Draining the Moat: Considerations for the Regulation of Defensive Patent Pools

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Introduction

Given the rising importance of intellectual property—and patents in particular—in the modern economy, it is no surprise that intellectual property litigation activity has been increasing steadily for quite some time. With increased litigation activity, however, come increased litigation costs. Large firms are prime targets for plaintiffs seeking to earn money through strike lawsuits followed by quick settlements. Companies active in markets where the products sold are based entirely on some form of intellectual property have looked for ways to combat rising litigation costs. One strategy employed by several firms in recent years is the formation of a defensive patent pool. Defensive patent pools are meant to insure against losses due to patent litigation by taking possible problem patents off the market before they can be used to sue pool members.

This paper will argue that defensive patent pools can have significant anticompetitive effects. However, those effects depend on the structure of the pool. Defensive patent pools that use a "catch and release" (CAR) strategy mitigate the anticompetitive effects of their behavior by re-licensing or selling patents purchased by pool members. Conversely, "catch and hold" (CAH) pools—which buy patents without re-licensing or selling them—are likely to impose significant barriers to entry in the markets in which they operate. Because there is no legitimate justification for "holding" rather than "releasing", regulators and courts considering the impact of CAH behavior should view such pools with suspicion. Nevertheless, they should not be banned: the competitive restraints imposed by CAH pools do not result from the type of conduct typically categorized as illegal *per se*, and their anticompetitive effects depend heavily on pool structure and membership. Thus, CAH pools should be subject to evaluation under the Rule of Reason.

Part I of this paper will give a brief history of patent pools and their relationship to U.S. antitrust law. In addition, it will take a closer look at defensive patent pools, reviewing common pool structures and characteristics. Part II presents an economic model with which the anticompetitive effects of different types of pooling behavior may be analyzed. Part III discusses possible applications of the model and its relationship to the current legal landscape. Part IV concludes.

I. Patent Pools

Patent pools are organizations that allow for-profit firms to share patent rights with each other and/or license those rights to third parties.[1] So-called "open" pools are made up of two or more member firms who have agreed to license the pooled patents to third parties.[2] "Closed" pools, on the other hand, have three or more member firms, and license pooled patents to members alone.[3] Although pools are not frowned upon today, they were not always looked upon with favor by U.S. antitrust regulators.[4]

The first patent pool was formed in 1856, after Elias Howe was granted a patent on the technology that enabled the use of "lock stitch" in sewing machines.[5] Howe's patent did not cover all the parts necessary to build a working sewing machine, and a flurry of patent litigation ensued.[6] Sewing machine manufacturers claimed that their patents covering different parts of the sewing machine were being infringed by competitors' products.[7] To avoid the potentially ruinous effects of continued litigation, the I.M. Singer Company, Wheeler & Wilson, Grover & Baker, and Howe agreed to license to each other a set of nine complementary patents[8] necessary to build a working sewing machine.[9] Their pool lasted until 1877, when the last of the group's patents expired.[10]

By the 1890s, patent pools had become common, their formation driven by firms' desire to avoid restrictions on anti-competitive activities imposed by the Sherman Act.[11] However, patent pools' apparent immunity from antitrust regulation did not last long. In 1912, the Supreme Court decided for the first time that a patent pool violated federal antitrust laws.[12] Federal and private efforts to break up patent pools increased through the 1930s, and the Court's stance on pools grew ever more hostile.[13] One of the patent pools litigated during this period was decried as the "most completely successful economic tyranny over any field of

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[1] Josh Lerner et al., *Cooperative Marketing Agreements Between Competitors: Evidence from Patent Pools* 1 (Nat'l Bureau of Econ. Research, Working Paper No. 9680, 2003).

[2] *Id.*

[3] *Id.*

[4] *Id.* at 4.

[5] Improvement in Sewing-Machines, U.S. Patent No. 4,750 (issued Sept. 10, 1846); Ryan L. Lampe & Petra Moser, *Do Patent Pools Encourage Innovation? Evidence from the 19th-Century Sewing Machine Industry* 7 (Nat'l Bureau of Econ. Research, Working Paper No. 15061, 2009).

[6] *Id.*

[7] *Id.*

[8] Patents are complementary when they cover "separate aspects of a given technology that do not compete with each other." U.S. DEPT. OF JUSTICE & U.S. FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 66 (2007) [hereinafter *DOJ Report*].

[9] Lampe, *supra* note 5, at 7-8.

[10] *Id.* at 8.

[11] Lerner, *supra* note 1, at 4. The U.S. Supreme Court refused to invalidate a patent pool in *E. Bement & Sons v. National Harrow Co.*, 186 U.S. 70, 91 (1902).

[12] Lerner, *supra* note 1, at 4. Standard Sanitary Mfg. Co. v. U.S., 226 U.S. 20 (1912).

[13] Lerner, *supra* note 1, at 4.

industry" in United States history.[14] Unable to rely on protection from antitrust regulation, patent pools were largely eradicated after the Second World War.[15]

Changes in the nature of technology and its role in the U.S. economy during the latter half of the Twentieth Century led the Department of Justice to reconsider its policy on patent pools.[16] By acknowledging that pooling arrangements "may provide procompetitive benefits by integrating complementary technologies, reducing transaction costs, clearing blocking positions, and avoiding costly infringement litigation," the Department of Justice ushered in a new era of less aggressive regulation of pooling behavior.[17] While patent pools may not be as widespread as they once were, they are certainly making a comeback.

a. Defensive Patent Pools

The purpose of a defensive patent pool sets it apart from other types of patent pool. Rather than reduce the transaction costs associated with licensing complementary patents, a defensive pool is created to reduce its members' exposure to the costs of patent litigation.[18] Those costs are sufficiently high to justify aggressive defensive action by firms that are active in IP-heavy industries: between 2005 and 2007, damages awards for the top ten U.S. patent litigations totaled $2.7 billion.[19] Of the 268 patent infringement cases tried between October of 2010 and January of 2011, 197 resulted in damages awards averaging almost $50 million apiece.[20] However, those statistics tell only part of the story. Today, most patent infringement lawsuits last two to three years,[21] and cost more than $5 million to litigate.[22] Those costs represent an approximate increase of 48 percent over average patent litigation costs in 2001, and estimates show that those costs will continue to increase at a rate of up to 20 percent for the foreseeable future.[23]

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[14] Hartford Empire Co. v. U.S., 323 U.S. 386, 436-437 (1945).

[15] Lerner, *supra* note 1, 5.

[16] Richard J. Gilbert, Deputy Assistant Att'y Gen., U.S. Dept. of Justice, Address at Spring Meeting of ABA Section of Antitrust Law (Apr. 6, 1995) at 1.

[17] U.S. DEPT. OF JUSTICE & FED. TRADE COMM'N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY 28 (1995) [hereinafter *Guidelines*].

[18] Org. for Econ. Co-Operation and Dev., *The Emerging Patent Marketplace* 27 (OECD Sci., Tech. and Indus. Working Papers, 2009/9, 2009). Some companies have turned to traditional insurers for patent litigation insurance. *See* Ian D. McClure, *Intellectual Property Insurance: Changing the IP Litigation Landscape*, IP PROSPECTIVE (Apr. 27, 2010, 4:03pm), http://www.ipprospective.com/burgeoning-business/intellectual-property-insurance-changing-the-ip-litigation-landscape/.

[19] Dawn R. Albert, *The Changing Face of IP Litigation*, *in* LITIGATION STRATEGIES FOR INTELLECTUAL PROPERTY CASES: LEADING LAWYERS ON ADAPTING TO NEW TRENDS, IMPROVING COURTROOM TACTICS, AND UNDERSTANDING THE IMPACT OF RECENT DECISIONS 1 (Aspatore Books ed. 2010).

[20] *U.S. Patent Litigation Statistics*, UNIV. OF HOUSTON LAW CENTER (Mar. 7, 2011), http://www.patstats.org/Patstats3.html.

[21] Richard D. Margiano, *Cost and Duration of Patent Litigation*, MANAGING INTELLECTUAL PROPERTY (Feb. 1, 2009), http://www.managingip.com/Article/2089405/.

[22] Albert, *supra* note 19, at 1.

[23] Albert, *supra* note 19, at 1.

Defensive patent pools look to reduce exposure to these costs by acquiring "patents that have potential to be asserted if an aggressive patent enforcer gets them, and license them free of charge to anyone willing to share the financial burden of acquisition of the patents."[24] They are generally structured in one of two ways:

1. Participatory pools: Member firms put money into an escrow account and take an active role in purchasing decisions.[25] They only contribute funds to those transactions in which they would like to participate.[26]
2. Non-Participatory pools: Member firms pay an annual membership fee, and do not take an active role in patent purchasing decisions.[27] In return, they receive a license to all of the patents in the pool at no extra cost.[28]

Within these two categories, pools may display different purchasing behavior. Some defensive pools, such as Allied Security Trust (AST), employ a CAR strategy, in which pool members involved with the purchase of a patent are made perpetual licensees, after which the patent is sold or donated.[29] Others, such as RPX Corp. (RPX), use a CAH strategy and simply buy patents and license them to all pool members at no extra cost, after which the purchased patents are held indefinitely.[30]

b. The Sherman Act, the Rule of Reason, and *Per Se Illegality*

The primary law governing collusive, anticompetitive conduct in the U.S. is Section 1 of the Sherman Act ("the Act"), which prohibits contracts or combinations in restraint of trade.[31] Whether a given practice violates the Act by restraining trade is determined by the courts through application of the so-called "Rule of Reason" ("the Rule"), first described and applied by the Court in *Standard Oil Co. of New Jersey v. United States*, 221 U.S. 1 (1911).[32] In *Standard Oil*, the defendant over a period of decades bought up nearly all of the oil refineries operating in the U.S.[33] The government alleged that the defendant used its increasing level of control over the nation's refining capacity to force its way into other markets, underprice its competitors, and threaten suppliers and distributors who did business with other firms.[34] All of these acts, the government argued,

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[24] Org. for Econ. Co-Operation and Dev., *supra* note 18, at 27.

[25] Don Clark, *Start-Up Takes on 'Patent Trolls'–Firm Plans to Defensively Buy Patents and Charge Fixed Membership-License Fees*, Wall Street Journal, Nov. 24, 2008, at B5.

[26] *Id.*

[27] *Id.*

[28] *Id.*

[29] *See Acquisition Model*, http://www.alliedsecuritytrust.com/Services/AcquisitionModel.aspx (last visited Mar. 31, 2011); *see also Licensing Model*, http://www.alliedsecuritytrust.com/Services/LicensingModel.aspx (last visited Mar. 31, 2011); *see also Divestiture Process*, http://www.alliedsecuritytrust.com/Services/DivestitureProcess.aspx (last visited Mar. 31, 2011).

[30] *See Defensive Patent Aggregation Service*, http://www.rpxcorp.com/index.cfm?pageid=19 (last visited Mar. 31, 2011).

[31] 15 U.S.C. § 1–2 (2000).

[32] *See Standard Oil,* 221 U.S. at 59.

[33] *Id.* at 32.

[34] *Id.* at 39–45.

involved or were the result of contracts or combinations in restraint of trade, and were therefore illegal.[35]

Central to the outcome of the case was whether the defendant's actions restrained trade in petroleum and petroleum derivatives.[36] The Court concluded that the appropriate meaning of the term "restraint of trade" within the context of the Act was a contract resulting in monopoly or its consequences.[37] According to the Court, those consequences are price inflation, reduced output, and reduced quality.[38] Conduct resulting in any of those three consequences was an undue restraint of trade, and was illegal.[39]

Subsequent decisions refined the Rule. Reaching back to the framework underlying its decision in *Addyston Pipe & Steel Co. v. United States*, 175 U.S. 211 (1899), the Court has identified certain categories of behavior as so plainly anticompetitive that they may be "presumed illegal without further examination under the rule of reason generally applied in Sherman Act cases."[40] For the most part, such *illegal per se* behavior involves naked price-fixing[41] or horizontal agreements among competitors to divide markets.[42] However, resort to the *per se* rule is appropriate in other cases if the allegedly anticompetitive conduct "would always or almost always tend to restrict competition and decrease output."[43] If that is the case, and the restraints imposed by the conduct are manifestly anticompetitive and lack any redeeming virtue, then courts need not engage in the fact-intensive inquiry required by the Rule.[44]

c. Regulatory Posture and the State of the Law

As patent pooling agreements are a type of horizontal agreement between competitors, they are subject to the terms of Section 1 of the Sherman Act, which is generally enforced through "criminal and civil enforcement actions brought by the Antitrust Division of the Department of Justice."[45] The predominant view in modern antitrust law is that the "only goal [of antitrust enforcers]. . . should be to

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[35] *Id.*

[36] *Id.* at 70–74.

[37] *Id.* at 61.

[38] *Id.* at 52.

[39] *Id.* at 61–62.

[40] Broadcast Music, Inc. v. Columbia Broadcasting System, Inc., 441 U.S. 1, 8 (1979); *see also Addyston Pipe & Steel Co.*, 75 U.S. at 240–41.

[41] *See, e.g.*, U.S. v. McKesson & Robbins, Inc., 341 U.S. 305 (1956) (manufacturer/wholesaler agreed with independent wholesalers on prices to be charged on products it manufactured); U.S. v. Socony-Vacuum Oil Co., 310 U.S. 150 (1940) (dominant firms agreed to purchase surplus gasoline with the intent and necessary effect of increasing price); U.S. v. Trenton Potteries Co., 273 U.S. 392 (1927) (manufacturers and distributors of pottery fixtures agreed to sell at uniform prices).

[42] *See* Palmer v. BRG of Ga., Inc., 498 U.S. 46, 49–50 (1990).

[43] Business Electronics Corp. v. Sharp Electronics Corp., 485 U.S. 717, 723 (2007).

[44] *See* Continental T.V., Inc. v. GTE Sylvania Inc., 433 U.S. 36, 50 (2007); *see also* Northwest Wholesale Stationers, Inc. v. Pacific Stationery & Printing Co., 472 U.S. 284, 289 (1985).

[45] DEPT. OF JUSTICE, *Antitrust Enforcement and the Consumer* 3 (2010).

promote efficiency in the economic sense."[46] As a result, they should aim to foster competition within the market so long as the competitive market itself is more efficient than monopoly.[47]

These goals seem at odds with those of the law governing patents, which recognizes that competition has a tendency to retard innovation.[48] To counteract those possibly anti-innovative forces, patentees are granted the right to protection from competition in order to foster the advancement of science.[49] Thus, there appears to be some tension between the aims of the U.S. antitrust and patent systems.[50]

Nevertheless, "there is a broad consensus that the basic goals of antitrust and [patent law] are aligned."[51] Antitrust and patent law should be looked at as "complementary bodies of law that work together to bring innovation to consumers": the former protects competition in the marketplace, while the latter protects an innovator's ability to earn a return on its investments.[52] That complementarity does not, however, resolve the difficult questions that may arise when "antitrust law is applied to specific activities involving intellectual property rights that do create market power."[53]

Antitrust principles are not applied as easily to intellectual property as they are to other forms of property, which makes the antitrust regulation of intellectual property less than straightforward.[54] Fortunately, the primary agencies involved in federal antitrust enforcement, the Antitrust Division of the U.S. Department of Justice and the U.S. Federal Trade Commission (the "Agencies"), have published the guidelines they follow when evaluating the potential anticompetitive effects of intellectual property licensing behavior.[55] The Agencies' 1995 *Antitrust Guidelines for the Licensing of Intellectual Property* (the "Guidelines") embody three general principles: (1) that intellectual property is essentially comparable to any other form of property for the purpose of antitrust analysis; (2) intellectual property is not presumed to create market power in the antitrust context; and (3) intellectual property licensing is generally procompetitive because it allows firms to combine complementary factors of production.[56]

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[46] RICHARD A. POSNER, ANTITRUST LAW 2 (2d ed., 2001).

[47] *Id.*

[48] *Id.* at 18. Technological innovation frequently requires significant investment in research and development. These sunk costs may not be recouped if others can copy the innovator's work. *Id.*

[49] *See id.*; *see also DOJ Report*, *supra* note 8, at 2.

[50] Jesse W. Markham, *The Joint Effect of Antitrust and Patent Laws upon Innovation*, 56 AM. ECON. REV. 291, 293 (Mar. 1966); *see also* Atari Games Corp. v. Nintendo of America, Inc., 897 F.2d 1572, 1576 (Fed. Cir. 1990) ("the aims and objectives of patent and antitrust laws may seem, at first glance, wholly at odds. However, the two bodies of law are actually complementary, as both are aimed at encouraging innovation, industry and competition").

[51] *DOJ Report*, *supra* note 8, at 2.

[52] *Id.*; *see also Atari*, 897 F.2d at 1576.

[53] *DOJ Report*, *supra* note 8, at 2.

[54] *Id.*

[55] *Guidelines*, *supra* note 17, at 1.

[56] *Guidelines*, *supra* note 17, at 2.

The first of the three principles, that antitrust should treat intellectual property in a similar way to other property, is perhaps the most controversial.[57] The Agencies themselves have acknowledged that regulating intellectual property in the exact same way as other property would be inappropriate.[58] Compared with real property, intellectual property is more easily misappropriated.[59] Furthermore, the economics of production in intellectual property markets differs significantly from that in other markets.[60] While the boundaries of ownership when dealing with tangible property are quite clear, in intellectual property they are frequently ill defined.[61] Finally, intellectual property's value is highly uncertain when purchasing or development decisions are made, and may depend on its combination with other factors of production.[62]

Although these differences will be taken into account when considering antitrust action against an intellectual property holder, it is the Agencies' policy to "apply the same general antitrust principles to conduct involving intellectual property that they apply to conduct involving any other form of tangible or intangible property."[63] Intellectual property holders' right to exclude resembles the rights held by owners of other types of property; and, certain types of conduct involving intellectual property may lead to anticompetitive effects. [64] Thus, intellectual property is neither "particularly free from scrutiny under the antitrust laws, nor particularly suspect under them."[65]

The second of the principles is that intellectual property rights are not presumed to confer market power upon the owner of the intellectual property.[66] There are several arguments that justify adopting this approach, among them that several intellectual properties may be competitive within a given market,[67] and that market power may tend to dissipate over the medium to long term in IP-heavy industries.[68] To avoid the potentially costly endeavor of going after every intellectual

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[57] *See, e.g.*, *Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy: Hearings Before the Fed. Trade Comm'n*, Fed. Trade Comm'n (Feb. 6, 2002) [hereinafter *Hearings*] (statement of Prof. Robert Pitofsky); Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1032 (2005) ("[t]reating intellectual property as 'just like' real property is a mistake").

[58] *See Guidelines*, *supra* note 17, at 3 (acknowledging that characteristics of intellectual property distinguish it from other forms of property); *see also DOJ Report*, *supra* note 8, at 4.

[59] *See Hearings*, *supra* note 57, statement of Prof. Robert Pitofsky.

[60] *Id.* Traditionally, the fixed costs associated with production in goods markets are eventually overshadowed by production costs; conversely, the fixed costs associated with intellectual property creation tend to be very high relative to the marginal costs of using the intellectual property, which tend to be near zero. *DOJ Report*, *supra* note 8, at 4.

[61] *DOJ Report*, *supra* note 8, at 4.

[62] *Id.*

[63] *Guidelines*, *supra* note 17, at 3.

[64] *Id.*

[65] *Id.*

[66] *Guidelines*, *supra* note 17, at 4.

[67] *Hearings*, *supra* note 57, statement of Prof. Robert Pitofsky; *see also Guidelines*, *supra* note 17, at 4.

[68] *Hearings*, *supra* note 57, statement of Prof. Robert Pitofsky.

property holder in the market, the Agencies' policy places limits on their own activities. Rather than presume market power, their aim is to pursue intellectual property owners whose market power is illegally acquired or maintained, or legally acquired and maintained and "relevant to [the owner's] ability . . . to harm competition through unreasonable conduct in connection with such property."[69]

While the Agencies' policy regarding the presumption of market power is relatively clear, the law is not. Courts have variously held that market power is presumed where a tying product is patented or copyrighted,[70] and that market power is not presumed from the mere existence of an intellectual property right.[71] Similarly, justices have expressed the view that if a product is protected by a patent, "it is fair to presume that the inability to buy the product elsewhere gives the seller market power."[72] Yet, they are also aware of the fact that "a patent holder has no market power in any relevant sense if there are close substitutes for the patented product."[73]

The third and final principle guiding the Agencies' policy with respect to intellectual property licensing is that certain licensing arrangements may be procompetitive even if, under different circumstances, they would raise regulators' suspicions.[74] Because intellectual property tends to be only one component among many in a production process, and because most intellectual property derives its value from its combination with complementary factors of production, the potential social benefit of a specific piece of intellectual property may not be realized if, for example, cross-licensing or other cooperative, coordinating arrangements are not allowed.[75] Whereas field-of-use or territorial licensing restrictions may run afoul of antitrust law under different circumstances[76] they may "serve procompetitive ends by allowing [an intellectual property owner] to exploit its property as efficiently and effectively as possible."[77]

The Guidelines apply these principles directly to pooling arrangements and cross-licensing agreements. The Agencies consider to be a pool any agreement "of two or more owners of different items of intellectual property to license one another or third parties."[78] Because pooling agreements can promote the dissemination of technology, they are often procompetitive.[79] Case law supports this view. For example, in *Broadcast Music, Inc.*, BMI issued blanket licenses to copyrighted musical compositions.[80] CBS sued BMI alleging that BMI's licensing

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[69] *Guidelines*, *supra* note 17, at 4.
[70] U.S. v. Loew's, Inc., 371 U.S. 38, 45 (1962).
[71] Abbott Labs. v. Brennan, 952 F.2d 1346, 1354–55 (Fed. Cir. 1991).
[72] Jefferson Parish Hosp. Dist. No. 2 v. Hyde, 466 U.S. 2, 16 (1984) (dictum).
[73] *Jefferson Parish Hosp.*, 466 U.S. at 37 n. 7 (O'Connor, J., concurring).
[74] *Guidelines*, *supra* note 17, at 4–5.
[75] *See id.* at 5.
[76] Posner, *supra* note 46, at 183–84.
[77] *Guidelines*, *supra* note 17, at 5.
[78] *Id.* at 28.
[79] *Id.*
[80] *Broadcast Music, Inc.*, 441 U.S. at 1.

practices constituted illegal price-fixing and were a *per se* violation of Section 1 of the Sherman Act.[81] The Court noted that a "middleman with a blanket license was an obvious necessity" to avoid the transaction costs associated with separate negotiations for licenses to each of the compositions included in the blanket license agreements.[82] Because the blanket license provided "an acceptable mechanism for at least a large part of the market for the performing rights to copyrighted musical compositions," the Court held that licensing practices such as BMI's should not automatically be declared illegal.[83] Rather, the Court held, they "should be subjected to a more discriminating examination under the rule of reason."[84]

However, pooling and cross-licensing agreements are not always procompetitive.[85] The Agencies will prosecute arrangements that "do not contribute to an efficiency-enhancing integration of economic activity among the participants."[86] Moreover, in such circumstances, the courts are more likely to hold that the agreement violates antitrust law.[87] In *U.S. v. Singer Manufacturing Corp.*, 374 U.S. 174 (1963), an American sewing machine manufacturer entered into a cross-licensing agreement with Swiss and Italian competitors.[88] The agreement itself and the circumstances surrounding its formation were "long and complicated."[89] On its face, the agreement transferred a patent held by the Swiss manufacturer to its American counterpart.[90] However, the Court found that its actual purpose was to protect the American manufacturer against competition from Japanese competitors.[91] Because "the arrangements by which [a] patent is utilized are subject to the general law,"[92] possession of a valid patent or patents "does not give the patentee any exemption from the provisions of the Sherman Act beyond the limits of the patent monopoly."[93] The Court noted that the aggregation of multiple patents by a single entity to circumvent those limitations may constitute anticompetitive behavior in violation of the Sherman Act, and that Singer's behavior went beyond the limitations imposed by antitrust law.[94]

d. Nuts and Bolts of Pool Validity: The DOJ's Business Review Letters

Businesses trying to avoid an outcome similar to *Singer* "may ask the [DOJ] for a statement of its current enforcement intentions with respect to" their proposed

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[81] *Id.* at 6.

[82] *Broadcast Music, Inc.*, 441 U.S. at 20.

[83] *Id.* at 24.

[84] *Id.*

[85] *Guidelines*, *supra* note 17, at 28.

[86] *Id.*

[87] *See*, *e.g.*, Nat'l Collegiate Athletic Ass'n v. Bd. of Regents of the Univ. of Oklahoma, 468 U.S. 85 (1984) (restraints not justified on basis of procompetitive effect).

[88] *Singer Mfg. Corp.*, 374 U.S. at 180.

[89] *Id.* at 176.

[90] *Id.* at 180.

[91] *Id.* at 192-93.

[92] *Id.* at 196 (quoting U.S. v. Masonite Corp, 316 U.S. 265, 277).

[93] *Singer Mfg. Corp.*, 374 U.S. at 196-97 (quoting U.S. v. Line Material Co., 333 U.S. 287, 308).

[94] *Id.* at 197.

conduct.[95] Since 1997, at least four patent licensing pools have submitted requests for review.[96] In its responses to those requests, the DOJ has described in detail the approach it takes to the analysis of pooling agreements and the indicia of validity it looks for when deciding whether an individual pool has anticompetitive effects.[97]

DOJ regulators consider two baseline factors when evaluating pool validity: whether the pooling or licensing scheme is premised on currently valid IP rights and whether the pool contains "competing" patents.[98] If the underlying IP rights are valid and are not substitutes for each other, the DOJ will consider (a) the pool's impact on potential rivals, (b) the extent to which the pool facilitates collusion between its members, and (c) whether the pool will retard innovation.[99]

All patent pool business review letters base the IP-validity requirement on the consent decree issued in *United States v. Pilkington PLC*, 1994-2 Trade Cases P 70, 842 (D. Ariz. 1994).[100] In *Pilkington*, the defendant licensed glass-manufacturing patents to several of its competitors.[101] Twenty years after entering into the agreements, their underlying IP expired.[102] Yet, the defendant continued to enforce the terms of its licenses.[103] The defendant eventually agreed to submit to a consent decree, which required that it inform its licensees that its patents had passed into the public domain; Pilkington was also enjoined from enforcing its licenses with respect to unprotected IP.[104] Accordingly, the DOJ has taken the position that a "licensing scheme premised on invalid or expired [IP] rights will not withstand antitrust scrutiny."[105]

While the validity requirement is based in law, the requirement of complementarity rests on the economic justifications for allowing pooling

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[95] U.S. DEPT. OF JUSTICE, *Pilot Program Announced to Expedite Business Review Process*, PUB. NO. 92-384 at 3 (1992).

[96] Visit http://www.justice.gov/atr/public/busreview/229887.htm for an index to letters by topic.

[97] U.S. DEPT. OF JUSTICE, *Business Review Letter, Proposed MPEG LA Licensing Agreement* 9 (Jun. 26, 1997) [hereinafter *MPEG Letter*].

[98] *See id.*; *see also* U.S. DEPT. OF JUSTICE, *Business Review Letter, Proposed Digital Versatile Disc Licensing Agreement* 9 (Dec. 16, 1998) [hereinafter *Philips DVD Letter*]; *see also* U.S. DEPT. OF JUSTICE, *Business Review Letter, Proposed Digital Versatile Disc Licensing Agreement* 10–11 (Jun. 10, 1999) [hereinafter *Hitachi DVD Letter*]; *see also* U.S. DEPT. OF JUSTICE, *Business Review Letter, Proposed 3G Patent Licensing Agreement* 9 (Nov. 12, 2002) [hereinafter *3G Letter*]. Competing patents are non-complementary patents, i.e., patents that may be substituted for each other to accomplish a similar goal within a given technological pipeline. *See MPEG Letter*, *supra* note 97, at 9.

[99] *MPEG Letter*, *supra* note 97, at 10–11; *Philips DVD Letter*, *supra* note 98, at 10,13; *Hitachi DVD Letter*, *supra* note 98, at 14; *3G Letter*, *supra* note 98, at 10–12.

[100] *MPEG Letter*, *supra* note 97, at 9; *Philips DVD Letter*, *supra* note 98, at 9; *Hitachi DVD Letter*, *supra* note 98, at 10; *3G Letter*, *supra* note 98, at 9.

[101] Complaint at 8, U.S. v. Pilkington Plc, No. 94-345 (D. Ariz. May 25, 1994).

[102] *Id.* 10.

[103] *Id.*

[104] U.S. v. Pilkington Plc, 1994-2 Trade Cas. (CCH) ¶ 70,842.

[105] *MPEG Letter*, *supra* note 97, at 9. All subsequent pool review letters rely on this authority as well. *See*, *e.g.*, *Philips DVD Letter*, *supra* note 98, at 9; *Hitachi DVD Letter*, *supra* note 98, at 10; *3G Letter*, *supra* note 98, at 9.

agreements.[106] Legal pools will "integrate complementary patent rights" while creating competitive benefits that are likely to outweigh any "competitive harm posed by other aspects of the program."[107] Where a proposed pool contains substitute patents,[108] pool members may have an "economic incentive to utilize [the pool] to eliminate competition among them."[109] Pool members could then use the pool as a price-fixing mechanism, "ultimately raising the price of products and services that utilize the pooled patents."[110]

Distinguishing complementary from substitute patents for the purpose of assessing pool validity is no simple task.[111] In theory, market prices for pure complements will move together, while prices for pure substitutes will exhibit an inverse relationship.[112] In reality, however, no two patents are likely to be pure substitutes or complements.[113] Because no perfect test for patent substitutability exists, the Agencies' approach has been to assess individual pools on a case-by-case basis.[114] The most consistent approach for determining whether a given patent can "swim" in a pool is found in the Agencies' regulation of standards-licensing agreements: there, the pool may contain only those patents deemed "essential" to compliance with the standard.[115]

Pools of complementary, valid patents are more likely to fulfill the other three requirements enumerated in the DOJ's business review letters. The impact on rivals is reduced by limiting pooled patents to "essentials" because licensees will not be forced to pay for tied patents they do not need.[116] Competitor impact may also be mitigated by independent and third-party-enforced, nondiscriminatory licensing practices.[117] Beyond these practices, the letters give little guidance; it seems that the DOJ prefers to take a more flexible, case-by-case approach to the evaluation of competitor impact.[118]

Competitor impact is closely related to the Agencies' preference for pool structures that make collusion more difficult.[119] The main concern here is that an

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[106] *See Guidelines*, *supra* note 17, at 28–29.

[107] *Philips DVD Letter*, *supra* note 98, at 9.

[108] Substitute patents are patents that may be "licensed and used in competition with each other." *Id.* at 10.

[109] *Id.* at 10; *see also MPEG Letter*, *supra* note 97, at 9.

[110] *Philips DVD Letter*, *supra* note 98, at 10.

[111] *DOJ Report*, *supra* note 8, at 74.

[112] *Id.*

[113] *Id.*

[114] *Id.* at 74–78.

[115] *See id.* at 77.

[116] *MPEG Letter*, *supra* note 97, at 9.

[117] *Id.* at 10; *see also* Matsushita Elec. Indus. Co. v. Cinram Int'l, Inc., 299 F. Supp. 2d 370, 377, 379 (D. Del. 2004).

[118] *See 3G Letter*, *supra* note 98, at 12; *see also Philips DVD Letter*, *supra* note 98, at 13; *see also Hitachi DVD Letter*, *supra* note 98, at 14; *see also MPEG Letter*, *supra* note 97, at 10–11.

[119] Collusion may hurt competitors because it allows pool members to set prices as a group or conduct other activities that make it more difficult for outsiders to enter or be competitive in the market. *See*, *e.g.*, *MPEG Letter*, *supra* note 97, at 11.

ostensibly legitimate pool may in actuality be a sham licensing agreement, which, for example, imposes high effective marginal costs on members by requiring large per-unit licensing fees.[120] Those high marginal costs may be used as a mechanism to enforce output and pricing guidelines.[121] Other structural elements of a pool that raise the specter of collusion include compelled negotiations between competitors and auditing practices that make cartel pricing enforcement less costly.[122]

The final factor considered by regulators when evaluating the legitimacy of a patent pool is the possible effect of the pool on innovation.[123] Although pools can promote the dissemination of technology, which may foster innovation, certain licensing terms may disincentivize technological development by pool members.[124] Overly broad grantback clauses, which require that a licensee agree "to extend to the licensor of intellectual property the right to use the licensee's improvements to the licensed technology," are the most problematic in this regard.[125] The disincentives grantbacks create cut in two directions: the licensor has little incentive to improve on its invention because it can free ride on its licensees' research; similarly, licensees will have less of an incentive to innovate because the benefits they will reap from future improvements are decreased.[126]

At first blush, it is surprising that the business review letters do not contain in-depth discussion regarding refusals by pools to license patents to outsiders.[127] However, antitrust law has long recognized the "right of [a] trader or manufacturer engaged in an entirely private business, freely to exercise [its] own independent discretion as to parties with whom [it] will deal."[128] Furthermore, "the essence of a patent grant is the right to exclude others from profiting by the patented invention."[129] In fact, exclusionary practices that prevent less efficient firms from the market may be beneficial because those firms' participation would reduce market efficiency.[130] Despite the legal and economic principles that would support a pool's absolute right to refuse to license to outsiders, the terms of pooling

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[120] Michael L. Katz & Carl Shapiro, *On the Licensing of Innovations*, 16 RAND J. ECON. 504, 512-13 (1985).

[121] *Id.*

[122] *See*, *e.g.*, Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 408 (2004) ("compelling negotiation between competitors may facilitate the supreme evil of antitrust: collusion"); *see also* ROGER D. BLAIR & JEFFREY L. HARRISON, MONOPSONY: ANTITRUST LAW AND ECONOMICS 124 (1993) (allowing purchase price auditing makes it more difficult to detect tacit or other pricing agreements).

[123] *MPEG Letter*, *supra* note 97, at 11; *Philips DVD Letter*, *supra* note 98, at 14; *Hitachi DVD Letter*, *supra* note 98, at 13.

[124] *See Guidelines*, *supra* note 17, at 28.

[125] *Id.* at 30.

[126] *DOJ Report*, *supra* note 8, at 92-93.

[127] Exclusionary conduct such as refusals to deal are an important consideration in antitrust regulation. *See*, *e.g.*, FED. TRADE COMM'N, *Exclusionary or Predatory Acts: Refusal to Deal*, http://www.ftc.gov/bc/antitrust/refusal_to_deal.shtm (Jul. 8, 2008).

[128] U.S. v. Colgate Co., 250 U.S. 300, 307 (1919).

[129] Dawson Chem. Co. v. Rohm & Haas Co., 448 U.S. 176, 215 (1980)

[130] Posner, *supra* note 46, at 196.

agreements are subject to the Sherman Act's prohibition against "unreasonable restraints of trade effected by 'a contract, combination ... or conspiracy.'" [131] Therefore, conduct "going beyond a mere refusal [to license to outsiders] ... may merit scrutiny under the antitrust laws."[132]

II. Assume a Can Opener: Modeling Competition Under a DPP Regime

The industries in which the members of the best-known defensive patent pools operate are highly concentrated.[133] Thus, it is appropriate to examine the effects on the market of DPP purchasing behavior under conditions of oligopolistic competition.[134] Furthermore, given the uncertainty associated with the valuation of individual patents and their effects on firms' cost structure, models operating under the assumption of perfect information will not accurately approximate firm behavior.[135] Therefore, a market model built around oligopolistic competition with production cost uncertainty is most likely to approximate the dynamics at play in the markets in which DPPs are active.

a. Market Structure

Consider a market for a homogenous good in which $F = \{F_1, \dots, F_i\}, i \geq 2$ risk-averse firms compete by simultaneously and independently setting prices. Market demand D is a convex, decreasing function of price, with $D(P^{max}) = 0$ and $D(0) = Q^{max}$. Firms' cost functions are derived from constant returns to scale production technology. The set of available production technologies is $\mathrm{T} = \{\tau_1, \dots, \tau_k : (\tau_i \neq \tau_j \forall \tau_i, \tau_j \in \mathrm{T}) \wedge (0 < \tau_i < \tau_{i+1} \forall \tau_i \neq \tau_k \in \mathrm{T})\}$, $k \geq 2$,where $\Phi: \mathrm{T} \to F$ maps each technology to the (possibly empty) set of firms that are using it. Let a given firm's cost function be $C_i(Q) = \tau_i \cdot Q$, with $\tau_i \in \mathrm{T}, C_i < P^{max}$. The probability that a firm has marginal cost τ_i is $\Theta: \tau_i \to (0,1), \sum_{j=1}^{k} \Theta(\tau_j) = 1$.

Firms operating in the market maximize their expected profits and supply all the demand they face. Production technologies are subject to a non-exclusive, cost-free license. Once a firm has entered into a licensing agreement for a single technology, it knows the costs it will incur through the use of that technology. Firms also have knowledge of Θ; however, they do not know for certain what type of technology any given rival is using. If by chance more than one firm sells its

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[131] Copperweld Corp v. Independence Tube Corp., 467 U.S. 752, 768 (1984) (quoting section 1 of the Sherman Act).

[132] *DOJ Report*, *supra* note 8, at 31.

[133] As an illustration, RPX is active in the market for patents covering the manufacture of semiconductors. RPX CORP., http://www.rpxcorp.com/ (last visited Mar. 31, 2011). In 2009, twenty semiconductor suppliers controlled 62.4% of the semiconductor market as measured by market share. ISUPLI CORP., *Semiconductor Value Chain Report* 1 (2011). The largest supplier, Intel Corp., held a 14% share. *Id.*

[134] N. GREGORY MANKIW, PRINCIPLES OF ECONOMICS 365–67 (5th ed. 2009).

[135] *See*, *e.g.*, *DOJ Report*, *supra* note 8, at 4 (discussing the uncertainties inherent in the valuation of patents.

product at the lowest price in the market, firms share market demand equally. The monopoly profit of a firm using τ_i is $\pi_i(P) = (P - \tau_i) \cdot D(P)$ and the shared profit of a firm using the same technology given an m-way tie at price P is $\hat{\pi}_i(P, m) = \frac{1}{m} \cdot (P - \tau_i) \cdot D(P)$, where π_i and $\hat{\pi}_i$ are strictly concave in price. Finally, market prices are set along the spectrum $\mathbb{P} = [0, P^{max}]$, with $P' = \arg\max_{P \in \mathbb{P}} \pi_1(P)$ denoting the profit-maximizing monopoly price for the firm using the lowest-cost technology and $\hat{P} = \min\{\tau_k, P'\}$ denoting the lesser of (1) the marginal cost associated with the highest-cost technology and (2) the monopoly price for the firm using the lowest-cost technology.[136]

b. Calculating the Market Equilibrium Without Licensing Restrictions

The classical result for a market in which a small number of firms compete by setting prices for a homogenous good under perfect information has become known as Bertrand's paradox: although the market does not operate under the traditional assumptions of perfect competition, it still settles at the competitive equilibrium, i.e., market price will be equal to marginal cost.[137] However, if there is uncertainty regarding other firms' costs, the competitive outcome is no longer guaranteed.[138] Therefore, an analysis under the assumptions of pure Bertrand competition is not appropriate.[139]

To discover the market's equilibrium price, we first look at a single firm F_1 which holds a non-exclusive license for what turns out to be the lowest-cost technology, τ_1. If it is operating as a monopolist facing a linear demand curve of the form $D(P) = P^{max} - r \cdot P, 0 < r \leq 1$, its profits can be described without reference to market demand or price by solving the following Lagrangian:

$$\Lambda = (P - \tau_1) \cdot Q + \lambda \cdot (P^{max} - r \cdot P - Q)$$

with first order conditions:

$$\frac{\partial \Lambda}{\partial P} = Q - \lambda \cdot r$$
$$\frac{\partial \Lambda}{\partial Q} = (P - \tau_1) - \lambda$$
$$\frac{\partial \Lambda}{\partial \lambda} = P^{max} - r \cdot P - Q.$$

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[136] Note that this implies $0 < \hat{P} \leq P' < P^{max}$.

[137] More precisely, Bertrand's paradox holds if firms possess bounded revenues, constant and identical marginal cost, and split market demand equally when there is a tie at the lowest price. Joseph E. Harrington, Jr., *A Re-Evaluation of Perfect Competition as the Solution to the Bertrand Price Game*, 17 MATH. SOCIAL SCIS. 315, 315-16 (1989).

[138] *See, e.g.*, Robert R. Routledge, *Bertrand Competition with Cost Uncertainty*, 107 ECON. LETTERS 356, 357-58 (2010).

[139] *Id.* at 357 (oligopolistic market with uncertainty does not possess pure strategy Bayesian Nash equilibrium).

Dividing the first equation by the second:

$$\frac{\partial \Lambda}{\partial P} \cdot \frac{1}{\frac{\partial \Lambda}{\partial Q}} \Longrightarrow Q = r \cdot (P - \tau_1)$$

Substituting this value for Q back into the demand function:

$$\begin{aligned} D(P) = Q &= P^{max} - r \cdot P \\ r \cdot (P - \tau_1) &= P^{max} - r \cdot P \\ P &= \frac{P^{max}}{2 \cdot r} + \frac{\tau_1}{2} \end{aligned}$$

Therefore,

$$\begin{aligned} \pi_1 &= (P - \tau_1) \cdot Q \\ &= \left(\frac{P^{max}}{2 \cdot r} + \frac{\tau_1}{2} - \tau_1\right) \cdot r \cdot (P - \tau_1) \\ &= \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r} \\ &\Longrightarrow \hat{\pi}_1 = \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r \cdot m} \end{aligned}$$

While F_1 could choose to price its goods without regard to other firms' decisions, it knows that there is a probability of $\theta_1 = \Theta(\tau_1)$ that any other given firm is using the same technology. Therefore, the best F_1 can do is base its pricing decisions on its expectations for costs in the entire market. In F_1's best-case scenario as the only firm with τ_1, it will earn monopoly profits of $\pi_1(P)$. However, the probability of this scenario occurring is only $(1 - \theta_1)^{n(F)-1}$. If F_1 and one other firm use τ_1 and price at the same level, F_1's profits are $\hat{\pi}_1(P, 2)$, with a probability of occurrence of $C_1^{n(F)-1}\theta_1 \cdot (1 - \theta_1)^{n(F)-2}$, and so on. Thus, expected profits given actual quantity demanded Q^* are:

$$\begin{aligned} E(\cdot) &= \pi_1(P) \cdot (1 - \theta_1)^{n(F)-1} \\ &\quad + \sum_{i=1}^{n(F)-1} \hat{\pi}_1(P, i+1) \cdot C_i^{n(F)-1} \cdot \theta_1^i \cdot (1 - \theta_1)^{n(F)-(i+1)} \\ &= \pi_1(P) \cdot (1 - \theta_1)^{n(F)-1} + \sum_{i=1}^{n(F)-1} \frac{\pi_1(P) \cdot C_i^{n(F)-1} \cdot \theta_1^i \cdot (1 - \theta_1)^{n(F)-(i+1)}}{1 + i} \\ &= \pi_1(P) \cdot \left[(1 - \theta_1)^{n(F)-1} + \sum_{i=1}^{n(F)-1} C_i^{n(F)-1} \cdot \frac{\theta_1^i \cdot (1 - \theta_1)^{n(F)-(i+1)}}{1 + i}\right] \end{aligned}$$

This simplifies to:

$$E(\cdot) = \pi_1(P) \cdot \frac{(1 - \theta_1)^{n(F)}}{n(F) \cdot \theta_1} \cdot \left[\left(\frac{1}{1 - \theta_1}\right)^{n(F)} - 1\right].$$

As expected, and illustrated in Figure 1, firms will tend to see lower profits if the market is crowded (larger $n(F)$) or if there is a higher likelihood that others are using τ_1 (larger θ_1).

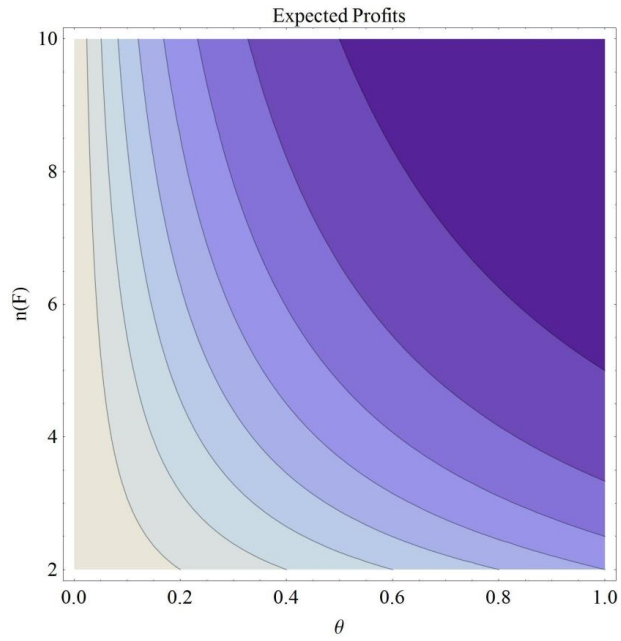

Figure 1: Contour plot of expected profits. $\boldsymbol{\theta_1}$ is on the x-axis, $\boldsymbol{n(F)}$ is on the y-axis. Darker areas indicate lower expected profits.

As a risk-averse firm, F_1 will seek to ensure that, on average, it will be no worse off in tie scenarios than in others. Therefore, F_1 must choose a price $\tilde{P}$ such that $E(\cdot) = \hat{\pi}_1$. Because F_1 does not know how many firms actually have τ_1, it must use its best estimate of that number, $m = \theta_1 \cdot n(F)$:

$$\hat{\pi}_1 = E(\cdot)$$

$$\frac{1}{m} \cdot Q^* \cdot (\tilde{P} - \tau_1) = \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r} \cdot \frac{(1-\theta)^n}{m} \cdot \left[\left(\frac{1}{1-\theta}\right)^n - 1\right]$$

$$\tilde{P} - \tau_1 = (1-\theta)^n \cdot \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r \cdot Q^*} \cdot \left[\left(\frac{1}{1-\theta}\right)^n - 1\right]$$

$$\tilde{P} = \tau_1 + (1-\theta)^n \cdot \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r \cdot Q^*} \cdot \left[\left(\frac{1}{1-\theta}\right)^n - 1\right].$$

Because all firms face the same decision, those firms using τ_1 will sell their goods at $\tilde{P}$ and split $D(\tilde{P})$ between themselves. That price will always be less than or equal to the price charged by a monopolist:

$$P = \frac{(P^{max} - r \cdot \tau_1)^2}{4 \cdot r \cdot Q^*} + \tau_1 = \frac{P^{max}}{2 \cdot r} + \frac{\tau_1}{2}$$

To prove $P \geq \tilde{P}$, first assume $P < \tilde{P}$. $\tilde{P}$ can be rewritten as $\tau_1 + \mathrm{B} \cdot \frac{\pi_1}{Q^*}$, where $\mathrm{B} = (1-\theta)^n \cdot \left[\left(\frac{1}{1-\theta}\right)^n - 1\right]$. If $P < \tilde{P}$,

$$P < \tau_1 + \mathrm{B} \cdot \frac{\pi_1}{Q^*}$$

$$(P - \tau_1) \cdot Q^* < \mathrm{B} \cdot \pi_1$$

Because $\pi_1 = (P - \tau_1) \cdot Q^*$, $P < \tilde{P}$ only if $\mathrm{B} > 1$:

$$(1-\theta)^n \cdot \left[\left(\frac{1}{1-\theta}\right)^n - 1\right] > 1$$

$$\left(\frac{1}{1-\theta}\right)^n - 1 > \frac{1}{(1-\theta)^n}$$

$$(1-\theta)^{-n} - 1 > (1-\theta)^{-n}$$

$-1 < 0$, $\mathrm{B} \leq 1$, and $\pi_1 \geq \mathrm{B} \cdot \pi_1$. Therefore $P \geq \tilde{P}$. This result is illustrated in Figure 2.

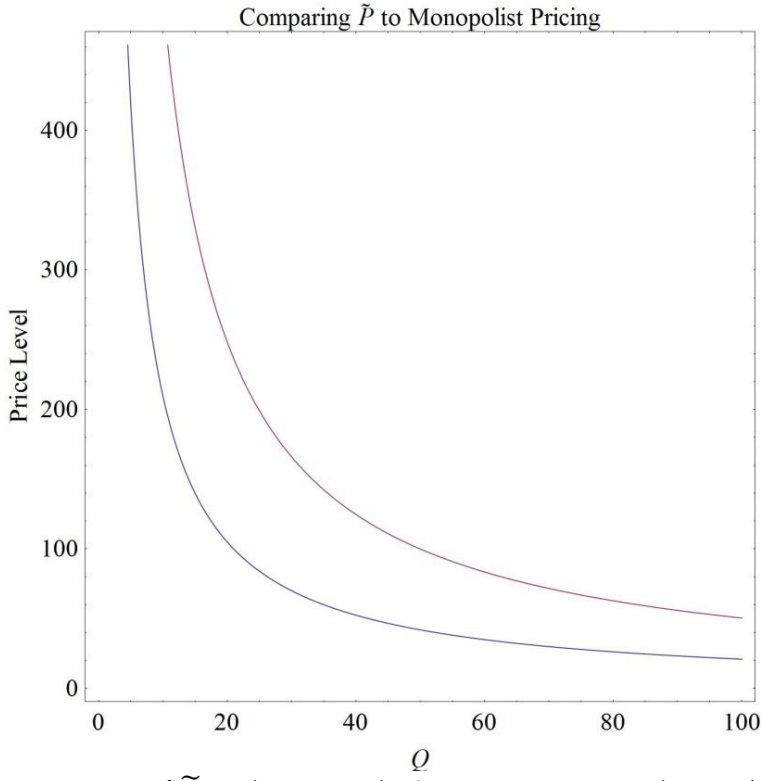

Figure 2: Comparison of $\tilde{P}$ and monopolist's price. Quantity demanded is on the x-axis, price level is on the y-axis. Monopolist's price is in light purple, $\tilde{P}$ is in dark purple.

c. Effects of Restrictive DPP behavior on the market equilibrium

Given certain assumptions, we would expect that market price would be at or below the monopoly price when there are no constraints placed on technology licenses. Thus, the statics in this model are more likely exhibited by markets in which CAR pools are active: in essence, the model predicts that CAR pools will tend not to disrupt markets because they allow other firms to license the patents released from their pools. However, an entity such as a CAH pool restricts the availability of patents after it has purchased them, and reduces the probability that other firms in the market will be able to compete with the pool's beneficiaries.

i. Market statics given non-rigid capacity constraints

Taking into account technology purchasing behavior requires some modifications of the model. Without capacity constraints, exclusive technology purchases result in trivial equilibria: a single producer in sole possession of τ_1 will capture the entire market at the monopolist's price, and an exclusive purchase of τ_1 by a group of producers leads to classical Bertrand competition and a market price of τ_1.[140] However, if producers are faced with a capacity constrained at q^{max} they will only be able to supply up to that amount, allowing other producers to participate in the market. Imposing that constraint also allows us to see how purchases by a restrictive pool affect the pricing decisions of both pool members and outsiders.

Investigation of this new market equilibrium also necessitates the relaxation of assumptions with respect to firms' knowledge and the order in which firms make their moves. The complexity introduced by requiring simultaneous behavior goes beyond the scope of this note, as would restricting all firms to less than perfect information regarding market conditions. While retaining those assumptions at this stage would make the model more powerful, doing so is not necessary in order to glean at least some insight into how restrictive (CAH) pools change the market.

Chowdhury presents a model of Bertrand competition with non-rigid capacity constraints in which firms may produce beyond capacity by incurring an additional per-unit cost, and may be adapted to help describe the effects of CAH pools.[141] Under the modified model, producers' cost curves become a piecewise function of Q:[142]

$$C_i(Q) = \begin{cases} \tau_i \cdot Q, & 0 \le Q \le q^{max} \\ \tau_i \cdot Q + \tau_i' \cdot (Q - q^{max}), & Q > q^{max} \end{cases}$$

where τ_i' is the additional per-unit expansion cost accrued when using τ_i, $0 < \tau_i' < \tau_{i+1}' \forall \tau_i' \in \mathrm{T}'$. Similarly, the demand curve maps a firm's price p_i and the vector of all firm-announced prices ϕ to demand for an individual firm's products:[143]

$$D_i(\phi) = \begin{cases} 0, & p_i > p_j \vee p_i > P^{max}, p_j \in \phi \\ \frac{1}{m} \cdot (P^{max} - r \cdot p_i), & p_i \le p_j, \forall p_j \in \phi \text{ and } m = n(\{p_k : p_i = p_k, p_k \in \phi\}) \end{cases}$$

Costs can be rewritten as a function of ϕ, where $\Gamma = (P^{max} - r \cdot p_i)$:

$$C_i(\phi) = \begin{cases} 0, & s_1 \\ \frac{\tau_i}{m} \cdot (P^{max} - r \cdot p_i), & s_2 \\ \frac{[\tau_i + \tau_i']}{m} \cdot \Gamma - \tau_i' \cdot q^{max}, & s_3 \end{cases}$$

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[140] Harrington, *supra* note 137, at 315.

[141] Prabal Roy Chowdhury, *Bertrand Competition with Non-Rigid Capacity Constraints* 1 (Indian Statistical Institute Discussion Papers in Econ. No. 09-02, 2009).

[142] *Id.* at 2.

[143] *Id.*

where

$s_1 = p_i > p_j \vee p_i > P^{max}, p_j \in \phi$

$s_2 = (0 \leq Q \leq q^{max}) \wedge (p_i \leq p_j, \forall p_j \in \phi \text{ and } m = n(\{p_k : p_i = p_k, p_k \in \phi\}))$

$s_3 = (Q > q^{max}) \wedge (p_i \leq p_j, \forall p_j \in \phi \text{ and } m = n(\{p_k : p_i = p_k, p_k \in \phi\})$

As before, firm i's profit is:[144]

$$\pi_i = [p_i - AC_i(\cdot)] \cdot Q$$

$$= Q \cdot \left[p_i - \frac{1}{Q} \cdot \begin{cases} 0, & s_1 \\ \frac{\tau_i}{m} \cdot \Gamma, & s_2 \\ \frac{[\tau_i + \tau_i']}{m} \cdot \Gamma - \tau_i' \cdot q^{max}, & s_3 \end{cases} \right]$$

$$= Q \cdot \left[p_i - \begin{cases} 0, & s_1 \\ \frac{\tau_i \cdot \Gamma}{m \cdot Q}, & s_2 \\ \frac{1}{Q} \cdot \left(\frac{[\tau_i + \tau_i']}{m} \cdot \Gamma - \tau_i' \cdot q^{max} \right), & s_3 \end{cases} \right]$$

$$= \begin{cases} 0, & s_1 \\ Q \cdot p_i - \frac{\tau_i \cdot \Gamma}{m}, & s_2 \\ Q \cdot p_i - \frac{[\tau_i + \tau_i']}{m} \cdot \Gamma - \tau_i' \cdot q^{max}, & s_3 \end{cases}$$

Profits can be maximized by solving the Lagrangian:

$$\Lambda = \pi_i + \lambda \cdot (D_i - Q)$$

$$\frac{\partial \Lambda}{\partial p_i} = \frac{\partial \pi_i}{\partial p_i} + \lambda \cdot \frac{\partial D_i}{\partial p_i}$$

$$\frac{\partial \Lambda}{\partial Q} = \frac{\partial \pi_i}{\partial Q} + \lambda \cdot \left(\frac{\partial D_i}{\partial Q} - 1\right)$$

$$\frac{\partial \Lambda}{\partial \lambda} = D_i - Q.$$

We can evaluate piecewise-partial derivatives for each component of the first order conditions:

$$\frac{\partial D_i}{\partial p_i} = \begin{cases} 0, & p_i > p_j \vee p_i > P^{max}, p_j \in \phi \\ -\frac{r}{m}, & p_i \leq p_j, \forall p_j \in \phi \text{ and } m = n(\{p_k : p_i = p_k, p_k \in \phi\}) \end{cases}$$

$$\frac{\partial \pi_i}{\partial p_i} = \begin{cases} 0, & s_1 \\ Q - \frac{\tau_i \cdot r}{m}, & s_2 \\ Q - \frac{[\tau_i + \tau_i'] \cdot r}{m}, & s_3 \end{cases}$$

[144] *Id.*

And $\frac{\partial \pi_i}{\partial p_i} + \lambda \cdot \frac{\partial D_i}{\partial p_i}$ is:

$$\frac{\partial \pi_i}{\partial p_i} + \lambda \cdot \frac{\partial D_i}{\partial p_i} = \begin{cases} 0, & s_1 \\ Q - \frac{\tau_i \cdot r}{m} - \lambda \cdot \frac{r}{m}, & s_2 \\ Q - \frac{[\tau_i + \tau_i'] \cdot r}{m} - \lambda \cdot \frac{r}{m}, & s_3 \end{cases}$$

The partial derivatives with respect to Q are:

$$\frac{\partial D_i}{\partial Q} = 0$$

$$\frac{\partial \pi_i}{\partial Q} = \begin{cases} 0, & s_1 \\ 1, & s_2 \\ 1, & s_3 \end{cases}$$

Therefore,

$$\frac{\partial \pi_i}{\partial Q} + \lambda \cdot \left(\frac{\partial D_i}{\partial Q} - 1\right) = \begin{cases} 0 - \lambda, & s_1 \\ 1 - \lambda, & s_2 \\ 1 - \lambda, & s_3 \end{cases}$$

Dividing by $\frac{\partial \pi_i}{\partial p_i} + \lambda \cdot \frac{\partial D_i}{\partial p_i}$ by $\frac{\partial \pi_i}{\partial Q} + \lambda \cdot \left(\frac{\partial D_i}{\partial Q} - 1\right)$ yields:

$$Q = \begin{cases} \frac{r}{m} \cdot (\tau_i + 1), & s_2 \\ \frac{r}{m} \cdot (\tau_i + \tau_i' + 1), & s_3 \end{cases}$$

Note that Q given s_1 falls away because it would require that firms operate beyond the maximum price customers are willing to pay.

Based on the definition of the demand function, we know that

$$\begin{cases} \frac{\Gamma}{m}, & s_2 \vee s_3 \end{cases} = \begin{cases} \frac{r}{m} \cdot (\tau_i + 1), & s_2 \\ \frac{r}{m} \cdot (\tau_i + \tau_i' + 1), & s_3 \end{cases}$$

We can now solve for p_i. If s_2 is true:

$$\begin{aligned} \frac{\Gamma}{m} &= \frac{r}{m} \cdot (\tau_i + 1) \\ P^{max} - r \cdot p_i &= r \cdot (\tau_i + 1) \\ r \cdot p_i &= P^{max} - r \cdot (\tau_i + 1) \\ p_i &= \frac{1}{r} \cdot [P^{max} - r \cdot (\tau_i + 1)] \\ \Longrightarrow \pi_i | s_2 &= \frac{\tau_i + 1}{m} \cdot [P^{max} - 2 \cdot \tau_i \cdot r - r] \end{aligned}$$

If s_3 is true:

$$\begin{aligned} P^{max} - r \cdot p_i &= r \cdot (\tau_i + \tau_i' + 1) \\ p_i &= \frac{1}{r} \cdot [P^{max} - r \cdot (\tau_i + \tau_i' + 1)] \\ \Longrightarrow \pi_i | s_3 &= \frac{\tau_i + \tau_i' + 1}{m} \cdot [P^{max} - 2 \cdot (\tau_i + \tau_i') \cdot r - r] - \tau_i' \cdot q^{max} \end{aligned}$$

Now we have the individual firm's maximized profit function, defined without explicit reference to price or market demand:

$$\pi_i = \begin{cases} \dfrac{\tau_i + 1}{m} \cdot [P^{max} - 2 \cdot \tau_i \cdot r - r], & s_2 \\ \dfrac{\tau_i + \tau_i' + 1}{m} \cdot [P^{max} - 2 \cdot (\tau_i + \tau_i') \cdot r - r] - \tau_i' \cdot q^{max}, & s_3 \end{cases}$$

Although a profit-maximizing firm in this market faces a different pricing decision than one in the market without output constraints, it still does not know for certain whether competitors share the technology it is using. Thus, it too must factor this uncertainty into its profit function.

Here, the m term is replaced by $\Theta(\tau_i) \cdot n(F)$, the firm's best estimate of the number of competitors in possession of its production technology:

$$\pi_i = \begin{cases} \dfrac{\tau_i + 1}{\Theta(\tau_i) \cdot n(F)} \cdot [P^{max} - 2 \cdot \tau_i \cdot r - r], & s_2 \\ \dfrac{\tau_i + \tau_i' + 1}{\Theta(\tau_i) \cdot n(F)} \cdot [P^{max} - 2 \cdot (\tau_i + \tau_i') \cdot r - r] - \tau_i' \cdot q^{max}, & s_3 \end{cases}$$

Figure 3 illustrates the profit function's behavior with respect to $\Theta(\tau_i)$ and $n(F)$.

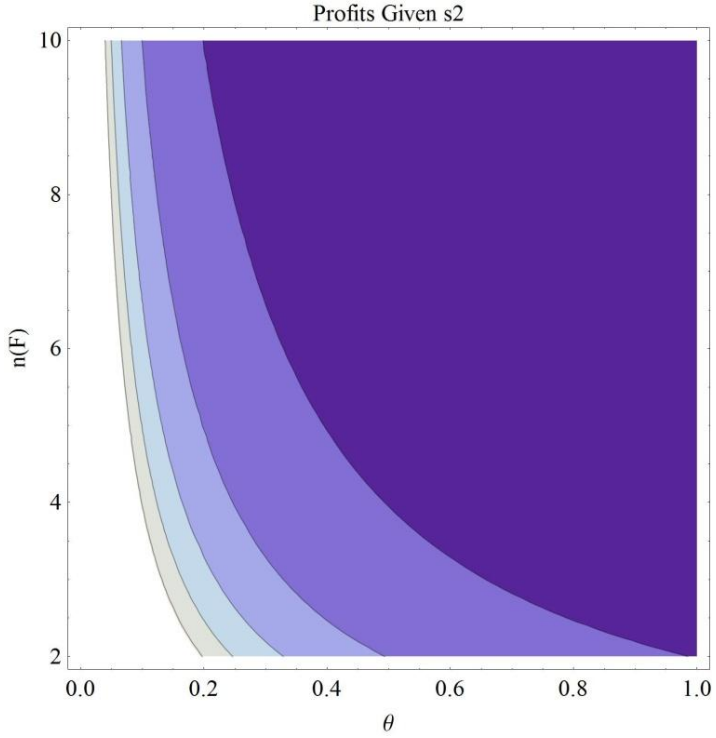

Figure 3: Profits where producers face non-rigid output constraints and condition s_2 is true. θ_1 is on the x-axis, $n(F)$ is on the y-axis. Darker areas indicate lower levels of profit. Note that profits decrease if more firms are operating in the market or if the firm's technology is more likely to be used by others.

ii. Restrictive DPPs, rising prices, and barriers to entry

Assume, now, that some entity ε enters the market to purchase an arbitrary number of the technologies in T at the behest of F_1, the firm currently using τ_1. Once a technology has been purchased, no firm in the market may use it. $\Theta(\cdot)$ is adjusted accordingly, so that the relative probabilities of occurrence for the remaining technologies remain constant.

Assume further that F_1 knows which technologies ε has purchased, that F_1 has an exclusive license to τ_1, and that F_1 is allowed to make the first move. F_1's profits are now certain, as $\Theta(\tau_1) = 1$:

$$\pi_1 = \begin{cases} (\tau_1 + 1) \cdot [P^{max} - 2 \cdot \tau_1 \cdot r - r], & s_2 \\ (\tau_1 + \tau_1' + 1) \cdot [P^{max} - 2 \cdot (\tau_1 + \tau_1') \cdot r - r] - \tau_1' \cdot q^{max}, & s_3 \end{cases}$$

As ε purchases additional technologies, fewer are available for use by F_1's competitors. This may exert upward pressure on market prices. To illustrate this outcome, let the average expected market price be:

$$\bar{P}_i = \frac{1}{n(F)} \cdot \left(p_i + \sum_{j=1}^{n(F)-1} E(p_j) \right)$$

$$E(p_j) = \sum_{k=2}^{n(\mathrm{T})} \Theta(\tau_k) \cdot p_j(\tau_k)$$

$$\Longrightarrow \bar{P}_i = \frac{1}{n(F)} \cdot \left(p_i + \sum_{j=1}^{n(F)-1} \sum_{k=2}^{n(\mathrm{T})} \Theta(\tau_k) \cdot p_j(\tau_k) \right)$$

As $\Theta(\tau_j) \to 1$, the result of a decreasing universe of available technologies, $E(p_j) \to p_j(\tau_j)$ and $\bar{P}_i \to \frac{p_i + n(F) \cdot p_j}{n(F)}$. Naturally, the higher the value for p_j, the higher the value for $\bar{P}_i$. Thus, if ε focuses its purchases on those technologies just slightly less efficient than τ_1, it will impose what amounts to a rising price floor below which F_1's competitors cannot operate.

In addition to raising market prices, ε's behavior will tend to impose barriers to entry that will weaken competitive pressures within the market. If licenses in the previously described technology market are sold, they add a per-unit cost to production. This additional cost can be factored into τ_i, such that $\tau_i = \gamma(\tau_i) + P(\tau_i)$, where $\gamma(\cdot)$ is a measure of a technology's efficiency and $P(\tau_i)$ is the per-unit royalty paid for the use of τ_i. Because the technologies produce the same homogenous final product, they are substitutes for each other; however, they are not perfect substitutes, as some are more expensive to use than others are.[145] As substitutes, each technology will have a positive cross price elasticity $CEP(\cdot)$ with all other technologies, such that $CEP(\tau_i, \tau_{i+j}) \geq CEP(\tau_i, \tau_{i+j+1})\ \forall \tau_j \in \mathrm{T}$ (firms will choose to license more efficient technologies before others). Note that this implies an inverse relationship between $\gamma(\tau_i)$ and $P(\tau_i)$.

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[145] *See* Mankiw, *supra* note 134, at 463–64.

As ε buys up technologies without licensing them out, $n(\mathrm{T})$, an indicator of the supply of technology, decreases. The laws of supply and demand dictate that, *ceteris paribus*, a decrease in supply of technology will tend to raise its price. Recall the individual firm's definite price function:[146]

$$p_i = \begin{cases} \frac{1}{r} \cdot [P^{max} - r \cdot (\tau_i + 1)], & s_2 \\ \frac{1}{r} \cdot [P^{max} - r \cdot (\tau_i + \tau_i' + 1)], & s_3 \end{cases}$$

There is a point at which the costs of production are so high that a firm would have to price above P^{max} to avoid operating at a loss. Because no consumers will buy goods if they are priced above P^{max}, a firm will be priced out of the market if:

$$\begin{cases} \tau_i > P^{max} \cdot \left(\frac{1}{r} - 1\right) - 1, & s_2 \\ \tau_i + \tau_i' > P^{max} \cdot \left(\frac{1}{r} - 1\right) - 1, & s_3 \end{cases}$$

Thus, if a firm cannot obtain a license at a cost below that level, it will not participate in the market. ε has restricted entry into F_1's market, reducing the competitive pressures it faces.

a. The Model's Conclusions and its Weaknesses

As is the case for most economic models, some of the assumptions underlying this model are unrealistic. Abandoning restrictions with respect to information and simultaneous behavior reduces the model's predictive power and theoretical rigor. The licensing and production behavior discussed are also less-than-perfect representations of realistic firm activity. Similarly, endogenous technological growth and development are ignored. Finally, the model treats all markets in the same way; research has shown that, under certain circumstances, barriers to entry are reduced as the number of patents active in a market decreases.[147]

Nevertheless, this note's model demonstrates that, given certain assumptions, oligopolistic competition with price uncertainty will lead to sub-monopolistic pricing as long as there are no licensing constraints. If output constraints are imposed and a firm begins to buy and hold the technologies necessary to compete in the market, average market prices will tend to increase, and it will become more expensive for other firms to enter the market.

These conclusions indicate that CAR strategies–which do not impose significant licensing constraints–are less likely to have a negative effect on consumer welfare and prospective market participants. Conversely, CAH strategies have the potential to raise prices and keep out would-be competitors. Thus, from a

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[146] The laws of supply and demand dictate that, *ceteris paribus*: holding supply constant, an increase in demand leads to a higher price and quantity at market equilibirum, and a decrease in demand leads to a lower equilibrium price and quantity; if demand is held constant, an increase in supply depresses prices and increases quantity, while a decrease in supply leads to higher prices and lower quantity. *Id.* at 77–82.

[147] *See, e.g.*, Iain M. Cockburn & Megan J. MacGarvie, *Entry and Patenting in the Software Industry* 22-23 (Nat'l Bureau of Econ. Research, Working Paper No. 12563, 2006).

theoretical perspective, CAH pools should be scrutinized closely to ensure that they are not vessels for anticompetitive behavior hiding behind the façade of otherwise legitimate, defensive activity.

III. Discussion

While firms joining patent pools may do so out of a genuine desire to reduce their exposure to costly patent litigation, their intentions do not necessarily mitigate the pools' market impact. The model developed in this paper demonstrates that aggressive purchases by defensive pools, particularly by those employing a CAH strategy, can impose barriers to market entry and may exert upward pressure on prices. They do so by reducing the supply of available technologies, which, in turn, raises the licensing costs for the patents that would-be competitors would need for market participation.

However, we need not limit our analysis to theoretical models. Defensive patent pools exist as profit-maximizing business entities.[148] Pool members and administrators alike have an incentive to be careful with how they spend the resources at their disposal. Buying a patent unrelated to any activity conducted by a member would be a waste, as a suit based on such a patent would not survive a motion to dismiss.[149] Therefore, if a pool has reviewed a patent and has not bought it, we can assume that the pool administrators or members do not consider the patent in question to be a real danger.

Conversely, the decision by a pool to purchase a patent leads to the logical conclusion that the pool is concerned that a lawsuit initiated by the patent's holder may have enough merit to make it beyond the pleading stage of litigation.[150] Because the pool's members need only be concerned about patents that could conceivably read on their products or processes, pools will not buy patents that are not sufficiently similar to the patents owned or used by the pool's members.

Under these circumstances, it is reasonable to presume that the purchased patent is a close substitute for a patent or patents already held by the pool. This outcome is diametrically opposed to the Agencies' policy, which clearly states that legal patent licensing pools generally should not contain substitute patents.[151] Thus, most purchases by defensive patent pools should be treated with suspicion: after all,

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[148] RPX and AST are just two examples of for-profit defensive patent pools.

[149] Plaintiffs must plead "enough fact[s] to raise a reasonable expectation that discovery will reveal evidence" of the conduct alleged in the complaint. *See* Bell Atlantic Corp. v. Twombly, 550 U.S. 544, 545 (2007).

[150] RPX in particular takes this strategy a step further: they work to identify and purchase patents of "high value, relevance and risk that could be used offensively against members of our client network. Depending on the situation, we may acquire assets from a third party or directly from an NPE. When necessary and possible, we will purchase patent rights directly out of an active litigation." RPX CORP., *Defensive Patent Aggregation Service*, http://www.rpxcorp.com/index.cfm?pageid=19 (last visited Mar. 3, 2011).

[151] *MPEG Letter*, *supra* note 97, at 10–11; *Philips DVD Letter*, *supra* note 98, at 10,13; *Hitachi DVD Letter*, *supra* note 98, at 14; *3G Letter*, *supra* note 98, at 10–12.

pools in possession of substitute patents have an "economic incentive to utilize [the pool] to eliminate competition" among pool members.[152]

By design, pools that employ a CAR strategy, allow outsiders to license pooled patents, or allow pool members to enter into independent licensing agreements with third parties have already put in place structural protections against the possible anticompetitive effects of their activities.[153] Recall that the anticompetitive effects of pooling behavior only become serious when the purchaser refuses to re-license the patents already purchased. By buying a patent, licensing it to pool members, and then releasing it, CAR pools fulfill their defensive function without damaging the markets in which they operate.

Conversely, CAH pools may be "achieving too much" when they buy and hold their patents. Because entities that buy and hold patents for the sole purpose of protecting pool members from litigation are by their very nature engaging in behavior that may have anticompetitive effects, they should be regarded with suspicion. If the legitimacy of a defensive patent pool is premised on the desire to avoid patent litigation costs, there is no justification for holding and refusing to license a patent after it has been licensed to pool members. Therefore, CAH conduct may in fact go beyond the "mere refusal [to license to outsiders]" still acceptable to antitrust regulators.[154]

Nevertheless, CAH pools should not be condemned to *per se illegality*. Although they may raise regulators' suspicions due to the high likelihood that purchased patents will be substitutes for patents held by members of the pool itself makes, a given pool's effect on the market depends heavily on its structure. This suggests that CAH pools should be should be subject to scrutiny under a rule of reason analysis.

IV. Conclusion

Large firms in IP-intensive industries are increasingly exposed to expensive, protracted patent litigation. They tend to be prime targets for plaintiffs seeking to earn money through strike lawsuits followed by quick settlements. One emerging strategy used to combat these suits is the defensive patent pool. Defensive patent pools insure against losses due to patent litigation by taking possible problem patents off the market before they can be used to sue pool members.

This note presented both legal and theoretical models with which the market impact of CAR and CAH defensive patent pools may be investigated. Both models suggest that the former type of patent pool tends not to have an anticompetitive impact on the markets in which it operates; conversely, the latter type of pool is more likely to inflate market prices and impose barriers to entry. Because there is no legitimate justification for "holding" rather than "releasing", regulators and courts considering the impact of CAH behavior should view such pools with

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[152] *Philips DVD Letter*, *supra* note 98, at 10.

[153] These are some of the indicia of validity identified by the DOJ in its business review letters as discussed above.

[154] *DOJ Report*, *supra* note 8, at 31.

suspicion. Nevertheless, they should not be banned. The competitive restraints imposed by CAH pools do not result from the type of conduct typically categorized as illegal *per se*, and their anticompetitive effects depend heavily on pool structure and membership. Thus, CAH pools should be subject to evaluation under the Rule of Reason.