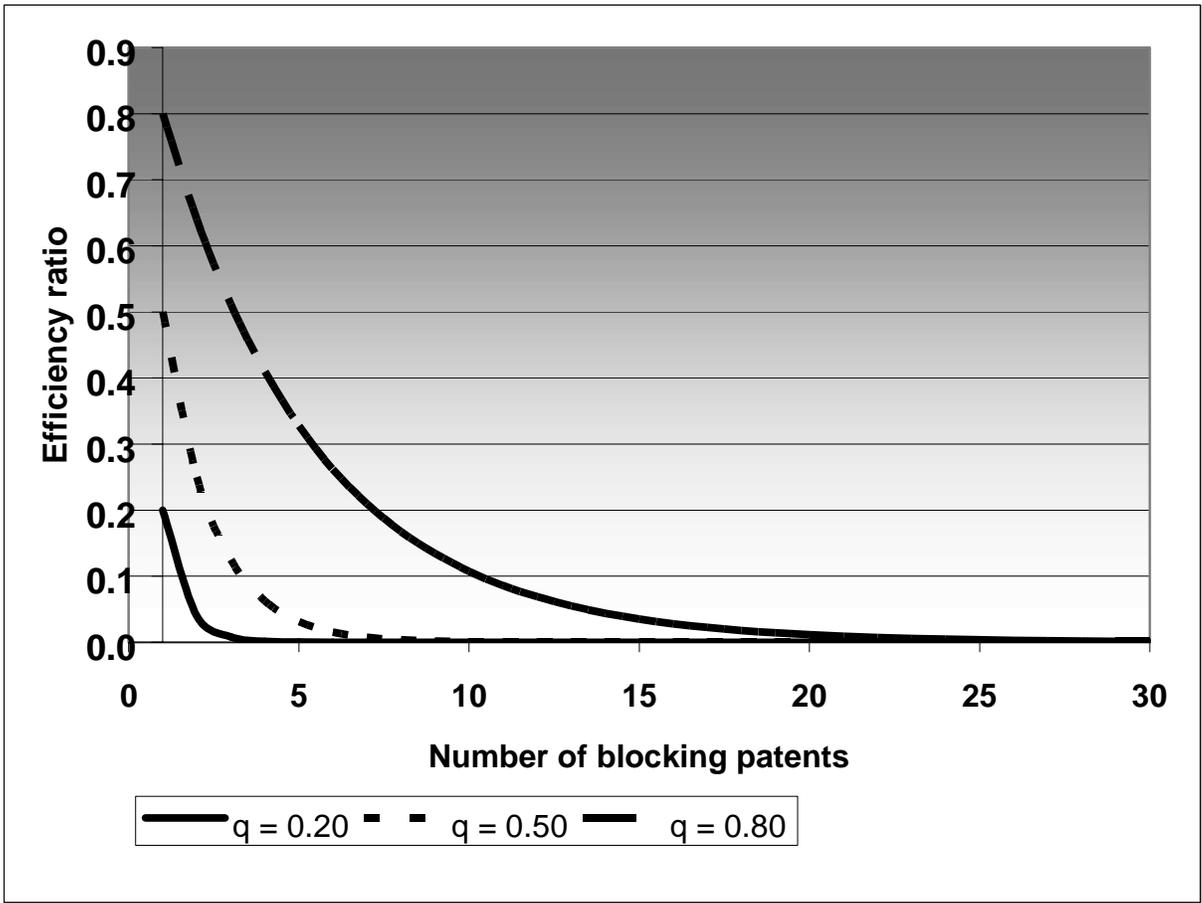


Figure 6. Required Efficiency Ratio for Pro-Competitive Patent Aggregation

Table 2: Competitive Hazard Scores (“Approved” = No Antitrust Violation; “Denied” = Antitrust Violation)

	Competitive Effect of Combining Patents					Weak Patents	Fix Product Prices or exclusive territories, fields of use	Restrict Alternative Products or Processes	Prevent Unilateral Licensing	Joint Defense	Total
	Substitutes with joint royalty-setting	Substitutes royalty-free cross license	Not Known	Comple- ments	Blocking						
	4	0	2	1	0	2	2	2	1	1	
Bement v. National Harrow (1902)			Y			N	Y	Y	Y	Y	8 Approved
Standard Sanitary v. U.S. (1912)				Y		N	Y	Y	Y	N	6 Denied
Standard Oil v. U.S. (1931)				Y		N	N	N	N	N	1 Approved
U.S. v. National Lead (1945): ex DuPont (pre-revision)	Y					N	Y	N	?	N	6.5 Denied
U.S. v. National Lead (1945): DuPont		Y				N	N	N	?	N	0.5 Denied
U.S. v. National Lead (1947) (post revision)	Y					N	N	N	?	N	4.5 Approved
Hartford-Empire v. U.S. (1942) (pre-revision)	Y					N	Y	N	Y	N	7 Denied
Hartford-Empire v. U.S. (1945) (post-revision)	Y					N	N	N	N	N	4 Approved
U.S. v. Line Material (1948)				Y		N	Y	N	N	N	3 Denied
U.S. v. U.S. Gypsum (1948)			Y			N	Y	Y	N	N	6 Denied
Cutter Laboratories (1949)			Y			N	N	N	N	N	2 Approved
Baker-Cammack (1950)				Y		N	N	N	?	N	1.5

											Approved	
U.S. v. New Wrinkle (1952)				Y		N	Y	N	?	N	Denied	3.5
U.S. v. Holophane (1954)			Y			N	Y	N	?	N	Denied	4.5
U.S. v. Associated Patents (1955)			Y			N	Y	N	Y	N	Denied	5
Mason City v. Clapper (1956)				Y		N	N	N	Y	Y	Denied	3
U.S. v. Krasnov (1956) ⁶	Y					Y	Y	N	Y	Y	Denied	10
King v. Anthony Pools (1962)			Y			N	N	N	N	N	Approved	2
United States v. Singer (1963)				Y		N	N	N	N	Y	Denied	2
Carpet Seaming v. Best Seam (1980)				Y		N	Y	N	N	N	Approved	3
MPEG-LA					Y	N	N	N	N	N	Approved	0
DVD					Y	N	N	N	N	N	Approved	0