# Ties that Bind: Policies to Promote (Good) Patent Pools

Richard Gilbert*
November 2009

## I. Introduction

Hundreds of patents cover products in many high technology fields such as semiconductors, information technology, and biotechnology.[1] Firms that make, sell, or use products in these fields often have to negotiate patent rights with many intellectual property owners.[2] The time and effort required to assemble these rights can interfere with the adoption and diffusion of new technologies and the cumulative payments to rights holders for use of their intellectual property can weigh heavily on technology costs.[3] Michael Heller and Roberta Eisenberg coined the term "tragedy of the anticommons" to describe a situation in which the presence of multiple independent property rights results in wasteful underuse of economic

* Department of Economics, University of California, Berkeley. The author is grateful to Dennis Carlton, Alan Cox, Michael Katz, Robert Merges, Carl Shapiro and Glenn Woroch for helpful discussions.

1 For example, as of August 2009, more than 1,000 active patents covered "semiconductor device making – cmos", more than 890 active patents covered "electronic funds transfer" over the Internet, and almost 1,000 active patents covered "genetic mutation, cell fusion, or genetic modification". These patent counts are based on searches of the U.S. Patent and Trademark Office patent database performed on August 19, 2009 for patents issued since August 1992.

2 See, e.g., Bronwyn Hall & Rosemarie Ham-Ziedonis, *The Determinants of Patenting in the U.S. Semiconductor Industry, 1980–1994*, 32 RAND J. ECON. 101 (2001), Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting, in* INNOVATION POLICY AND THE ECONOMY (Adam B. Jaffe, Josh Lerner, and Scott Stern eds. 2001), Carl Shapiro, *Technology Cross-Licensing Practices: FTC v. Intel (1999)*, in THE ANTITRUST REVOLUTION: ECONOMICS, COMPETITION, AND POLICY, 4TH ED. (John E. Kwoka, Jr. & Lawrence J. White, eds., 2003) and Mark Lemley & Carl Shapiro (2007), *Patent Holdup and Royalty Stacking*, 85 TEXAS L. R. 1991.

3 See, e.g., Roger B. Andewelt, *Analysis of Patent Pools Under the Antitrust Laws*, 53 ANTITRUST L.J. 611 (1984), Steven C. Carlson, Note, *Patent Pools and the Antitrust Dilemma*, 16 YALE J. ON REG. 359 (1999), Philip B. Nelson, *Patent Pools: An Economic Assessment Of Current Law And Policy*, 38 RUTGERS L. J. 539 (2007), Michael A. Carrier, *Resolving the Patent-Antitrust Paradox Through Tripartite Innovation*, 56 VANDERBILT L. R. 1047 (2003), Richard Gilbert, *Antitrust for Patent Pools: A Century of Policy Evolution*, 3 STAN. TECH. L. REV. 1 (2004), and U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION (2007) ("Antitrust and IP Report").

resources,[4] in contrast to the "tragedy of the commons" that describes the wasteful overuse of economic resources in the absence of property rights.[5] A "patent thicket", in which many independent patent holders have rights that cover a technology, is one example of the anticommons.[6]

A patent confers the right to exclude others from making, using or selling products that embody the patented technology. The right to exclude can lead to underuse of the patented technology if the patentee charges a high price or does not fully exploit the patent through production or licensing.[7] This type of underuse is a cost of providing incentives for invention and disclosure. The patent system grants a power to exclude in return for greater invention and disclosure of patented technologies. The underuse that can occur from a patent thicket is a different and potentially more burdensome cost. By granting many patent rights to pieces of technologies that must work together, the patent system creates risks that technology users will incur costly delays in assembling the patent rights that are necessary to make or use a technology or will bear excessive royalties from the cumulative royalty demands of patent owners.

The underuse caused by a patent thicket can harm patent owners as well as the consumers who face excessive royalties or high transaction costs from multiple patent rights. Intellectual property owners are harmed if their collective royalty demands or the transaction costs from licensing many patents slow the adoption or use of products covered by the patented technologies. One way around this lose-lose dilemma is for intellectual property owners to form a patent pool to share their

---

4 Michael Heller & Rebecca Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biological Research*, 280 SCIENCE 698 (May 1, 1998). See also Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990).

5 Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (December 13, 1968).

6 See Shapiro, note 2 above. Michael Heller makes the case that the anticommons is a problem in many circumstances including air traffic, urban development, regulation, and organ transplants, as well as for products that may infringe multiple patents. Michael Heller, *The Boundaries of Private Property*, 108 YALE L. J. 1163 (1999) and THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES (2008).

7 See, e.g., Dennis Carlton & Jeff Perloff, MODERN INDUSTRIAL ORGANIZATION (1999) and Suzanne Scotchmer, INNOVATION INCENTIVES (2004).

intellectual property with each other and with others through a program of joint licensing.[8]

Competition policy toward patent pools has focused on the prevention of potentially anticompetitive practices by patent pools and has generally ignored the central question of how to encourage the formation and stability of patent pools that benefit consumers. While patent pools have pro-competitive benefits when the manufacture or use of products may infringe multiple patents, there are powerful economic forces that prevent beneficial patent pools from forming or that limit the patents in the pool to only a fraction of the patents that cover the products. Section II of this article examines the determinants of pools that benefit consumers and Section III describes the forces that prevent pools from forming or that limit their membership. Section IV proposes several policies that would promote the formation of patent pools and encourage owners of relevant patents to join and remain a member of the pool.

## II. Good pools and bad pools

Antitrust enforcers historically have viewed patent pools with an element of mistrust. They had good reasons, as many of the first patent pools in the United States were created to squelch competition.[9] But many patent pools promote competition and enhance the adoption of new technology.[10] In the 1990s, several firms pooled their patents related to the MPEG-2 standard, a format for the

---

[8] A patent pool is an example of a collective rights organization. According to Robert Merges, patent pools substitute a regularized transactional mechanism (the pool license) for a property rule that requires individual bargaining for each transaction (negotiation between a single patentee and a potential licensor). Merges, Robert, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293 (1996). See also Adewelt, note 3 above. (The essence of a patent pool is a mutual agreement among patent owners to waive their respective exclusive patent rights.)

[9] Examples of anticompetitive patent pools are in Gilbert note 3 above and Steve C. Carlson, *Note: Patent Pools and the Antitrust Dilemma*, 1999 YALE J. REG. 359.

[10] The U.S. Department of Justice and Federal Trade Commission (2005), *Antitrust Guidelines for the Licensing of Intellectual Property* observe that cross-licensing and pooling arrangements may provide procompetitive benefits by integrating complementary technologies, reducing transaction costs, clearing blocking positions, and avoiding costly infringement litigation. By promoting the dissemination of technology, cross-licensing and pooling arrangements are often procompetitive.

encoding of digital video and audio signals broadcast by terrestrial, cable and satellite television systems and for movies and other programs that are distributed on Digital Versatile Discs and other media.[11] The MPEG pool (MPEG stands for the Motion Picture Experts Group) claims that the MPEG-2 standard faced a patent thicket with hundreds of patents covering the technology owned by many different firms and that the cost of locating and individually negotiating patent rights made it "virtually impossible for the standard to be used."[12] The pool offered one-stop shopping for many (though not all) of the patents required to use the standard. The MPEG pool advertises that "MPEG-2 became the most successful standard in consumer electronics history, and the MPEG LA® Licensing Model has become the template for addressing other patent thickets."[13]

The U.S. Department of Justice commented favorably on the MPEG LA patent pool.[14] The Justice Department has done the same for other recent patent pools, including two patent pools for DVD technologies,[15] a patent pool for third generation cellular technologies,[16] and another for radio frequency identification (RFID) tags.[17]

What distinguishes a "good" patent pool or cross-licensing arrangement from one that is likely to harm technology users? A patent pool can be anticompetitive if

---

11 http://en.wikipedia.org/wiki/MPEG-2.

12 MPEG LA at http://www.mpegla.com/aboutus.cfm.

13 Ibid. LA stands for Licensing Agent.

14 Business Review Letter from Joel I. Klein, Assistant Att'y Gen., U.S. Dep't of Justice, to Garrard R. Beeney, Esq. (June 26, 1997), *available at* http://www.usdoj.gov/atr/public/busreview/215742.pdf.

15 Business Review Letter from Joel I. Klein, Assistant Att'y Gen., U.S. Dep't of Justice, to Garrard R. Beeney, Esq. (December 16, 1998), *available at* http://www.usdoj.gov/atr/public/busreview/2121.pdf ("DVD 3C Business Review Letter") and Business Review Letter from Joel I. Klein, Assistant Att'y Gen., U.S. Dep't of Justice, to Carey R. Ramos, Esq. (June 10, 1999), *available at* http://www.usdoj.gov/atr/public/busreview/2485.pdf ("DVD 6C Business Review Letter").

16 U.S. Department of Justice (2002), Business Review Letter from Letter from Charles A. James to Ky P. Ewing, November 12, 2002, *available at* http://www.usdoj.gov/atr/public/busreview/200455.htm

17 Business Review Letter from Thomas O. Barnett, Assistant Att'y Gen., U.S. Dep't of Justice, to William F. Dolan and Geoffrey Oliver (October 21, 2008), *available at* http://www.usdoj.gov/atr/public/busreview/238429.pdf.

it inhibits competition between patented technologies or products made or sold by firms that participate in the pool, or if the pool issues licenses that restrain competition downstream between products that utilize the pool's technology and other products. Competition creates benefits for consumers when products or technologies are *substitutes* for each other. Two products or technologies are substitutes if an increase in the price of one of them increases the demand for the other. When glass companies formed the Hartford-Empire pool, they combined patents that covered two competing ways to manufacture glass. The pool exercised almost complete control over the manufacture of glass containers in the United States and eliminated any competition that could have occurred between the two main manufacturing technologies.[18]

The cross-licensing arrangements orchestrated by the United States Gypsum Company restricted licensees from competing in non-patented products, thereby limiting competition that would have constrained prices for patented gypsum boards.[19] Agreements between National Lead and other manufacturers of titanium dioxide coordinated a cartel that limited competition by establishing exclusive territories in which producers could sell their products, including products that did not infringe each other's patents.[20] In the language of antitrust, these are naked restraints of trade, cloaked in a mantel of protection of intellectual property. It is not surprising that these arrangements cultivated a deep mistrust of patent pools on the part of antitrust enforcers.

Competition in the supply of *substitutes* benefits consumers because competition offers choice and forces suppliers to offer attractive prices to win buyers. Competition in the supply of *complements* does not offer the same benefits. Two products or technologies are complements if an increase in the price of one of

---

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

19 United States v. United States Gypsum Co., 333 U.S. 364 (1948).

20 United States v. National Lead Co., 63 F. Supp. 513 (S.D.N.Y. 1945), *aff'd*, 332 U.S. 319 (1947). (The suppression of this commerce was not limited to patented processes but extended to all products within the 'licensed field.', 63 F. Supp. 513, 518).

them reduces the demand for the other. Pairs of shoes that have similar style and functionality are substitutes, but right and left shoes of the same pair are complements. Computer hardware and software are complementary products. Suppliers of cell phones, DVDs, encryptions standards, and microprocessors require the rights to use many complementary technologies.

Two or more patents, each of which is essential to make or use a technology, are complements because no one patent is useful without access to the others. In its review of the proposed patent pool related to a standard for RFID tags the U.S. Department of Justice clarified the definition of a patent that is essential for a standard as one that is "necessarily essential to the standard …" or one that is "essential to the standard as a practical matter because there are no economically viable substitutes . . . i.e., not reading on the standard itself but nonetheless required to manufacture a competitive product compliant with the standard, due to production or design costs, consumer preferences, or other reasons… ."[21]

Patents on technologies that add value to a product can be complements to other patents even if they are do not block the use of those patents. A patent that covers a mechanism to load a digital versatile disc is complementary to patents that cover the DVD encryption technology, even if it is not essential to record or play a DVD. An increase in the cost of the player mechanism reduces the demand for DVD players and hence reduces the demand for licenses to the DVD standard.

Coordination among suppliers of complements can benefit consumers by reducing the search and transaction costs of assembling necessary intellectual property rights and by avoiding "royalty stacking", which can occur when patentees set royalties independently for complementary technologies.[22] Royalty stacking is a special case of double-marginalization, which can occur when firms sell or license complementary products or technologies and demand is sensitive to price. Augustin

---

[21] Business Review Letter from Thomas O. Barnett, Assistant Att'y Gen., U.S. Dep't of Justice, to William F. Dolan and Geoffrey Oliver (October 21, 2008), *available at* http://www.usdoj.gov/atr/public/busreview/238429.pdf.

[22] Lemley and Shapiro, note 2 above.

Cournot was the first to identify the cost imposed by independent supply of complements, hence royalty-stacking or double-marginalization is also called the Cournot complements effect.[23]

As in the case of essential patents, pooling and joint licensing of patents that are complements, but not essential, can promote competition by reducing transaction costs and speeding the adoption of new technologies. But pooling of non-essential complementary patents can create costs as well, as the following stylized example demonstrates.[24]

Suppose that a new audio encryption technology can be used in a computer or in a portable media player. A single patent covers the encryption standard. The owner of the patent cannot distinguish between licensees of the standard for computers and those for media players and hence has to set a single royalty for both. In addition, there are three patents that cover use of the encryption technology in a media player, but are not infringed by the use of the encryption technology in a computer.

Independent licensing of the three media patents likely would lead to excessive royalties from royalty stacking as each licensor attempted to capture a high fraction of the value of the encryption technology in a media player. Pooling these patents along with the encryption technology patent would eliminate royalty stacking and reduce the total royalty required to use the new technology in a media player. But the pool could be a detriment to computer users.

Recall that the owner of the encryption patent sets one royalty for both consumers of portable media players and computer users. In the absence of the pool, the high price of the media patents reduces the royalty that the owner of the encryption patent can profitably charge. The pool lowers the total price of the

---

[23] Augustin Cournot, *Researches into the Mathematical Principles of the Theory of Wealth*, originally published in French (1838), translated by N. Bacon (1927). See also, e.g., Dennis Carlton & Jeff Perloff, MODERN INDUSTRIAL ORGANIZATION (1999) at 166-8.

[24] This example is related to the analysis in Daniel Quint, *Economics of Patent Pools When Some (but not all) Patents are Essential*, University of Wisconsin Working Paper, January 2009.

media patents by eliminating royalty stacking, which in turns allows the owner of the encryption patent to charge a higher royalty. On net, this is a good outcome for consumers of portable media players. Computer users, however, pay more for the encryption patent as a result of the pool and are worse off.

The example illustrates that pooling of patents that are complementary but not essential to use a technology in all applications need not make all consumers better off.[25] Whether this is sufficient justification to oppose the pooling of complementary but non-essential patents is another matter. Pooling of non-essential complementary patents has benefits by potentially lowering royalties for some products. Furthermore, pooling of non-essential complementary patents reduces transaction costs and can accelerate the adoption of a new technology. These are benefits for all consumers, even if the pool results in somewhat higher prices for the consumers of some other products.[26]

The Court of Appeals for the Federal Circuit concluded that including non-essential patents in a package license did not raise antitrust concerns given that the package included essential patents.[27] While the preceding discussion demonstrates that including complementary but non-essential patents in a package license can result in higher royalties for some licensees, the Federal Circuit emphasized the benefits of package licensing and noted that a package license does not compel a licensee to use all of the patents in the package and that the royalty for a package

---

[25] Quint shows that the pool can even lower total economic welfare in some cases. See note 24 above.

[26] A patent pool may raise prices for all consumers if the licensed patents add value to a product but no single patent is essential. In this instance, patents are complements because each licensed patent adds value to other licensed patents, but they are also substitutes because licensing fewer patents is a competitive alternative to licensing more patents. See Josh Lerner & Jean Tirole (2004), *Efficient Patent Pools*, 94 AMER. ECON. REV., 691 (2004). This scenario contrasts with the licensing of essential patents along with non-essential patents, for which pooling benefits some, if not all, consumers.

[27] U.S. Philips Corp. v. Int'l Trade Comm'n, 424 F.3d 1179 (Fed. Cir. 2005) and U.S. Philips Corp. v. Princo Corp., 173 F. App'x 832 (Fed. Cir. 2006).

licensing is largely, if not entirely, based on the patents that are essential to the technology in question.[28, 29]

Clearly pools of patents that are substitutes for each other can harm technology users and consumers by eliminating competition between alternative technologies. Furthermore, a pool of complementary patents can harm competition if the pool issues licenses that impede downstream competition. An example is a license that requires licensees not to deal in competitive technologies that do not infringe the pool's patents.[30] Just as a single firm with market power may engage in conduct that excludes competition, a patent pool that offers a portfolio license may engage in similar conduct.

Patent pools can harm consumers by reducing incentives to innovate. The government intervened to break up an agreement between automobile manufacturers to cross-license technology related to pollution controls under the theory that a broad agreement harms incentives for innovation by making it difficult for any one company to benefit from its research and development.[31]

---

[28] 424 F.3d 1179, 1191. Package licensing would not increase profit-maximizing royalties in the short run if all patents are essential to practice a technology. Furthermore, under some conditions, package licensing of essential patents provides incentives to invent around patents and invest in complementary assets that are closer to their socially optimal levels than what would obtain in the patents were licensed separately. See Richard Gilbert & Michael Katz, *Should Good Patents Come in Small Packages? A Welfare Analysis of Intellectual Property Bundling*, 24 INT'L J. INDUS. ORG. 931 (2006). For a contrasting discussion of whether patent pools should be limited to essential patents, see Richard Gilbert, *The Essentiality Test for Patent Pools*, Forthcoming in Rochelle Dreyfuss, Diane Zimmerman and Harry First (eds.), *Working within the Boundaries of Intellectual Property*, Oxford University Press and Michael A. Lavine, *Ripples in the Patent Pool: The Impact and Implications of the Evolving Essentiality Analysis*, 4 NYU J. L. & BUS. 605 (2008).

[29] The Court also observed that the patents that are essential to practice a technology can change as a technology matures and that it would be unwise to subject the licensor of a portfolio of patents to continuous antitrust scrutiny based on changing evaluations of essentiality. 424 F.3d 1179, 1191, 1196.

[30] See, e.g., United States v. United States Gypsum Co., 333 U.S. 364 (1948), note 19 above.

[31] United States v. Automobile Mfrs. Ass'n, 307 F. Supp. 617 (C.D. Cal 1969). A similar allegation led to the break up of the Manufacturers Aircraft Association patent pool. See note 99 below. See also Ryan Lampe & Petra Moser, *Do Patent Pools Encourage Innovation? Evidence from the 19th-Century Sewing Machine Industry*, Stanford University Working Paper (2009) (Evidence that the Singer patent pool coincided with a period of lessened innovation in the sewing machine industry.)

Patent pools also can raise antitrust concerns by sheltering weak patents from validity challenges.[32] Patents are "probabilistic rights".[33] They convey the exclusive right to make, use, or sell the technology covered by the patent only if the patent is valid, and challenged patents are often held to be invalid. The scope of a patent is also probabilistic because the patent scope depends on determinations of patent claims that are difficult to know before they are adjudicated.

Some patent pools have included explicit agreements to support weak patents. These include covenants not to challenge patents, joint defense agreements, and allocation of patent rights to parties who are best able to defend them.[34] Patent pools also can support weak patents by creating an institutional environment in which patentees find that it is mutually advantageous to recognize each other's patents without explicit agreements that forbid challenges by the pool's members.[35] Including invalid, expired, or non-essential patents in a pool raises the risk that the pool will act like a cartel and eliminate competition between technologies that are substitutes for each other.[36] These concerns are somewhat

---

[32] Patent validity cannot be assumed. See, e.g., Mark Lemley and Carl Shapiro, *Probabilistic Patents*, J. ECON. PERSPECTIVES 19 (2005), 75-98.

[33] See, e.g., Mark Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSPECTIVES 75 (2005) and Joseph Farrell and Robert Merges (2004), *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors, and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L. J. (2004).

[34] The cross-licensing arrangement between the Singer Manufacturing Company and a Swiss rival, Gegauf, had elements of such conduct. The terms of the agreement provided that each party would vigorously defend its patent rights in its relevant territory and not contest the validity of the other's patents. United States v. Singer Manufacturing, 374 U.S. 174 (1963).

[35] See, e.g., Jay Pil Choi, *Patent Pools and Cross-Licensing in the Shadow of Patent Litigation*, HERMES-IR Technical Report (2009) and Richard Gilbert, *Antitrust for Patent Pools: A Century of Policy Evolution* (2004), note 3 above, at 18. Although a patent pool may lessen incentives to challenge the patents in the pool, this is less likely to harm welfare if the pool includes a large number of essential patents with independent probabilities that each patent is valid and infringed. The probability that all of the pool's patents are invalid or not infringed declines with the number of patents while the cost of litigating patents increases with the number of patents challenged. Consequently, if probabilities are independent and the number of patents is sufficiently large, it is likely that the social cost of challenging the patents is larger than the expected benefit. In that case, the fact that a pool undermines incentives to challenge patents does not harm welfare because challenges to patent validity and infringement fail a benefit-cost test.

[36] A further concern is that non-essential patents raise the risk of foreclosure. The Department of Justice gave the example of patents on two alternative ways to insert DVD-ROM discs into packaging. In addition to the risk of eliminating price competition, the Department noted that including one of the technologies in the pool could foreclose the other technology because the pool's portfolio license

exaggerated.[37] Including non-essential or invalid patents in a pool does not allow the pool to choose a higher profit-maximizing royalty for its portfolio license for all licensees if there is at least one other valid patent in the pool that is essential to make the product.[38] While it is not unlikely that any single patent in a pool may turn out to be invalid or not infringed, most pools include a very large number of patents,[39] and the likelihood is very high that at least one of them is essential to practice the technology covered by the pool.[40]

Is it better to include uncertain patents in a pool or to exclude them from the pool's portfolio license? Both actions present risks. Putting weak or non-essential patents in a pool risks possible coordination to raise prices, requiring licensees to pay for technology that should be free, and possibly foreclosing competition from substitute technologies that are arbitrarily excluded from the pool. As we discuss in more detail below, an additional concern is that allowing patentees to contribute weak or non-essential patents to a pool can dilute the distribution of licensing revenue to essential patent holders, which can make the pool unstable or more difficult to form in the first place.

While antitrust authorities have focused on rules that determine when patents should be excluded from pools, they have paid relatively little attention to the crucial issue of how to encourage patentees to form beneficial pools and how to

---

would provide, at no additional cost, a license to use the technology in the portfolio. See DVD 3C Business Review Letter, note 15 above, at 10-11.

37 See Richard Gilbert, *The Essentiality Test for Patent Pools*, in Rochelle Dreyfuss, Diane Zimmerman and Harry First (eds.), *Working within the Boundaries of Intellectual Property*, Oxford University Press, forthcoming. Recent communications from the U.S. antitrust authorities suggest some flexibility with respect to these criteria. See Antitrust and IP Report, note 3 above, at 77-78. ("The Agencies acknowledge, however, that it might be reasonable to include substitute patents in a pool in certain situations.")

38 Although including non-essential patents in a pool can raise royalties for some customers. See Quint, note 24 above.

39 The MPEG-2 pool offers a portfolio license for 870 patents that it represents are essential to practice the MPEG-2 encoding standard. See note 12 above.

40 Suppose the pool contains $N$ patents, each of which is essential and valid with independent probability $p$. The probability that at least one patent is essential and valid is $1-(1-p)^N$. For example, if $p$=0.5 and $N$=10, the probability that at least one patent is essential and valid is 0.999.

make those pools resistant to defection. The next section explains why patent pools may not form or may be casualties of internal forces that cause them to disintegrate.

## III. Good patent pools may fail to form or be unstable to defections

Incentives should exist to form patent pools that benefit licensors as well as licensees. This is an application of the "Coase Theorem", which teaches that economic agents will negotiate efficient solutions when transaction costs are low and agents have effective property rights that control the use of their resources.[41] Ronald Coase developed his arguments in the context of agents whose activities imposed unpriced costs on others, such as pollution externalities.[42] The insight of the Coase Theorem applies as well to patent rights, for which royalty stacking, entrenched blocking positions and costly search for patent rights adversely affect joint profits. However, in the patent pool case, clear property rights and costless bargaining are not sufficient to conclude that patentees will pool their patents when pooling maximizes their joint profits.

The failure of patentees to pool their patents when pooling is jointly profitable is not a direct contradiction of the Coase Theorem. If all of the owners of patents that are necessary to make or use a technology were locked in a room and could not leave without reaching an agreement, it is likely that they would negotiate a jointly beneficial licensing outcome. The problem is that patentees are not compelled to negotiate with other patentees. They don't have to enter the room, but instead can seek privately profitable arrangements that exclude other patentees.

The economic "theory of the core" addresses the ability of agents to bargain for efficient outcomes. Core theory considers the agents in an economy and the outcomes they can guarantee for themselves when they form coalitions with other

---

41 See, e.g., W. Kip Viscusi, John M. Vernon, & Joseph E. Harrington, *Economics of Regulation and Antitrust* (1995) at 712 and Steven D. Levitt, *A Freakonomics Contest: The Coase Theorem Online*, available at http://freakonomics.blogs.nytimes.com/2007/11/13/a-freakonomics-contest-the-coase-theorem-online/.

42 Ronald H. Coase, *The Problem of Social Cost*, 3 J. LAW & ECON. 1 (1960).

agents. A single patent licensor is a coalition of one. Other coalitions may consist of some, or all, owners of patents that are necessary to make or use a technology. The grand coalition is the set of all the relevant players. When the core exists, the grand coalition is a stable bargaining outcome.[43]

In the patent example, the core exists if every patentee prefers her payoff when part of a pool that consists of all patentees to the payoff she could get in any different coalition of patentees. In general terms, the core of an economy with complementary patents may not exist.[44] Patent owners may have many reasons not to pool their patents, even if a pool would maximize their joint profits. They may refuse to join because they believe that their patents are worth more as independent licensor than they would receive under the pool's royalty allocation methodology, or they may have strategic interests, such as protecting confidential R&D plans, that they feel may be compromised if they join a pool. In some cases they may refuse to join any pool. In other cases they may choose to join a pool that does not include all patentees, such as either of the two pools that license DVD patents. If patentees are motivated purely by the licensing revenues they can collect, then the pool could profitably offer enough to a *single* patentee to convince that patentee to remain in the pool. However, in general, the pool cannot afford to compensate *every* patentee that may defect to become an independent licensor.

Patent pools do form and sometimes they include a large fraction of the patents that are essential to make or use a technology. Incentives to defect from a pool or not join in the first place depend on many factors. The remainder of this

---

43 See, e.g., Lester Telser, *The Usefulness of Core Theory in Economics*, 8 J. ECON. PERSPECTIVES 151 (1994). For a demonstration that the core of a game may not exist, see, e.g., Varouj A. Aivazian and Jeffrey L. Callen, *The Coase Theorem and the Empty Core*, 24 J. LAW & ECON. 175, (1981).

44 Eric Maskin demonstrates that the core may not exist if a coalition consisting of a subset of players generates positive externalities for other players, even if all players would be better off in the grand coalition. See Eric Maskin, *Bargaining, Coalitions, and Externalities*, Presidential address to the Econometric Society (2003). Positive externalities exist for essential patents; the owner of an essential patent benefits when others pool their essential patents. See also Reiko Aoki & Sadao Nagaoka, *Coalition Formation for a Consortium Standard Through a Standard Body and a Patent Pool: Theory and Evidence from MPEG2, DVD and 3G*, Institute of Innovation Research, Hitotsubashi University Working Paper WP#05-01 (February 2005).

section considers some of these factors that make pooling more or less attractive to individual patentees.

1. *Business strategies affect pooling incentives*

Patent owners often differ in their licensing objectives. Some patentees do not manufacture or sell products that use their patents, and it is understandable that these patentees want to maximize profits subject to any constraints from commitments they may make as part of their licensing programs.[45] For some other patentees that are vertically integrated into downstream production the overriding objective may be to sell products that employ the patented technologies rather than profit from licensing revenues.[46] A patent pool facilitates the adoption of a new technology by allowing one-stop shopping for patent rights and reduces the potential costs of royalty stacking. Vertically integrated patentees may settle for low or even zero royalties in return for rapid adoption of their preferred technologies and speedier or more effective market entry.

Most recent patent pools were formed to license patents that are necessary to use a defined standard, such as MPEG encoding, DVDs, or mobile telephony. The companies that founded these organizations are vertically integrated firms that both own intellectual property and sell products that use the patented technologies. The companies that established the DVD pools manufacture and sell digital versatile discs or complementary hardware and services, such as DVD players and movies. In 1998, five vertically integrated companies – Ericsson, Nokia, IBM, Toshiba and Intel – formed the Bluetooth Special Interest Group (SIG) to promote the Bluetooth short-range wireless communications technology specification. The Bluetooth SIG has grown to include more than 200 firms that guide the development of Bluetooth

[45] Examples of commitments include an obligation to license under RAND (reasonable and non-discriminatory) terms or most-favored customer agreements that discourage the patentee from setting different license terms for licensees. RAND commitments are discussed in Section IV.

[46] It is worth noting, however, that even vertically integrated firms have incentives to collect royalties from their patents. See Reiko Aoki and Sadao Nagaoka, note 44 above.

technology and more than 10,000 member companies that develop, manufacture, or sell *Bluetooth* enabled products worldwide.[47]

Alcatel-Lucent, Cisco, Clearwire, Intel Corporation, Samsung Electronics and Sprint formed the Open Patent Alliance (OPA) patent pool to promote adoption of the fourth generation WiMAX wireless technology based on the IEEE 802.16e standard. The objective of the pool is to provide "a more competitive royalty structure."[48] It is noteworthy that Alcatel-Lucent joined this pool while choosing to license its MP3 and MPEG-2 patents independently. Alcatel-Lucent is a telecommunications company. Unlike digital video and audio encoding technologies, WiMAX technology is central to its core business.

Other pools have formed that limit royalties to promote social objectives rather than to profit from new products. The Syngenta seed company and other agricultural technology companies donated patents to the Gold Rice patent pool to promote use of a genetically-engineered strain of rice designed to combat vitamin A deficiency in developing countries.[49] Companies, universities and research organizations have made patents available for royalty-free licenses to clear potential patent thickets that could hinder research in agriculture, medicine, and biotechnology. Examples include the green fluorescent protein project, the Public Intellectual Property Resource for Agriculture, the SARS IP Working Group, and the UNITAID pool for AIDS medications.[50]

Different business strategies can cause firms to pool their patents with some firms, but not with others. Two pools to license DVD patents emerged in part as a consequence of differing approaches to industry standards. Sony, Pioneer, and

---

47 Bluetooth membership directory, available at https://www.bluetooth.org/apps/directory/default.aspx.

48 Intel News Release, "Open Patent Alliance Formed to Advance WiMAX 4G Technology," available at http://www.intel.com/pressroom/archive/releases/20080609corp.htm.

49 See http://www.goldenrice.org/Content2-How/how9_IP.html.

50 See http://www.stopaidssocieties.org.uk/2008/07/patent-pool-plans-progress/ and David Serafino, *Survey of Patent Pools Demonstrates Variety of Purposes and Management Structures*, KEI Research Note 2007:6, Knowledge Ecology International (4 June 2007).

Philips pooled their DVD patents in 1998.[51] Soon after, Hitachi, Matsushita Electric, Matsushita Electric Industrial, Time Warner, Toshiba, and Victor formed a separate pool (the DVD 6C pool). One explanation offered for the existence of two separate pools is that the two groups could not reach an accord about their respective shares of joint royalty payments.[52] Another explanation for the fork in the patent pool road was a disagreement between the two groups over the promotion of DVD standards.

Philips, Pioneer, and Sony favored a single-sided disk format that could hold 3.7 GB of data while the six-firm group favored a double-sided format that could hold 5 GB of data. They resolved their disk format differences in a compromise solution prior to initiation of their licensing program, but they continued to disagree over standards for recordable and re-writable disks.[53] Thus one explanation for the splitting of DVD patents into at least two separate pools is the historically divergent business interests of different owners of DVD patents.[54]

2. *Pool royalties affect pooling incentives*

A patent pool can discourage independent licensing if it can commit to charge a sufficiently high royalty. Consider the following example. There are 10 essential patents, each owned by a single firm. Each potential licensee has a willingness to pay of $10 per unit for the technology covered by the 10 patents and incurs a

---

51 U.S. Federal Trade Commission and Department of Justice, *Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition*, at 69.

52 YOSHIKO HARA, *Royalty dispute foils one-stop DVD patent licensing plan*, EE Times, June 18, 1999. Available at http://www.eetimes.com/story/eezine/OEG19990618S0008.

53 See JIM TAYLOR, MARK JOHNSON & CHARLES CRAWFORD, *DVD Demystified*, at 6-1-6-8 and INTEREST: Integrating Research and Standardization, Project co-funded by the European Commission within the Sixth Framework Programme, March 16, 2006, at 105-114.

54 Fortunately, there has been some convergence in DVD technologies. Both pools currently license patents they own that cover all of the different DVD formats (although they continue to administrate their licensing programs as separate pools). See DVD6C Licensing Group, *Frequently Asked Questions about the DVD Patent Joint Licensing Program*, available at http://www.dvd6cla.com/faq.html (… the new DVD Patent Joint License also extends to +R/+RW Discs that conform to the +R/+RW Standard Specifications); see also Philips, *Licensing Programs*, available at https://www.ip.philips.com/services/?module=IpsLicenseProgram&command=Search. DVD players are available that support multiple DVD standards. *DVD Formats Explained*, available at http://www.webopedia.com/DidYouKnow/Hardware_Software/2007/DVDFormatsExplained.asp.

transaction cost of $0.50 per unit for every licensing transaction.[55] A pool that offers a package license for the 10 patents can demand a per unit royalty of up to $9.50 (equal to the $10 willingness to pay less a transaction cost of $0.50). If all the licensors licensed independently, they could collect royalties that total no more than $5.00 per unit (the $10 willingness to pay less $5.00 in transaction costs for the 10 separate licensing transactions). As a simplification, I assume that licensing incurs no direct costs other than transaction costs and that a pool shares royalties equally among its members.

Suppose that the ten firms unite to form a patent pool and charge a royalty of at least $9.00 per unit. If the pool can sustain at least the $9.00 royalty, then no firm will have an incentive to leave the pool. If a firm attempted to license a patent on its own, it would have no demand for its patent because licensees' total willingness to pay would be $9.00 per unit (the $10 value less two licensing transactions at $0.50 each), which is less than the cost to a licensee of assembling the required patents given that the pool alone charges at least $9.00.

The key to this result is the ability of the pool to commit to a high royalty. The $9.00 royalty in this example does not leave enough royalty "headroom" for a patentee to profit by becoming an independent licensor. In fact, the pool is stable to defection if it can commit to a royalty of at least $8.19 per unit. The most that a single patentee can collect by defecting from the pool is $9.00 per unit less the royalty charged by the pool. If the pool charges $8.19 per unit for a package license, the most a single defecting patentee can earn is $0.81 per unit ($9.00-$8.19). If the patentee remains in the pool, its share of the pool's royalty is $0.82 per unit, which is more than it can make by defecting. If the pool charges any lower royalty, then a pool that includes all ten patents will not be stable because at least one firm will have an incentive to leave the pool. Thus one element that contributes to a stable pool is the ability of the pool to commit to a high royalty.

---

[55] The transaction cost includes the costs of identifying licensors and negotiating licenses, but also can represent profit dissipation from independent licensing of complementary patents in a more general model with price-elastic demand; i.e., the Cournot complements/royalty-stacking problem.

3. *Patent damage infringement rules affect pooling incentives*

The laws that govern damages for patent infringement can operate in ways that make it more or less attractive for patentees to license independently rather than as part of a pool. Patent law may allow a patentee to obtain an injunction that prevents conduct that would infringe the patent's claims.[56] The threat of injunctive relief provides a patentee with bargaining power than can be disproportional to the number of patents that she owns. In the previous example, if nine patents are in the pool and one is licensed independently, a licensee needs the one "outside" patent just as much as the nine "inside" patents. The licensee's willingness to pay for a license net of transaction costs when the licensee has to transact with the pool and with an independent licensor is $9 per unit. Under some reasonable bargaining assumptions – including the ability to demand injunctive relief for patent infringement – the pool and the independent licensor may split the $9 net value with each earning a royalty of $4.50 per unit.[57] Of course the independent licensor with a single patent gets to keep the entire $4.50 royalty, while the pool has to share its $4.50 royalty with the remaining nine patentees. If each patent has a single owner, it is clearly more profitable to be an independent licensor in this case.[58]

The U.S. Supreme Court reigned in the injunction threat in its eBay v. MercExchange decision.[59] Prior to this decision, courts often presumed that a

---

56 See, e.g., Alan L. Durham, *Patent Law Essentials: A Concise Guide* at 185.

57 One economic model that describes the outcome of bargaining among profit-maximizing firms is the Nash cooperative bargaining solution. See, e.g., Kenneth Binmore, A. Rubinstein, and A. Wolinsky, *The Nash Bargaining Solution in Economic Modelling*, 17 RAND J. ECON. 176 (1986). (Note that the Nash bargaining solution differs from the concept of a Nash equilibrium that is employed in many oligopoly models, although both trace their origins to the work of John Nash.) When patents are known to be valid and infringed, the patents are essential to make or use only one technology and have no value for any other technology, patent holders maximize profits, and a patent holder can obtain injunctive relief to block any activity that infringes its patent, the Nash bargaining solution suggests that the allocation of value corresponds to the number of owners of intellectual property rights rather than to the number of patents that each firm owns. See, e.g., Richard Gilbert & Michael Katz, note 28 above.

58 Patent law allows a patentee who does not practice the technology to earn a reasonable royalty as compensation for infringement. Alan L. Durham, *Patent Law Essentials: A Concise Guide*, at 183. The "reasonable royalty" can be based on royalty rates that emerge from market negotiations, but these negotiations reflect the power of the threat of an injunction.

59 eBay v. MercExchange, 547 U.S. 388 (2006).

patent's right to exclude entitled the patentee to injunctive relief. In this decision the Supreme Court held that injunctive relief for patent infringement should not be automatic and instructed courts to consider the factors that influence a decision to grant injunctive relief in other disputes. The eBay decision could make pooling more attractive by lessening a patentee's bargaining power as an independent licensor, but the effect depends on whether courts deny injunctive relief and on how they evaluate infringement damages in its absence. It is too early to tell.

4. *Patent pool governance rules affect pooling incentives*

Patents that are essential to make or use a technology have a collective value that can be shared among the patent owners. There is, however, no clear market rule that determines how royalties should be shared among essential patent owners.[60] As independent licensors, royalties depend on the bargaining skills of patentees, their licensing objectives, the qualities of their patents, and opportunity costs that patentees may have if they choose not to license their patents, and the methods that courts apply to calculate infringement damages. But these market-determined royalties from independent licensing do not translate easily to a rule that patent pools can use to allocate licensing revenues to their members.[61]

Patent pools vary widely in their license terms and in the allocation of any royalties to pool members. Some pools license their patents royalty-free in an effort to promote adoption of new technologies covered by their patents. The Bluetooth Special Interest Group provides its members with a non-exclusive, royalty-free, perpetual license to each member's patents that are necessarily infringed by the Bluetooth Specification and are required to make, use or sell Bluetooth compliant

---

[60] The allocation of rewards for discoveries that are essential to make or use a technology affects incentives to make these discoveries, and under some strong assumptions one can show that each essential discovery should earn the same reward to promote efficient investment in R&D. See RICHARD GILBERT & MICHAEL KATZ, *Efficient Division of Profits from Complementary Innovations*, University of California Working Paper, June 2009.

[61] Furthermore, these market-determined outcomes need not be economically efficient. See Gilbert & Katz, ibid, note 60.

products.[62] The Multimedia Home Platform offers a royalty-free license for technology related to receiving and executing Java-based applications on a television set.[63] The Open Invention Network for Linux offers a royalty-free license for the Linux operating system.[64]

Royalty-free licenses or royalties that are deliberately held below profit-maximizing levels promote the adoption of technology covered by a pool's patents. This can serve the objectives of some patentees, but not others. A study of nine patent pools based on standards developed since the 1990s found that the participation of owners of patents covered by the standard ranged from a low of 29 percent for the WCDMA pool (a third generation mobile wireless technology) to 58 percent for one of the DVD pools.[65] Expressed as a fraction of the number of patents covered by the standards rather than the number of owners, the participation rate ranged from 10 percent for the WCDMA to pool to 75 percent for the 1394 pool (based on the IEEE-1394 communications standard, also known as firewire). Participation in the nine patent pools was greater for vertically integrated firms that hold patents covered by the standards, consistent with the view that firms that sell products covered by the patents are more likely to benefit from a pool.

For those pools that charged royalties, the authors examined how pool participation related to the distribution of royalties among pool members. Five of the nine pools allocated licensing earnings to pool members in proportion to the number of patents that the members contribute to the pool.[66] The other pools valued patents differently and allocated royalties according to relative patent valuations. The pools with proportional sharing rules tended to have lower

---

62 Bluetooth Patent/Copyright License Agreement, available at https://www.bluetooth.org/Membership/agreements.htm.

63 See David Serafino, note 50 above.

64 *Ibid*. Indeed, the open-source movement, of which the OIN is a part, can be likened to a patent pool that commits itself to offer royalty-free licenses.

65 Anne Layne-Farrar & Josh Lerner, *To Join or Not to Join: Examining Patent Pool Participation and Rent-Sharing Rules*, SSRN working paper, (November 2006).

66 The five pools, all administrated by MPEG-LA, use proportional allocation rules, but differ in the allocation of royalties for new patents that are added to the pool. Layne-Farrar & Lerner, Ibid., at 13.

participation rates. The flexibility to allocate royalties in proportion to patent value is a lever that a pool can use to encourage participation. However, the results are only suggestive given the small population of pools and the fact that pool governance rules should be designed from the start with the objective of encouraging participation, which complicates a comparison of different allocation rules.[67]

Patent pools cannot provide one-stop shopping or protect technology users from high royalties if they do not include all of the patents that are essential to use the technology. The MPEG-2 pool includes several hundred patents that cover the MPEG-2 encoding standard, but that did not prevent Alcatel-Lucent from pursuing infringement claims for patents that it alleged covered the MPEG-2 standard and were not in the pool. The Open Patent Alliance did not prevent Adaptix from bringing a lawsuit against the Sprint-Clearwire WiMax joint venture, alleging infringement of six of its WiMax patents.[68] Nonetheless, even partial pools that do not include all patents that are necessary to make or use a product offer considerable savings in transactions costs and can mitigate royalty stacking compared to separate licensing with independent patentees.

5. *Partial pools may be stable*

Pools that comprise fewer than all of the patents that cover a technology can be stable against defection when a pool that consists of all essential patents is unstable at similar licensing terms. To see why, consider once again the example in which ten patents are essential to make or use a technology each of which is owned by a separate firm. Licensees value the technology covered by the patents at $10 per unit and each licensing transaction costs $0.50 per unit. The total of all royalties cannot exceed the technology value less total licensing costs. Suppose that six firms

---

[67] Moreover, one of the four pools with patent valuation rules was an agreement between two owners of patents on laser eye surgery that the Federal Trade Commission challenged as anticompetitive. See Federal Trade Commission press release, *Summit and VISX Settle FTC Charges of Violating Antitrust Laws*, April 21, 1998.

[68] Washington Business Journal, *Sprint, Clearwire face patent infringement suit on WiMAX technology*, available at http://www.bizjournals.com/washington/stories/2008/12/15/daily115.html.

pool their patents while the remaining four firms choose to license their patents independently. The pool shares royalty income equally among its members and each of the independent licensors collects the same royalty.

Suppose the pool with six members charges a royalty of $4.50 per unit. If one of the pool members defects it becomes another independent licensor. In that case, licensees have to complete a total of six licensing transactions (five independent licenses plus the pool), each of which incurs a cost of $0.50 per unit, for a total cost of $3.00 per unit. A pool member that defects to join the ranks of independent licensors would earn only $.50 per unit. This is the $10.00 willingness to pay, less the $3.00 transaction cost, less the pool royalty of $4.50, which equals $2.50 per unit, and that is divided equally among the five independent licensors. The hypothetical defector is better off in the pool, where it would collect $4.50/6 = $0.75 per unit. Hence the six-member pool is stable if it charges a royalty of at least $4.50 per unit, even though the full ten-member pool requires a royalty of at least $8.19 per unit to be stable.

All else equal, a large patent pool benefits independent licensors of complementary patents by reducing transaction costs, which allows independent licensors to collect more royalties. Furthermore, a larger the pool implies that an independent licensor has to share royalty revenues with fewer other independent licensors of complementary patents. Assuming that patentees wish to maximize royalties, for the pool to be stable against defections there is a critical royalty the pool must sustain that increases with the number of firms in the pool.

Return to the example with 10 essential patents each owned by a single patentee. Let $M$ be the size of the pool, which can range from all ten patents to only one. Assuming that the pool shares royalties equally among its members, each member of a pool of size $M$ with a pool royalty $R$ earns a royalty equal to $\pi_i^{pool} = \frac{R}{M}$. A patentee that defects from the pool earns $\pi_i^{defector} = \frac{10 - R - (12 - M).5}{11 - M}$. To

understand this equation, note that if the pool has *M* members, then there are 10-*M* independent licensors. If one of the pool members defects and licenses its patent independently, then the number of independent licensors increases to 11-*M*. This number determines the independent licensor's share of the royalties that are available to all independent licensors. The royalty available to independent licensors is the $10 willingness-to-pay for the technology, less the royalty charged by the pool and total licensing costs. The total number of licensing transactions required to access all of the essential patents when one more patentee defects from a pool of size *M* is 12-*M*.[69] The independent licensors share the royalty that is available when the pool commits to a royalty of *R*. This available royalty is $10 - R - (12 - M) * (.5)$. Table 1 shows how the critical royalty depends on the pool size.

Table 1: Critical Pool Royalty for a Stable Pool with *M* patents
(10 essential patents, willingness-to-pay = $10.00 per unit; per unit transaction cost = $0.50 per license)

| Pool size, *M* | Critical Pool Royalty ($ per unit) |
|---|---|
| 2 | 0.91 |
| 3 | 1.50 |
| 4 | 2.18 |
| 5 | 2.95 |
| 6 | 3.82 |
| 7 | 4.78 |
| 8 | 5.80 |
| 9 | 6.96 |
| 10 | 8.19 |

The example demonstrates that if the pool cannot commit to a high royalty, then smaller pools may be stable when larger pools are not. From Table 1, if the pool can commit to a royalty of $5.00 per unit, but not more, then a pool with 7 or fewer members is stable and larger pools are not stable. For a pool to be stable with a large number of patents, either the transactions costs from assembling different

[69] For example, if the pool included all ten patentees and one defects, then licensors must conduct two licensing transactions to access all the patents.

licenses must be very large or the pool must be able to commit to a royalty that captures a large fraction of the value of the technology that the patents cover.[70] This assumes that the pool cannot disadvantage defectors or take other actions to cement its membership, as discussed in more detail in the next section.

Patent owners that choose to remain outside a pool can unravel the benefits from pooling by interfering with one-stop shopping and by demanding high royalties. This is not to say that choosing to remain outside a patent pool is wrong or necessarily harms the high-technology economy. Patent pool participation is nearly always voluntary and the licensing strategies adopted by patent pools can be inconsistent with the business model of a firm that is engaged in research and development and that relies on licensing revenues to fund its business model. Toshiba may be content to license its DVD patents at a low royalty as a member of a DVD patent pool because Toshiba is a consumer of patented technology and a seller of equipment and media that use the patented technologies. But what about a firm that is a pure play technology producer for DVDs and has no other sales of DVD-related equipment or merchandise? A reasonable business strategy for such a firm is to maximize its profits from technology licensing.

In addition to any costs that may be imposed by less than universal participation in patent pools are the costs of patent pools that never form. These are the Sherlock Holmes "dogs that do not bark" of the high technology economy. There are no patent pools for microprocessors (although Intel has extensive cross-licensing agreements with other technology companies) or for most biotechnologies. What can be done to make patent pooling more attractive to owners of essential or complementary patents, and can pools adopt policies that enhance their stability?

---

[70] In this example, every licensee has the same willingness-to-pay for a license; *viz.*, $10 for every licensed unit. Consequently the pool can charge a royalty that extracts all of the value of the licensed technology, leaving nothing left over for an independent licensor. The argument that a high royalty can limit incentives for independent licensing applies even if the pool cannot charge royalties that extract all of the value from licensees, although the analysis is more complex and with elastic demand a high royalty limits the profit of the pool as well as the profit of an independent licensor.

## IV. How to promote good patent pools

Antitrust authorities must be watchful for pools that might act as cartels and limit competition. But over-zealous enforcement to minimize the risk of anticompetitive patent pools can deter the formation of pools that create value or undermine their stability. This section offers some suggestions to promote beneficial pooling arrangements while guarding against pools that clearly harm competition.

1. *Allow pools the flexibility to charge high royalties for complementary patents*

The business review letters issued by the Department of Justice in response to the two proposed DVD pools noted approvingly that "the agreed royalty is sufficiently small relative to the total costs of manufacture that it is unlikely to enable collusion among sellers of DVD discs, decoders or players." Low royalties obviously benefit consumers and mitigate the risk that the pool might raise royalties by eliminating competition between substitute technologies.[71] But a focus on a risk that a pool may charge too much ignores the risk that owners of essential patents may choose to license their patents independently, which can harm competition by increasing transaction costs and contributing to royalty stacking. A pool that is limited to essential patents should not be compelled to choose a royalty so low that it encourages independent licensing of essential patents.[72]

---

[71] Antitrust enforcers have other tools to guard against pools that may eliminate competition between substitute technologies. Under some conditions, a requirement that pool members offer individual licenses can be a screen to identify anticompetitive pools, as only welfare-increasing pools are profitable with independent licensing. See Lerner & Tirole, note 25 above. Antitrust authorities have approved of this condition in proposed patent pools. See Antitrust and IP Report, note 3 above. In general, however, independent licensing selects against anticompetitive pools only when the pools include all essential patents. See Brenner, note 79 below. Empirical evidence suggests that pools of complementary patents are more likely to allow independent licensing. Josh Lerner, Marcin Strojwas, and Jean Tirole, *The Design of Patent Pools: The Determinants of Licensing Rules*, 38 RAND J. ECON. 610 (2007).

[72] A corollary is that pools should have discretion in how they allocate royalty income to their members. For example, it may be necessary to allow firms that specialize in research to earn higher royalties than vertically integrated firms in order to compel the former to join a pool. See, e.g., Lerner, Strojwas, and Tirole, Ibid., and Reiko Aoki & Sadao Nagaoka, *The Consortium Standard and Patent Pools*, 55 ECON. REV. 346 (2004).

Scrutiny of royalty setting by patent pools can be justified given the difficulty of ascertaining when patents may cover technologies that are substitutes. If, however, a pool consists of patents that are essential or highly complementary to make or use a product, the pooling of the patents does not confer additional market power on the patentees, and arguably the same principle that allows flexible pricing for a single firm should apply as well to the pool.

High pool royalties can raise concerns about "raising rivals' costs".[73] The basic argument is that for an integrated firm, the cost of an input is its marginal cost, regardless of its price. Hence an integrated firm can tilt the playing field for downstream competition by increasing the price of an input that it sells to downstream competitors. A related potential concern is that a patent pool consisting of integrated firms will charge high royalties to disadvantage un-integrated downstream competitors. However, the raising rivals' costs concern does not apply to patent pools that charge a uniform price to all licensees including members of the pool and for which the ownership of patents is widely distributed among the pool members and the pool shares licensing revenue equally among its members. In this case, which is typical of most patent pools, the pool royalty will closely approximate each firm's marginal cost for the licensed technology.

More specifically, suppose that each of $N$ firms contributes a single patent to a pool and the pool shares royalties equally. Then each member of the pool pays the pool royalty $R$ for a portfolio license and gets back $R/N$ in royalty income. Its net cost for the portfolio license is $\left(\frac{N-1}{N}\right)R$, which is essentially the same price that non-members pay for a portfolio license if the pool includes more than a few patents. In effect, if many firms own essential patents, then no firm is fully integrated with respect to the cost of patent rights. This holds even if the patents are pooled, provided that the pool charges a uniform royalty and shares revenues

[73] Janusz Ordover, Garth Saloner, and Steven Salop (1990), *Equilibrium Vertical Foreclosure*, 80 AMER. ECON. REV. 127 (1990).

equally among its members.[74] Concerns about rivals' costs could arise if the pool charges a higher royalty to firms that are not members of the pool.[75] Of course, as in other allegations of cost-raising conduct, there are factors that should be considered that might justify the differential royalties.

Furthermore, a patent pool does not necessarily increase the incentives to raise the costs of downstream rivals relative to incentives to engage in such behavior in the absence of a pool. Suppose an integrated firm owns an essential patent and chooses not to join a patent pool. That firm could choose to charge a very high royalty for use of its patent by un-integrated downstream rivals. The high royalty does not increase its own costs, but it can disadvantage its downstream rivals. With essential patents, each patentee can play the raising rivals' costs game, and a patent pool can mitigate the risk of such strategic conduct.[76]

These preceding discussion offers reasons why patent pools should be treated no differently than a single firm with regard to the setting of a profit-maximizing uniform royalty for the pool's patent portfolio. Indeed, there is justification for allowing the pool to set royalties that exceed the level that would maximum its royalty revenue. A high royalty undercuts the draw of independent licensing by leaving less headroom available to an independent licensor. If the pool can commit to a sufficiently high royalty, it can reduce the incentive of owners of essential patents to leave the pool or not join the pool in the first place. The high royalty can benefit consumers if the alternative is that the pool fragments and royalty stacking from independent licensing results in an even higher total royalty for the necessary patent rights.

---

74 A uniform royalty does not mean that the pool has to charge only a single royalty, provided that each potential licensee faces the same royalty schedule. For example, the royalty could depend on the number of licensed units.

75 See, e.g., Matsushita Electrical Industrial Co., Ltd., v. Cinram International, Inc., U.S. Dist. Ct., D. Delaware, No. CIV.01-882-SLR, Jan. 5, 2004. (allegation that DVD 6C patent pool charged higher royalties to non-members).

76 See Sung-Hwan Kim, *Vertical Structure And Patent Pools*, 25 REV. IND. ORG., 231 (2004). (In the presence of vertically integrated firms, a patent pool reduces double marginalization and weakens the incentive to raise rivals' costs.)

Agency advice, such as business review letters, that endorse the setting of low royalties by a patent pool do not imply that the pool would violate the antitrust laws if it were to set a high royalty. However, such guidance shapes the policies adopted by patent pools. While competition authorities do not have to coax patent pools to increase their royalties, they should take note that higher royalties for patent pool portfolio licenses do not necessarily mean higher prices for consumers. Indeed, consumers could be worse off if pools are compelled to charge low royalties. Off course, an antitrust policy that takes a more permissive stance toward royalty setting by patent pools is beneficial only if pools do not eliminate competition between alternative technologies.

2. *Allow more flexible licensing terms for pools of complementary patents*

Some of the most egregious patent pools of the past created market power by pooling intellectual property rights that were substitutes for each other and then enforcing strict limits on the ability of the pool members to compete using alternative technologies. For example, the U.S. Gypsum patent pool fixed prices and prevented its members from selling unpatented gypsum board.[77] Patent pools and other collective rights organizations should not be permitted to adopt measures that restrain competition.

Restrictive licensing terms can be anticompetitive if imposed by rights owners who control technologies that are actual or potential substitutes for each other. Suppose two owners of patents that cover alternative types of DSL modems choose to pool their patents. One owner has patents that cover a type X modem and the other owner has patents that cover a type Y modem. The modem technologies are substitutes – consumers can use either type for high-speed Internet access. It would harm competition if the owners agreed to license only type X modems for residential users and only type Y modems for commercial users, assuming that each modem type would be an acceptable alternative for both users.

---

[77] United States v. United States Gypsum Co., 333 U.S. 364, 384 (1948).

The source of the competition problem in this example is not the restriction of licensing to residential and commercial users but rather the fact that the pool includes technologies that are substitutes for each other. Suppose we change the example and assume that the patentees own patents that are essential to manufacture or use both modem types. In this case, pooling of the patents does not eliminate competition that could have occurred without the pool. Neither X nor Y modems can be manufactured or sold without licensees from both patent owners.

A pool that offers field-of-use restricted licenses does not harm competition if the patents in the pool are not substitutes for each other. Residential users who are limited to the X modem might want to try the Y modem, but no one can legally sell a Y modem without obtaining licenses to patents that also cover the X modem as both modem technologies require rights to both sets of patents. This is analogous to a situation in which a single firm owns the patent rights to both X and Y modem types. If a single firm can lawfully restrict the users of the different modem types, then a patent pool should be able to do the same, provided that the pool includes patents that are essential to make or sell both types of modems.

Vertical restraints such as territory or field-of-use restrictions, exclusive dealing, and resale price maintenance can harm competition by eliminating competition at a level of a supply chain or by enhancing incentives for collusion. But vertical restraints can also promote competition by allowing firms to better appropriate the benefits of investments in service or product quality.[78] A licensor might want to limit competition to provide incentives for the licensee to make investments in the licensed technology. The licensor might want to reserve certain regions or applications for her own use, without which she would not be willing to license the technology to others. Differential licensing terms can promote competition by encouraging the licensor to make the technology available in places or for uses in which the technology has a lower value.

---

[78] See, e.g., Leegin Creative Leather Products, Inc. v. PSKS, Inc., 551 U.S. 877 (June 28, 2007).

Vertical restraints are neither always pro-competitive nor always anticompetitive. Their effects should be analyzed taking into account specific circumstances and in particular whether the entities that impose the vertical restraints have significant market power. These principles should apply as well to patent pools. Furthermore, by preventing the pool from issuing restricted licenses that might promote beneficial investments, heightened antitrust scrutiny can make the pool less attractive to its members and contribute to fragmented ownership of patent rights.

Antitrust authorities have been open to some licensing restrictions imposed by patent pools. The agencies have not objected to requirements that licensees grant back to the pool members a non-exclusive license to a patent that is deemed essential to practice to the pool's technology. The business review letters published by the Antitrust Division concerning several patent pools do not explicitly prohibit the pools from imposing flexible licensing terms. But the MPEG-2 letter approvingly notes the absence of such terms, as do the two business review letters regarding pools formed by DVD manufacturers and the business review letter for the RFID patent pool. These statements do not imply that restrictive licenses would incur antitrust liability, but positive statements to the contrary provide a template for others to design their licensing programs. The result is that antitrust policy potentially lowers the benefit to a patentee from participating in a pool while giving individual licensors greater discretion to design licensing terms that capture value from their technologies. Of course, as with royalty levels, an antitrust policy that takes a more permissive stance toward restrictive licensing by patent pools is beneficial only if pools do not eliminate competition between alternative technologies.

3. *Poison Pills for Patent Pools*

A patent pool contributes to its undoing by making it more attractive for owners of essential patents to leave the pool or not join it in the first place. The incentives for a patentee to leave a pool or not join the pool are similar to the

incentives of a firm to defect from a cartel, although a pool comprised of essential patents is pro-competitive, while a cartel of competing firms is anticompetitive. The cartel benefits its members if they remain in the cartel. Each member of the cartel would like to defect provided others remain in the cartel. If they all defect, they are all worse off than if they remained in the cartel. A cartel can be stable if its members know that all of its members will defect if any one of them defects. Similarly, a beneficial patent pool may be stable if each of its members knows that the pool will unravel if any one of them defects.[79]

This reasoning suggests that a pool may be more stable if it can commit to its own destruction if enough of its members defect. Corporate finance offers one way for pools to make such a commitment. Firms sometimes adopt "poison pills" to discourage a hostile takeover by another company. The target company attempts to make its stock less attractive to the acquirer, for example by allowing existing shareholders (except the acquirer) to buy more shares of the company at a significant discount, which makes it more difficult for the acquiring entity to achieve control of the target.[80] The patent pool's version of a poison pill is a binding resolution that would require its dissolution in the event that one or more of its members chooses to exit the pool and act as an independent licensor of an essential patent (or possibly not join the pool in the first place). This agreement can strengthen the stability of a patent pool because patentees should know that they are strictly worse off if the pool dissolves or never forms.

To see why such a resolution can contribute to the stability of a patent pool, consider again the example of a pool with ten members, each of which owns a single essential patent. As before, licensees have a willingness to pay of $10 per unit for all ten patents and the cost of negotiating each license is $0.50 per unit. The previous analysis showed that a pool consisting of all ten members is stable only if it can commit to a per unit royalty of at least $8.19 (see Table 1). If the pool cannot

---

79 A formal derivation of this argument can be found in Steffen Brenner, *Optimal formation rules for patent pools*, 40 ECON THEORY 373 (2009).

80 See, e.g., *Poison Pill* at http://en.wikipedia.org/wiki/Poison_pill.

commit to a royalty as high as $8.19 per unit, then at least one of its members would have an incentive to defect, or not join the pool in the first place. However, a resolution that requires the dissolution of the pool in the event of a defection can allow the pool to be stable with a much lower royalty. Suppose the pool charges only $5.01 per unit for a package license. A defector could charge up to $3.99 for an independent licensee ($10 willingness to pay, less $1 in transaction costs, less the pool royalty of $5.01) if the pool keeps its other members and continues to charge $5.01 for a package license. If, however, the pool dissolves after the defection, then each patentee, including the defector, could command a royalty of only $0.50 per unit (equal to $10 willingness to pay, less $5 in transaction costs, divided among the 10 individual patentees). This is less than each patentee's share of royalties when it remains in the pool ($5.01 shared equally among the 10 patentees).

The value of the threat to dissolve the pool depends on the costs from independent licensing. If these costs are small, independent licensing does not impose a large penalty on patentees relative to what they could earn as members of a patent pool. For example, if the transaction costs from independent licensing were only $0.01 per unit, then the 10 patentees would earn $0.91 per unit as symmetric independent licensors (the $10 willingness to pay less $0.10 in transaction costs, divided among 10 independent licensors). The pool would have to offer each patentee a royalty share of at least $0.91 per unit to keep the patentee in the pool, which would require the pool to maintain a royalty of at least $9.10.

A governance rule that dissolves the pool if membership falls below a pre-determined level can lower the minimum royalty that the pool must charge in order to discourage its members from leaving the pool or not joining in the first place. This is a valuable tool because the pool may not be able to commit to a high royalty, particularly when the pool does not include all of the essential patents. Independent licensors of essential patents can have sufficient bargaining power to extract a large share of the value of the licensed technology. This bargaining power forces the pool

to accept a correspondingly lower royalty for its patent portfolio, which makes the pool less stable.

In practice it can be difficult for a pool to adopt and commit to an automatic self-destruct mechanism. It is difficult to know how many patents are essential to make or use a technology, which makes it difficult to know where to set the critical membership level. It is also difficult to know the impact from independent licensing until it occurs and infringement suits have been resolved, which can take a long time. In the interim, the pool members would have an interest in maintaining the status quo.

4. *Apportion royalties for patent infringement*

The confluence of intellectual property law, the economics of bargaining over royalties for patent rights that cover complex products, and the bounded rationality of the judicial process creates an environment that enhances the incentives for an individual patentee to remain outside a pool by sometimes allowing a patentee to obtain an injunction that bars the use of its patent. A concrete example is the jury decision that initially awarded Alcatel-Lucent $1.5 billion for infringement of two MP3 patents.[81]

There is no single collective rights organization for the licensing of MP3 patents. Thompson is the licensing agent for patents owned by Fraunhofer IIS, a research laboratory that contributed to the development of digital encoding technologies.[82] Thompson lists twenty patent families related to the MP3 standard, of which eighteen have patents issued in the U.S. Audio MPEG, a subsidiary of Sisvel S.p.A., licenses MP3 patents owned by France Telecom, Philips, and others. Audio MPEG lists sixteen U.S. patents that it states are relevant for MP3 players, decoders

[81] Lucent Technologies Inc. v. Gateway, Inc. And Microsoft Corporation, et al., Order On Microsoft's Motions For Judgment As A Matter Of Law And New Trial And Lucent's Motion To Alter Or Amend The Judgment Regarding U.S. Patent Nos. 5,341,457.

[82] Thompson is also the licensing agent for Coding Technologies from Sweden (co-inventors of mp3 PRO) and Agere Systems (co-inventors of mp3 SURROUND). See http://mp3licensing.com/about/thm.html.

and encoders.[83] Alcatel-Lucent has at least two patents that it claims are essential to practice MP3 technologies. Thus at least 36 patents have claims that cover MP3 technologies, most of which are licensed by two firms, Thompson and Sisvel.

The jury in the Alcatel-Lucent patent case based its damage award for patent infringement on a reasonable royalty of 0.5% per licensed computer. It arrived at the total damage award of $1.5 billion by multiplying the 0.5% royalty times the average price of a personal computer and then applying that figure to the total number of computers sold over the damages period. While not clear from the record, the jury calculation apparently applied the 0.5% royalty to each of the infringed Alcatel-Lucent patents.

A key problem with the damages approach accepted by the jury is that it attributed the royalty to the *entire market value* of the computer rather than apportioning the royalty to account for the value contributed by the MP3 patents at issue. The notion that royalty calculations should be apportioned to account for the value of the patents is not novel and indeed the district court judge identified the failure to do so as a basis for a new trial to quantify damages. The court said[84,85]

> Two major problems arise in applying the entire market value rule here. The first is the failure of the evidence to establish a link between the cost of the *computers* (rather than the operating system, Windows Media Player, the MP3 codec or some other "unit") and the customer demand or value of the patented technology. The second and probably even more troublesome problem is the failure to establish that the patented features themselves produced any customer demand or value of the product.

We focus on the first problem, the failure to establish a link between the cost of computers and the value of the patents. The MP3 patents covered technology employed by the Windows Media Player, which Microsoft supplies as a component

---

83 See http://www.audiompeg.com/patents.asp.

84 Lucent Technologies Inc. v. Gateway, Inc. and Microsoft Corporation, et al., Order On Microsoft's Motions For Judgment As A Matter Of Law And New Trial And Lucent's Motion To Alter Or Amend The Judgment Regarding U.S. Patent Nos. 5,341,457 and Re 39,080, U.S. District Court, S. District of California, Civil No: 02CV2060-B(CAB) (August 6, 2007) at 31 (emphasis in original).

85 A codec is a device or computer program capable of encoding and/or decoding a digital data stream or signal.

of its Windows operating systems. While the Media Player enhances the functionality of the computer, the Player is a component of the operating system software and it seems reasonable that a prevailing royalty rate should apply to the software, not to the entire computer.[86] To do otherwise would lead to nonsensical results. For example, a feature-laden computer could cost $3,000. The 0.5% royalty applied to such a computer for each patent would give a value for the two Alcatel-Lucent patents of $30, which is a significant fraction of the price of the entire operating system. On its face this result appears to assign too much value to the two MP3 patents given all of the other functionality of the Windows operating system.

A rule that instructed courts to apportion infringement damages to account for the different inputs necessary to make and use products covered by the patents at issue would reduce the incentives of a patent holder to negotiate licenses independently and enhance incentives for patent pooling. However, as demonstrated by the actions of the district court judge in the Alcatel-Lucent trial, a statutory rule that requires apportionment is not necessary for courts to avoid the most egregious errors in awarding damages for patent infringement. In the Alcatel-Lucent MP3 case, a reasonable presumption is that the infringed patents' share of the value estimated for patented MP3 technology is equal to the infringed patents' share of all MP3 patents.[87] But this should only be a starting point in a damages calculation. Some patents are more valuable than others – perhaps because they cover products for which there are few alternatives. A patentee in an infringement action may offer evidence to show that her patents account for a share of product value attributed to patented technologies that is larger than her numerical share of patents that cover the product.

---

[86] Of course this does not imply that the 0.5% royalty percentage is correct even when applied to the price of the operating system software.

[87] Gilbert and Katz provide a theoretical analysis in which such a proportionate sharing rule provides efficient incentives for investment in research and development when many patents are essential to use a technology. Richard Gilbert & Michael Katz, *Efficient Division of Profits for Complementary Innovations*, University of California at Berkeley working paper (2009). The analysis assumes a single application for which all patents are essential and the patents have no other opportunity costs.

Damage awards such as the jury award in the Alcatel-Lucent case have important incentive effects both for investments in R&D and for patent pooling. Damage awards give correct incentives for R&D if they correspond to the incremental value added by innovations that result from R&D effort. Excessive awards may energize efforts to patent new technologies, but they also increase costs to technology users, which can make it more difficult for those users to develop and commercialize their innovations. Furthermore, excessive damage awards discourage patent holders from participating in patent pools and instead increase their incentives to license independently. Conversely, damage awards that correspond to a patent's contribution to a product's value rather than the bargaining power of an independent patentee would promote patent pooling by aligning infringement damage awards more closely with the royalties that a patentee would collect as part of a patent pool, provided that the pool has the ability and incentive to maximize licensing profits. The alignment, of course, is not and cannot be perfect. Patents can differ in value and patent owners often will disagree over the governance rules of patent pools.

5. *Compulsory licensing and RAND commitments*

Compulsory licensing is fundamentally the substitution of a property right for a liability right. The property right inherent in a patent is the right to exclude access to the intellectual property or to allow access on negotiated terms. A liability right offers no right to exclude, but only a right to demand compensation for access.

U.S. copyright law specifically enables compulsory licensing of certain musical compositions and public broadcasts.[88] Patent owners, however, generally have no obligation to license their patents and instances of compulsory licensing have been rare. When compulsory licensing has occurred, the justification usually has been for reasons related to national security or public health.[89] An exception is

[88] U.S. copyright law includes provisions for compulsory licensing of nondramatic musical compositions, public broadcasting, retransmission by cable systems, subscription digital audio transmission, and nonsubscription digital audio transmission such as Internet radio. See, e.g., Copyright at http://en.wikipedia.org/wiki/Compulsory_license.

[89] See, e.g., Carol M. Nielsen & Michael R. Samardzija, *Compulsory Patent Licensing: Is It a Viable*

in the area of antitrust enforcement, where patent owners have consented on several occasions to license their patents to alleviate competition concerns.[90]

While compulsory licensing of intellectual property – including patents – has the potential to promote competition and stimulate innovation, and some studies suggest that these benefits have been realized in certain instances of compulsory licensing decrees,[91] compulsory licensing is a heavy-handed approach to clear patent thickets. It is very difficult to design royalties that strike an appropriate balance between promoting the utilization of technology covered by the licensed intellectual property and providing adequate incentives for innovation.[92] In most circumstances, voluntary collective rights organizations are a superior alternative to compulsory licensing for patents, if only because the owners of patents are likely to have better information about patent values than would an agency charged with designing the terms of a compulsory license.[93] Nonetheless, the threat of

---

*Solution in the United States?*, 13 MICH. TELECOMM. TECH. L. R. 509, 533 (2007) for a discussion of statutory provisions that allow for compulsory licensing of intellectual property.

90 For examples of compulsory licensing of patents as antitrust remedies, see, e.g., Richard Gilbert & Willard Tom, "Is Innovation King at the Antitrust Agencies? The Intellectual Property Guidelines Five Years Later," 69 ANTITRUST L. J. 43 (2001) and Makan Delrahim, *Forcing Firms To Share The Sandbox: Compulsory Licensing Of Intellectual Property Rights And Antitrust*, Presented at the British Institute of International and Comparative Law, London, England, May 10, 2004.

91 See, e.g., Timothy F. Bresnahan, *Post-Entry Competition in the Plain Paper Copier Market*, 75 AM. ECON. REV. 15 (May, 1985) (Prices in the plain paper copying industry fell and innovation increased after Xerox was required to license its patents to all comers at nominal costs.) and Petra Moser and Alessandra Voena, *Compulsory Licensing: Evidence from the Trading with the Enemy Act*, Stanford University working paper (February 3, 2009) (Innovation increased in U.S. industries affected by WWI compulsory licensing of German patents).

92 Furthermore, compulsory licensing can lower welfare in the short run if it substitutes production by a low-cost licensor for that of higher-cost licensee. For a discussion of some of the pitfalls of compulsory licensing, see Richard Gilbert & Carl Shapiro, *An Economic Analysis of Unilateral Refusals to License Intellectual Property*, 93 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 12749 (1996).

93 See Merges, note 8 above. (Argument that collective rights organizations are superior to compulsory licensing because they are more likely to set efficient prices and less susceptible to lobbying.) and Robert Merges, *Compulsory Licensing vs. the Three "Golden Oldies": Property Rights, Contracts, and Markets*, CATO POLICY ANALYSIS No. 508 (January 15, 2004).

compulsory licensing has been an effective stick to force firms to pool their patents as a way to break open patent logjams.[94]

The U.S. government used the threat of compulsory licensing to compel the pioneers of the aircraft industry to form a patent pool in 1917. The industry was enmeshed in litigation over the scope and validity of patents, and some patentees, particularly the Wright-Martin Company, were demanding royalties that the government and other aircraft manufacturers deemed excessive.[95] Creation of the Manufacturers Aircraft Association patent pool resolved the litigation chaos.

The government negotiated a portfolio license from the pool, which resolved the problem of royalty stacking from multiple patentees with blocking patents. But the negotiated royalty for the Association's portfolio license ($200 per aircraft) was a fraction of the royalty that Wright-Martin was demanding for a single patent ($1,000 per aircraft). This suggests that the government was doing more than just reducing the cost of inefficient pricing of complementary patents and instead may have been exerting its considerable market power as both an industry regulator and a purchaser of aircraft and related equipment.[96]

The government also had strategic motivations when it urged General Electric to buy out the U.S. branch of Marconi, a foreign pioneer of radio technology, and pool patents from Marconi, AT&T, Telefunken and Westinghouse into what became in 1919 the Radio Corporation of America (RCA). A purpose of this patent pool was to exclude foreign manufacturers and operators from a technology of strategic importance. In engineering the RCA pool, the government also condoned an allocation of patent rights in which GE, RCA, and Westinghouse acquired rights to the pool patents to develop wireless communication technologies while AT&T and

---

94 See the discussion of the Aircraft Manufacturers Association, note 96 below and more generally, Merges & Nelson, note 4 above.

95 See Joel Klein, Joel, *Cross-Licensing And Antitrust Law*, Speech Before the American Intellectual Property Law Association, San Antonio, Texas, May 2, 1997, available at http://www.usdoj.gov/atr/public/speeches/1118.htm.

96 George Bittlingmayer, *Property Rights, Progress, and the Aircraft Patent Agreement*, 31 J. LAW & ECON. 227,232 (1988).

its manufacturing subsidiary, Western Electric, focused on wired communications, with little interference between the two groups.[97]

The government negotiated a consent decree in 1923 that dissolved the RCA pool.[98] In 1972 the U.S. government intervened to break up the Manufacturers Aircraft Association, which by that time had grown to encompass virtually the entire aircraft industry. The government complained that the pool hindered innovation by forcing manufacturers to cross-license any innovations to each other at low royalties.[99]

Standard-setting organizations often condition certification of a standard on a requirement that firms agree to license patents that cover a proposed standard on terms that are "reasonable and non-discriminatory" (RAND). A RAND commitment is a liability rule (the obligation to pay royalties for the licensed patents) and is similar in this respect to a compulsory license.[100] When firms and consumers make investments that are specific to a technology, there is a risk that owners of patents that read on a standard would exploit these investments by charging high royalties. A RAND commitment promotes broad adoption of a standard by limiting this risk.

Setting-setting organizations can demand RAND commitment only from owners of patents that participate in the standard-setting process. Some patentees have avoided RAND commitments by refusing to disclose patents that may cover a standard or by remaining outside of negotiations that lead to a particular standard.[101] As we have noted, to the extent that some patentees offer to license

---

97 See William J. Donovan & Breck P. McAllister, *Consent Decrees in the Enforcement of Federal Anti-Trust Laws*, 46 HARVARD L. R. 885, 901-2 (1933).

98 Ibid. at 901. See also Merges & Nelson, note 4 above.

99 Bittlingmayer, note 96 above.

100 However, a RAND commitment does not oblige patentees to license their patents to every possible licensee. For example, the Via licensing program for the 802.11 wireless standard is available to *manufacturers of end user products* that implement the IEEE 802.11 standard. (emphasis added) See http://www.vialicensing.com/licensing/IEEE80211_index.cfm.

101 See, e.g., U.S. Federal Trade Commission, In the Matter of Rambus Incorporated, Docket No. 9302, Complaint filed June 18, 2002 (alleged failure to disclose patents and patent applications by a participant in a standard-setting organization, and which subsequently withdrew from the organization.)

their intellectual property at low royalties, this encourages other owners of complementary intellectual property to charge higher royalties. In particular, a RAND royalty obligation for some patentees increases the profit-maximizing royalties for owners of complementary patents that avoid a RAND commitment. In this way RAND commitments can discourage participation in standard setting and discourage firms that avoid a RAND commitment from joining patent pools that may form to promote adoption of standards.

6. *Standards Estopple*

Robert Merges and Jeffrey Kuhn have proposed a policy of "standards estoppel" to address some of these concerns.[102] In their proposal a patentee should be barred ("estopped") from asserting a patent that covers a standard when the standard is publicly disclosed and the patentee has either indicated when the standard was being developed that she would not assert the patent or has unreasonably delayed infringement litigation. Their position is that a patentee should not benefit from conduct that exploits industry-wide lock-in that occurs when firms and consumers make sunk investments that rely on a standard.

Standards estoppel, if accepted as a form of patent misuse, would address some recent attempts by patentees to avoid licensing patents that cover standards under RAND terms. In the Alcatel-Lucent case, AT&T (the former parent of Lucent), did not assert the patents at issue when the MP3 standard was being developed. This, along with the delay before Alcatel-Lucent asserted its MP3 patents, might be sufficient to trigger a standards estoppel defense. Similarly, under standards estoppel, Negotiated Data Solutions would have to abide by the prior RAND commitments made by National Semiconductor on the same patents or be estopped from asserting its patents.[103] Arguably, Rambus could be held to a RAND commitment under standards estoppel because it delayed assertion of its patents

---

[102] Robert Merges & Jeffrey Kuhn, *An Estoppel Doctrine for Patented Standards*, 97 CA. L. R. 1 (2009).

[103] See also U.S. Federal Trade Commission, In the Matter of Negotiated Data Solutions LLC, Docket No. C-4234, Complaint filed September 22, 2008 (alleged violation of RAND commitments for patents assigned to a separate corporation.)

until after the industry had sunk investments related to memory standards that Rambus claimed infringed its patents.

Standards estoppel only goes part way towards addressing concerns about assertion of patents for complex technologies that are licensed independently without a RAND commitment. Suppose Alcatel-Lucent was present when the MP3 standard was adopted and did no more than refuse to pool its patents with other patents that cover the MP3 standard specification. A refusal to participate in a patent pool could lead to excessive transaction costs and royalties. A RAND commitment would not fully address this concern because it does not specify the royalty that is "reasonable" and a patent pool, by lowering double-marginalization and reducing transaction costs, affords more headroom for an independent licensor to charge a high royalty.

What else can standard-setting organizations do to minimize the transaction costs and potential royalty-stacking from independent licensing? One alternative is for the standard-setting organization to condition certification of the standard on an agreement by all firms to pool their patents. A standard-setting organization such as ANSI (the American National Standards Institute) could require pool participation as a condition for ANSI approval. Patentees could elect not to join the pool, but that would (or could) result in ANSI withholding its standard certification. A technology without ubiquitous patent participation still could become a de facto industry standard. Many technologies become de facto standards, particularly when there is a single firm that has sufficient market presence to determine the course of technology evolution in an industry. But the technology would not have the official ANSI stamp of approval absent a pooling agreement by all who own or control patents that are essential to use the technology.

Such a proposal is unlikely to be practical because it is difficult, if not impossible, to ascertain all of the patents that may cover a standard. Even if the proposal were practical, it may not be socially desirable because it could raise significant obstacles to formal standard-setting. Actual and potential patentees

would have to weigh the benefit of a standard against the ability to assert their patents independently after the standard has been adopted. Patentees can have good reasons not to join a patent pool. Pools may be dominated by patentees whose objective is to sell products that use the pool's patents rather than earn patent royalties. Other patentees may be in the business of creating and patenting new technologies and may get little direct benefit from product sales. Participation in a pool that sets low royalties to encourage technology adoption can be inconsistent with the business model chosen by firms that patent new technologies but do not sell products that use the invention.

Standards create benefits by allowing economies of scale and aligning network effects to promote technology adoption. Yet formal standardization faces many obstacles as industry participants have different views about the technical merits of alternative standards and how they affect their business opportunities. Furthermore, firms have different business models that shape their decisions to participate in patent pools. For these reasons, as well as others, requiring patentees to participate in pools or to make formal standardization conditional on pool participation seems too blunt a policy instrument. At the same time, there are merits in a proposal such as standards estoppel that would limit the ability of firms to act strategically to exploit sunk investments made in support of a standard.

## V. Conclusions

Over time, antitrust authorities have refined their views of patent pools and have concluded that they promote competition under some circumstances. In business reviews and policy statements the agencies have spoken approvingly of pools that are limited to patents that are valid and essential to practice a technology, that allow patents to be licensed individually as well as in a package, and that do not engage in restrictive license terms. These are desirable characteristics. However, agency guidance has largely overlooked the important question of how to create incentives for patentees to form and maintain beneficial pools.

This article notes that patent pools are often unstable because pools create a "positive externality" for independent licensors: individual patentees often can generate a greater royalty stream by acting as an independent licensor than as a member of a patent pool. In many circumstances the benefits from independent licensing increase with the size of the pool. This benefit is a force that limits the equilibrium size of the pool to a level that is less than the number of patents that are essential to make or use a technology or to implement a standard.

There is a maximum profit that can be derived from the demand for the technologies covered by patents. If the pool charges less than this maximum profit, it leaves "headroom" available to independent licensors. The temptation to defect from a patent pool, or not join the pool in the first place, is greater the more "reasonable" are the licensing policies of the pool. Low royalties increase the headroom available to an independent licensor, and makes independent licensing relatively more attractive compared to participation in a pool.

A history of abusive conduct by patent pools that combine patents that are actual or potential substitutes for each other or that impose anticompetitive licensing terms has led antitrust authorities to scrutinize pools and their licensing practices. Pools that combine patents that cover substitute technologies can eliminate competition and act as an industry cartel. While antitrust authorities and the courts correctly draw a hard line to prevent abuses by pools that eliminate or restrict competition, such scrutiny can be counterproductive for pools that combine complementary patents. When pools combine complementary patents, the licensing of the pool's patents at reasonable terms creates incentives for independent licensing that undermine the benefits of pooling.

This article suggests that antitrust authorities should give pools wide discretion to design licensing terms that promote the integrity of the pool, provided that the pool includes patents that are highly complementary. Pools that combine complementary patents can harm competition if the patents are likely to be invalid, but the benefits of pooling survive with high probability if the pool includes many

patents that have independent probabilities of being valid and essential to make or use products covered by the pool's patents.

There are many policies that antitrust authorities may consider to promote the creation and stability of beneficial patent pools. These include allowing the pool to charge high royalties and impose restrictive licensing terms, provided that the terms are no more restrictive than would be imposed by a single licensor. Apportioning damages for patent infringement – which I interpret as no more than correctly imputed a patent's contribution to product value – would promote pooling of complementary patents by reducing the ability of an independent licensor to obtain a disproportionate share of the value of the patents that cover a technology. Antitrust authorities also should allow pools to adopt creative governance rules that make the pool less susceptible to defection and better able to attract a critical mass of complementary patents. One example is a constitution that calls for the dissolution of the pool if membership falls below a certain threshold. This self-destruct mechanism can be a threat to keep patentees in the pool, as dissolution of the pool would make all patentees worse off.

The tensions between the benefits of pooling and the incentives for independent licensing are powerful. No one policy is likely to provide the glue necessary to make pooling of complementary patents an equilibrium outcome for most industries. Instead, the message in this article is that antitrust authorities and the courts should encourage policies that promote the formation and durability of beneficial pools that combine complementary patents, just as they are concerned about limiting abuses by pools that are potentially anticompetitive because they combine patents that are substitutes for each other.