

HAS THE ACADEMY LED PATENT LAW ASTRAY?

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ABSTRACT

Scholarly commentary widely asserts that technology markets suffer from a triplet of adverse effects arising from the strong patent regime associated with the establishment of the Court of Appeals for the Federal Circuit in 1982: “patent thickets” burdening innovation with transaction and litigation costs; “patent holdup” resulting in excessive payouts to opportunistic patent holders; and “royalty stacking” causing exorbitant patent licensing fees. Together these effects purportedly depress innovation and inflate prices for end-users. These repeated assertions are inconsistent with the continuing robust output, declining prices, and rapid innovation observed in the most patent-intensive technology markets during the more than three decades that have elapsed since 1982.

Recent empirical studies relating to each of these assertions have found little to no supporting evidence over a variety of markets and periods. Nonetheless courts, legislators, and antitrust agencies have taken, or have proposed taking, actions consistent with these assertions. Most importantly, policymaking entities have sought to mitigate thickets, holdup, and stacking effects by limiting injunctive relief for important segments of the patentee population. Substituting monetary relief for injunctive relief—what I call the “depropertization” of the patent system—yields three potential efficiency losses. First, depropertization impedes efficient resource allocation by shifting the pricing of technology assets from the relatively informed marketplace to relatively uninformed judges and regulators. Second, depropertization distorts markets’ organizational choices by inducing entities to undertake innovation and commercialization through vertically integrated structures, rather than contractual relationships now clouded by the prospect of judicial renegotiation. Third, depropertization may facilitate oligopsonistic efforts to depress royalties on patent-protected inputs, resulting in wealth transfers to downstream entities and discouraging innovation by upstream R&D suppliers. This possibility is consistent with lobbying behavior by downstream intermediate users in the smartphone market, who advocate limiting injunctive relief for significant categories of patent holders. These potential welfare losses, combined with the paucity of evidence for thicket, holdup, and

DOI: <https://doi.org/10.15779/Z388P5V91H>

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stacking effects, recommend against policy actions that have weakened the remedies available to patent holders in information technology markets.

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I. INTRODUCTION

Commentary by legal scholars and economists on the patent system has often focused on three alleged adverse effects of strong patent protection that purportedly restrain innovation. First, commentators claim that a strong patent system induces “patent thickets” that slow down innovation in a web of dispute-resolution and licensing costs.¹ Second, they assert that a strong patent system induces “patent holdup”—a variant of the standard economic holdup problem in which the holder of a patent on the component of a complex product can extract an “exorbitant” licensing fee from manufacturing and other entities that cannot design around the patent.² Third, they assert that a strong patent system induces “royalty stacking”—a variant of the standard double marginalization scenario in which uncoordinated pricing by the holders of patented complementary inputs results in an aggregate licensing burden that “excessively” inflates the price borne by end-users.³ As a policy matter, this triplet of assertions drives toward a single solution: namely, significant limitations on patent holders’ ability to seek injunctive relief and monetary damages against allegedly infringing users. Constraints on the value of a patent in litigation reduce the patent holder’s bargaining power in licensing and settlement negotiations, which limits the holder’s incentives to engage in the “opportunistic” behavior that lies behind thickets, holdup, and royalty stacking. So goes what has become a standard narrative.

To be sure, not all scholars and commentators have adopted this narrative and some have expressly criticized it.⁴ However, these alleged adverse effects of a strong patent system have been widely asserted in scholarly and policy discussions⁵ and are embedded within a broader set of concerns regularly voiced by legal scholars and some economists over “excessively” strong or numerous patents.⁶ These prevailing academic

1. *See infra* Section II.A.1.

2. *See infra* Section II.A.2.

3. *See infra* Section II.A.3.

4. For some existing critiques, see *infra* notes 13 and 237 and accompanying text.

5. For citation data as an indicator of the influence of these views among academics and policymakers, see *infra* notes 43–46, 112 and 141. For data on Supreme Court amicus briefs as an indicator of the prevalence of IP-skeptical views among academics, see Jonathan M. Barnett, *Three Quasi-Fallacies in the Conventional Understanding of Intellectual Property*, 12 J.L. ECON. & POL’Y 1, 3, 33–34 (2016) (noting that 74% of amicus briefs filed by academics in patent-related Supreme Court cases during 2008–2015 favor alleged infringer).

6. For some of the most influential publications, see generally MICHELE BOLDRIN & DAVID K. LEVINE, *AGAINST INTELLECTUAL MONOPOLY* (2008); JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT*

views are either implicitly or explicitly reflected in courts' rulings in patent-related cases, antitrust agencies' enforcement actions and policy pronouncements, legislative debates over enacted and proposed amendments to the patent statute, and practitioner commentary. Most notably, these assertions are reflected in a 2006 Supreme Court decision, *eBay Inc. v. MercExchange, L.L.C.*,⁷ and over a decade of case law interpreting that decision, which has significantly limited the circumstances in which a patent holder can secure injunctive relief.⁸ Erosion of the injunction remedy has been coupled with the adoption of royalty determination standards by some courts, antitrust agencies, and standard-setting organizations ("SSOs") that may undercompensate the holders of "standard essential patents" ("SEPs") in information and communications technology ("ICT") industries.⁹ As a result, patentees in those market segments now have little expectation of obtaining an injunction against future use and a reduced expectation of compensatory damages for past or future use. In the aggregate, these changes have effectively converted a significant portion of issued patents from a set of legal entitlements protected by property rules akin to land and other tangible property, in which prices are determined through market transactions, to entitlements protected by liability rules in which prices are determined subject to a judicially administered rate ceiling.¹⁰

Even a partial depropertization of the patent system is not something to be taken lightly. It is an elementary principle that market transactions in general price assets more accurately and rapidly than command-and-control regulators. Well-supported economic principles hold with little qualification that reasonably secure property rights, and the associated pricing mechanism, are an institutional precondition for achieving efficient resource allocation, translating into increased investment and growth.¹¹

INNOVATORS AT RISK (2008); ADAM B. JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT* (2004).

7. 547 U.S. 388 (2006) (rejecting the principle that a patent holder who defends validity and shows infringement is presumptively entitled to injunctive relief).

8. See *infra* Section II.B.1.

9. See *infra* Section II.B.3–4.

10. For the standard source on the distinction between property rules and liability rules, see Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules and Inalienability: Another View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

11. See generally HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL: WHY CAPITALISM TRIUMPHS IN THE WEST AND FAILS EVERYWHERE ELSE* 5–10 (2000) (arguing that secure property-rights institutions account for economic growth in the West relative to other regions); DOUGLASS C. NORTH & ROBERT PAUL THOMAS, *THE RISE OF THE*

Given this analytical presumption, any significant deviation from the market pricing principle in an area of commercially vital activity should rest on strongly persuasive grounds. Yet that is demonstrably not the case for the three assertions that have provided the putative grounds for the partial deproertization of the patent system. Based on available evidence, these assertions appear to be primarily theoretical propositions that, until shown otherwise, are inconsistent with observed market performance during the more than three decades that have elapsed since the establishment of the Federal Circuit.

The disconnect between theory and evidence is apparent on both a “macro” and “micro” level. On a macro level, in markets in which conditions are most fertile for thickets, holdup, and stacking to occur (most notably, ICT markets characterized by multicomponent products and dispersed patent holders), we can observe all the signs of vigorous economic health: constantly increasing output, constantly decreasing prices (adjusted for quality), constant entry, and constant flow of new innovation. On a micro level, recent empirical studies find little to no evidence for these claimed adverse effects in real-world technology markets.¹² What that literature *does* find is that market players tend to anticipate those *potential* adverse effects and take preemptive efforts to prevent or mitigate them. Those “micro” findings nicely fit the “macro” picture that innovation markets have thrived during an extended period of historically strong patent protection.

Unlike initial critiques of thicket, holdup, and stacking arguments—which principally identified important theoretical limitations to those arguments¹³—my critique is primarily empirical and relies on more recent

WESTERN WORLD: A NEW ECONOMIC HISTORY 1–8 (1973) (arguing that property rights promote economic growth by aligning private with social investment incentives, as illustrated by economic development in Western Europe during 900 A.D. to 1700 A.D.).

12. See *infra* Section III.

13. See Einer Elhauge, *Do Patent Holdup and Royalty Stacking Lead to Systematically Excessive Royalties?*, 4 J. COMPETITION L. & ECON. 535, 535 (2008) (“[P]redicted royalty rates are overstated because of incorrect assumptions about constant demand, one-shot bargaining, and informational symmetry.”); J. Gregory Sidak, *Holdup, Royalty Stacking, and the Presumption of Injunctive Relief for Patent Infringement: A Reply to Lemley and Shapiro*, 92 MINN. L. REV. 714, 732 (2008) (“Lemley and Shapiro employ the wrong framework for determining the optimal rule for injunctive relief. Moreover, even within their flawed framework, Lemley and Shapiro establish a downwardly biased benchmark for the reasonable royalty rate. . . . These assumptions skew the results of their model in favor of the infringing party.”); Damien Geradin & Miguel Rato, *Can Standard Setting Lead to Exploitative Abuse? A Dissonant View on Patent Hold-Up, Royalty Stacking and the Meaning of FRAND*, 3 EUR. COMPETITION J. 101, 122–29 (2007) (surveying and criticizing anticommons, patent thicket, patent holdup, and royalty

examinations of those arguments' descriptive force in contemporary and historical technology markets.¹⁴ Given that those studies find little evidence of thicket, holdup, and stacking effects, two scholarly tasks are in order. First, it is necessary to revisit the assumptions behind the theoretical models that have supported strong expectations of transactional blockage in patent-intensive markets. This exercise shows that these models rely on assumptions that do not track real-world standard-setting environments involving sophisticated players, repeat play, and significant standards turnover, which therefore explains why these models have such weak descriptive force. Second, it is necessary to revisit the policy actions taken (or proposed policy actions to be taken) on the basis of those theories. To do so, this Article presents a qualitative social cost-benefit analysis with respect to ongoing and proposed retractions of the injunction remedy by courts and antitrust agencies. This cost-benefit approach strongly favors reinstating the historical presumption in favor of injunctive relief for patent holders that can defend validity and show infringement.

The reasoning is straightforward. Given our current empirical understanding, the social costs associated with injunctive relief do not seem to be high: in general, markets tend to anticipate and work around patent-related transactional roadblocks in the innovation and commercialization process. However, the social costs associated with substituting liability

stacking literature); Vincenzo Denicolò, Damien Geradin, Anne Layne-Farrar & A. Jorge Padilla, *Revisiting Injunctive Relief: Interpreting eBay in High-Tech Industries with Non-Practicing Patent Holders*, 4 J. COMPETITION L & ECON. 571, 582–85 (2008) (arguing that Lemley and Shapiro's holdup model relies on several restrictive assumptions and may apply only in limited circumstances that do not justify broadly denying injunctions); John Golden, "Patent Trolls" and Patent Remedies, 85 TEX. L. REV. 2111, 2124–35 (2007) (arguing that Lemley and Shapiro's holdup model fails to address undercompensation risk, given uncertainty over judicial outcomes and damage awards, resource constraints and litigation costs, which may offset overcompensation risk due to holdup effects); David E. Adelman, *A Fallacy of the Commons in Biotech Patent Policy*, 20 BERKELEY TECH. L.J. 985, 986 (2005) ("This often implicit presumption is contradicted by the overabundance of research opportunities created by recent advances in genomics (and other biotech fields), which have transformed biomedical science into an unbounded resource. The uniquely open-ended nature of biomedical science requires a reassessment of how patenting affects biotech research and innovation.").

14. For earlier contributions that reviewed the then-existing empirical evidence on royalty stacking, see Damien Geradin, Anne Layne-Farrar & A. Jorge Padilla, *The Complements Problem Within Standard Setting: Assessing the Evidence on Royalty Stacking*, 48 B.C. L. REV. 149 (2007); Denicolò et al., *supra* note 13, at 596–600. This Article looks at evidence relating to a broader set of related theories and, given the passage of time, covers a broader pool of relevant evidence.

rules for property rules *are* likely to be high and cannot be easily corrected by the market.

There are three principal types of costs associated with moving from property rule to liability rule protections for technology assets. First, courts and regulators are inherently underinformed compared to market participants and therefore unlikely to price assets appropriately, while imposing significant incremental transaction costs to achieve that lackluster result. Second, a liability rule regime ignores the fact that patents do not only operate to recover returns on innovation but supply legal “envelopes” that shield informational assets against expropriation and thereby enable transactions with third parties that can most efficiently implement the commercialization functions that are necessary for an innovation to reach market.¹⁵ Withdrawing those legal envelopes may inefficiently drive innovation and commercialization activities within the confines of large firms that can reach market through integrated corporate structures. Third, a diluted patent regime, combined with latitude for standard-setting organizations to pre-specify royalty rates and preclude injunctive relief by contract, may facilitate oligopsonistic coordination by downstream users of R&D inputs. This concern is particularly salient given the fact that industry advocates of holdup and stacking theories tend to be manufacturers that are located at intermediate levels of the ICT supply chain, rather than upstream R&D specialist firms that have often been responsible for the most significant advances in digital communications technology. The result may be distorted pricing that fails to provide upstream R&D suppliers with sufficient rates of return, resulting in long-term dynamic efficiency losses that outweigh short-term static efficiency gains.

Organization is as follows. Part II describes the concepts of patent thickets, holdup, and royalty stacking, and shows how each concept has supported policy actions that have qualified property-rule protections in favor of liability-rule protections for significant portions of the patentee population. Part III assesses the theory and evidence behind each concept, showing that the evidence for each assertion is lacking, which in turn reflects limitations in the theory behind each assertion. Part IV presents a cost-benefit approach that supports reinstating the historical presumption in favor of injunctive relief for valid and infringed patents. Part V briefly concludes.

15. On the expropriation risks inherent to contracting over informational assets, see *infra* note 243 and accompanying text

II. THICKETS, HOLDUP, AND STACKING

This Part describes briefly the patent thicket, holdup, and stacking propositions that are widely asserted in the academic literature. It then shows how these propositions have had an impact on, or are consistent with, policy actions undertaken by courts and agencies.

A. THE CONCEPTUAL TRIPLET

Legal and economics scholars often attribute three principal welfare losses to strong forms of patent protection. Note that the following discussion is intended to provide an overview, rather than a comprehensive literature review.

1. *Patent Thickets*

The thicket thesis is straightforward. In the patent context, it contends that the issuance of large numbers of patents held by large numbers of owners is likely to depress innovation by burdening innovators with significant transaction costs relating to dispute resolution or licensing activities.¹⁶ The fragmentation of ownership interests increases the transaction costs of reaching agreement among IP-holders with respect to the use of any single bundle of technology assets. If those costs are sufficiently high, then a large part of the value generated by the innovation is dissipated, which, in the extreme case, causes the transaction to terminate because net expected value has fallen to zero or below.¹⁷ Transaction costs refer generally to the coordination costs required to reach agreement among

16. For commonly cited sources, see MICHAEL A. HELLER, *THE GRIDLOCK ECONOMY* 4–6, 49–53 (2008) (arguing that issuance of large numbers of patents to dispersed holders can generate transaction costs that impede innovation); Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, in 1 *INNOVATION POLICY AND THE ECONOMY* 120–21 (Adam B. Jaffe, Josh Lerner & Scott Stern eds. 2001) (noting concerns about a “patent thicket” that can impose “an unnecessary drag on” innovation); and Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 *SCIENCE* 698, 698 (1998) (arguing that the proliferation of patent rights in biomedical research may generate “blocking” effects that hinder innovation). Notably, in response to empirical studies concerning anticommons effects, Professor Eisenberg has qualified her initial position. See Rebecca S. Eisenberg, *Noncompliance, Nonenforcement, Nonproblem? Rethinking the Anticommons in Biomedical Research*, 45 *HOUS. L. REV.* 1059, 1098 (2008) (noting limited evidence for the anticommons thesis and modifying the thesis to address transaction costs associated with contractual negotiations relating to use of research materials).

17. Heller & Eisenberg, *supra* note 16, at 698 (“[A]voiding tragedy requires overcoming transaction costs, strategic behaviors, and cognitive biases of participants Once an anticommons emerges, collecting rights into usable private property is often brutal and slow.”) (citations omitted).

multiple parties, which could encompass the costs relating to holdout behavior by patent owners.¹⁸ Holdout behavior may arise because, assuming each component is a necessary element in the relevant product (and cannot be designed around at a reasonable cost), each patent owner has an incentive to withhold agreement so it can capture the largest portion of the value embodied in the product.¹⁹ If each patent owner adopts this individually rational waiting strategy, then collective irrationality ensues: the transaction cannot move forward and innovation gets stuck in the patent thicket.

2. *Royalty Stacking*

Royalty stacking is an application of the standard double marginalization problem in the economics of industrial organization.²⁰ Suppose there is a different monopoly supplier for each of the required inputs into a single product. Each supplier rationally sets a price for its input so as to maximize its individual profits. But this may mean that the total price charged to the end-user lies above the collective revenue-maximizing level and inefficiently restricts total output. Absent price coordination, the standard solution is vertical integration: all suppliers merge into a single firm, which can then set the profit-maximizing price for the package delivered to the end-user. In the patent context, commentators have asserted that the same scenario could arise whenever a product consists of multiple essential components, each of those components are patented, and the patents are held by multiple parties.²¹ In that case, each patent owner

18. Heller & Eisenberg, *supra* note 16, at 698; Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1478, 1482 (2005) (describing transaction costs as understood by the anticommons literature).

19. James M. Rice, *The Defensive Patent Playbook*, 30 BERKELEY TECH. L.J. 725, 732 (2015) (“When SSOs incorporate patented technology into a standard, the patent holder gains leverage and the power to holdout for inflated licensing rates because of the expense of switching to a different standard.”).

20. For the original source, see AUGUSTIN COURNOT, RESEARCHES INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH (Nathaniel Bacon trans., MacMillan Co. 1897) (1838). For a more modern discussion, see generally Carl Shapiro, *Theories of Oligopoly Behavior*, in 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 329 (Richard Schmalensee & Robert Willigs eds., 1989).

21. See Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 2013–16 (2007) (noting that double marginalization arises in the patent context when multiple component suppliers hold patents over essential inputs required by a downstream firm); Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (and One Not to)*, 48 B.C. L. REV. 149, 152 (2007) (providing hypothetical illustration of stacking problem where Intel must pay 1% royalty to each of 5,000 component suppliers, eliminating any possible profit).

demands an individually profit-maximizing royalty as the product travels down the supply chain, which inflates the total price borne by end-users, inefficiently restricts output and fails to maximize collective revenues for the patent owners as a group.²²

3. Patent Holdup

The concept of holdup was pioneered by Nobel Prize winner, Oliver Williamson.²³ The simplest holdup scenario consists of three elements: (i) *firm A* makes an investment in the context of a contractual relationship with *firm B*, who does not make any such investment; (ii) the investment is “specific” to the relationship—meaning, it has no or a lower value in any other use; and (iii) the contract is incomplete and *firm B* subsequently exploits that gap by unilaterally altering the terms of the relationship to its advantage. Given that contractual incompleteness precludes *firm A* from pursuing a legal remedy, *firm A* rationally forfeits to *firm B* almost all the value of its investment in the relationship in order to avoid a total loss. In the patent context, “holdup” has been used to describe a circumstance in which (i) a firm has invested in adopting or developing a technology, (ii) the firm is sued for infringement by the holder of a patent that covers (or purports to cover) a component of that technology, and (iii) it is costly to design around the patented component.²⁴ To preserve consistency with

22. Benjamin C. Li, *The Global Convergence of FRAND Licensing Practices: Towards “Interoperable” Legal Standards*, 31 BERKELEY TECH. L.J. 429, 432 (2016) (“A royalty rate that may have seemed reasonable on its own is not reasonable when a company developing a particular technology must pay several thousand separate royalties to account for all of the patents implicated by its technology. Stacking all of these royalties on top of each other can make a product too expensive to bring to market.”); Zelin Yang, *Damaging Royalties: An Overview of Reasonable Royalty Damages*, 29 BERKELEY TECH. L.J. 647, 652 (2014) (“The cumulative effect of potentially overcompensating thousands of patentees represents a crushing cost for producers and stifles innovation.”); Joseph Farrell, John Hayes, Carl Shapiro & Theresa Sullivan, *Standard Setting, Patents and Hold-Up*, 74 ANTITRUST L.J. 603, 608 (2007) (“[S]tandards hold-up is . . . a public policy concern because downstream consumers are harmed when excessive royalties are passed on to them.”).

23. See OLIVER E. WILLIAMSON, *THE ECONOMIC INSTITUTIONS OF CAPITALISM* 46–52, 64–67 (1985).

24. See Lemley & Shapiro, *supra* note 21, at 1993 (describing holdup as a situation “in which the defendant has already invested heavily to design, manufacture, market, and sell the product with the allegedly infringing feature”); Daniel G. Swanson & William J. Baumol, *Reasonable and Nondiscriminatory (RAND) Royalties, Standards Selection, and Control of Market Power*, 73 ANTITRUST L.J. 1, 19–21 (2005) (describing circumstance in which a licensor holds a patent to a critical element of a technology standard and then “holds up” licensees who are locked in after having made relationship-specific investments in the standard).

Williamson's original definition of holdup, patent holdup also requires that the investing firm did not anticipate or could not reasonably have anticipated the patent at the time it made the investment.²⁵ This last assumption is sometimes dropped in looser uses of the term "holdup" that have become current in some patent commentary, as reflected in statements by practitioners,²⁶ antitrust agencies,²⁷ courts,²⁸ and some scholars.²⁹

B. IDEAS MATTER: POLICY ACTIONS BASED ON THE CONCEPTUAL TRIPLET

Academic theories concerning the adverse effects of a strong patent system would be of little practical interest were it not for the fact that policymaking entities have taken actions under patent or antitrust law, or issued influential statements, that explicitly or implicitly rely on, or are consistent with, those theories. Starting in the late 1990s, notions of thickets, holdup, and stacking began to appear in academic publications³⁰ and, starting in the early 2000s, those notions then began to appear in statements and reports issued by the federal antitrust agencies,³¹ and

25. See, e.g., Gerald F. Masoudi, *Antitrust Enforcement and Standard Setting: The VITA and IEEE Letters and the "IP2" Report*, U.S. DEP'T JUST. (May 10, 2007), www.justice.gov/atr/speech/antitrust-enforcement-and-standard-setting-vita-and-ieee-letters-and-ip2-report. These remarks were delivered by the author when he served as Deputy Assistant Attorney General in the Department of Justice, Antitrust Division.

26. See, e.g., Suzanne Michel, *Bargaining for RAND Royalties in the Shadow of Patent Remedies Law*, 77 ANTITRUST L.J. 889, 892 n.9 (2011).

27. See *infra* Section II.B.2, 3, 5.

28. See *infra* Section II.B.1, 4.

29. Reflecting this looser understanding, Professors Contreras and Gilbert propose that a "RAND" (reasonable and nondiscriminatory royalty) commitment should be imposed in all patent litigations involving "holdup," which is defined to include any circumstance in which the infringing party must incur switching costs to move to a non-infringing alternative. See Jorge L. Contreras & Richard J. Gilbert, *A Unified Framework for RAND and Other Reasonable Royalties*, 30 BERKELEY TECH. L.J. 1451, 1456–60 (2015). To illustrate this proposition, the authors describe a hypothetical in which the infringing party is aware that the dominant technology is covered by a patent. *Id.* at 1492–93. As I discuss subsequently, *infra* notes 229, 230 and 235 and accompanying text, this line of argument invites potential licensees to infringe and wait to be sued, shifting the pricing of IP assets from the market to the courts.

30. For early publications on patent thickets, see Heller & Eisenberg, *supra* note 16, and Shapiro, *supra* note 16, at 121, 124–26; on patent holdup, see Shapiro, *supra* note 16, at 121, 124–26; on royalty stacking, see Shapiro, *supra* note 16, at 122 and T. Randolph Beard & David L. Kaserman, *Patent Thickets, Cross-Licensing and Antitrust*, 47 ANTITRUST BULL. 345, 356 (2002). For other academic publications on these concepts, see *supra* Sections II.A.1–3.

31. For an indicative statement, see Timothy J. Muris, Chairman, Fed. Trade Comm'n, *Competition and Intellectual Property Policy: The Way Ahead* (Nov. 15, 2001), <https://www.ftc.gov/public-statements/2001/11/competition-and-intellectual-property->

subsequently, proliferated in court opinions in antitrust and patent infringement actions.³² I identified use of the terms “patent thicket,” “patent holdup,” or “royalty stacking” (and close variants) in sixty-eight federal court decisions, twenty decisions issued in International Trade Commission (“ITC”) proceedings,³³ and fourteen decisions issued in FTC proceedings.³⁴ Two examples can illustrate the practical impact these theories can have on the strength of patent rights in the marketplace. In a 2011 decision that cast doubt on the validity of patents relating to isolated genetic material, the Southern District of New York specifically referenced scholarly views that biomedical markets suffer from patent thickets.³⁵ In a 2015 decision (discussed in further detail subsequently³⁶), the Court of Appeals for the Federal Circuit—the nation’s appeals court for patent litigation—specifically cited scholarly arguments concerning holdup risk in upholding an award of attorney’s fees *against* a SEP holder that sought injunctive relief against an infringer.³⁷

The FTC and the Department of Justice (“DOJ”), which periodically undertake patent-related antitrust enforcement actions, often have referred to thicket, holdup, and stacking theories in policy statements and sometimes cite scholarly publications that support those theories.³⁸ The Table below

policy-way-ahead (citing scholarly assertions of a “patent thicket”). For agency reports that mention these concepts, see *infra* Table I.

32. For court opinions mentioning patent thickets, see *infra* notes 56, 113 and 142; for opinions mentioning holdup and stacking, see *infra* note 87.

33. The ITC is an administrative tribunal whose jurisdiction includes, among other things, actions brought by patent holders to seek “exclusion orders” blocking importation into the U.S. of allegedly infringing products. See 19 U.S.C. § 1337 (2012); Daniel E. Valencia, *Appeals from the International Trade Commission: What Standing Requirement?*, 27 BERKELEY TECH. L.J. 1171, 1176 (2012) (“A typical exclusion order, limited or general, might direct CBP to exclude from entry articles ‘that infringe’ or ‘are covered by’ one or more specified claims of a specified patent.”).

34. Federal court, ITC, and FTC decisions were identified through searches on January 9–14, 2018 in the LexisNexis, Westlaw, and Cheetah Antitrust and Competition Law databases. Search terms used: “patent thicket,” “patent thickets,” “patent holdup,” “patent hold-up,” “patent holdup,” or “royalty stacking.”

35. *Ass’n for Molecular Pathology v. U.S. Patent & Trademark Office*, 702 F. Supp. 2d 181, 208–09 (S.D.N.Y. 2010) (stating that the “proliferation of intellectual property rights directed to genetic material has . . . been postulated to contribute to ‘the tragedy of the anti-commons’” and citing to scholarly articles in support of this view), *aff’d in part, rev’d in part*, 653 F.3d 1329 (Fed. Cir. 2011), *cert. granted, judgment vacated sub nom.* *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 566 U.S. 902 (2012).

36. See *infra* notes 93–95 and accompanying text.

37. *Microsoft Corp. v. Motorola, Inc.*, 795 F.3d 1024, 1051–52 (9th Cir. 2015).

38. See, e.g., FED. TRADE COMM’N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 56–57 (2011), www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-

shows the number of times the terms, “thicket,” “hold-up,” and “stacking” (and close variants), have been substantively mentioned³⁹ in major reports issued since 2003 by the FTC, DOJ and the U.S. Patent & Trademark Office (“USPTO”) on antitrust and intellectual property matters, as well as the 2007 report issued by the Antitrust Modernization Committee (“AMC”), an entity formed by congressional action in 2002.⁴⁰ In a notable recent deviation from these trends, the newly-appointed head of the Antitrust Division, Assistant Attorney General Makan Delrahim, called on November 10, 2017 for a reevaluation of antitrust policies toward SEPs in view of what he called a “one-sided focus on the hold-up issue.”⁴¹

remedies-competition-report-federal-trade/110307patentreport.pdf (noting that “IT products are often surrounded by ‘patent thickets’” that can generate liability risk and transaction costs that deter innovation and citing scholarly articles in support of this view).

39. For this purpose, I excluded references to those terms if the reference solely consisted of the title of another publication or a cross-reference to another use of the term in the same report.

40. Antitrust Modernization Commission Act of 2002, Pub. L. No. 107-273, 116 Stat. 1856.

41. Makan Delrahim, Assistant Att’y Gen., U.S. Dep’t. of Justice, Assistant Attorney General Makan Delrahim Delivers Remarks at the USC Gould School of Law’s Center for Transnational Law and Business Conference (Nov. 10, 2017), www.justice.gov/opa/speech/assistant-attorney-general-makan-delrahim-delivers-remarks-usc-gould-school-laws-center.

Table 1: Major Government Reports on Antitrust & Intellectual Property (2003–2013)

| Year Issued | Agency | References to “Thicket” or “Thickets” | References to “Holdup” or “Hold Up” or “Hold-Up” | References to “Stacking” |
|--------------------|----------|---------------------------------------|--|--------------------------|
| 2003 ⁴² | FTC | 93 | 35 | 22 |
| 2007 ⁴³ | FTC, DOJ | 13 | 9 | 18 |
| 2007 ⁴⁴ | AMC | 0 | 5 | 0 |
| 2011 ⁴⁵ | FTC | 5 | 115 | 0 |
| 2013 ⁴⁶ | DOJ, PTO | 0 | 5 | 0 |

In the discussion that follows, *this Section* describes in more detail how the conceptual triplet of thicket, holdup and stacking theories have had a material effect on, or are consistent with, actions taken by courts, agencies and other policymaking entities that have contributed to the depropertization of the patent system.

1. *The Seminal Case: eBay Inc. v. MercExchange, L.L.C. (2006)*

The most dramatic intersection between academic discussions and changes in the law may be the Supreme Court’s 2006 decision in *eBay Inc. v. MercExchange, L.L.C.*⁴⁷ The Court’s decision and, in particular, the

42. FED. TRADE COMM’N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY (2003), www.ftc.gov/sites/default/files/documents/reports/promote-innovation-proper-balance-competition-and-patent-law-and-policy/innovationrpt.pdf. For references to “thickets,” see *id.* Exec. Summary at 6, 7, 15; for references to “hold-up,” see *id.* ch. 3 at 30, 37, 38; for references to “stacking,” see *id.* ch. 1 at 33; ch. 2 at 3; and ch. 4 at 5.

43. FED. TRADE COMM’N & U.S. DEP’T OF JUSTICE, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION (2007), <https://www.justice.gov/sites/default/files/atr/legacy/2007/07/11/222655.pdf>. For references to “thickets,” see *id.* at 8, 42, 57; for references to “hold-up,” see *id.* at 8, 35 n.11, 42; for references to “stacking,” see *id.* at 8, 57, 95.

44. DEBORAH A. GARZA ET AL., ANTITRUST MODERNIZATION COMM’N, REPORT AND RECOMMENDATIONS (2007), https://govinfo.library.unt.edu/amc/report_recommendation/amc_final_report.pdf. For references to “hold-up,” see *id.* at 407–08.

45. FED. TRADE COMM’N, *supra* note 38. For references to “thickets,” see *id.* at 56, 147, 147 n.35; for references to “hold-up,” see *id.* at 5, 10, 15.

46. U.S. DEP’T OF JUSTICE & U.S. PATENT & TRADEMARK OFFICE, POLICY STATEMENT ON REMEDIES FOR STANDARDS-ESSENTIAL PATENTS SUBJECT TO VOLUNTARY F/RAND COMMITMENTS (2013), <https://www.justice.gov/sites/default/files/atr/legacy/2014/09/18/290994.pdf> [hereinafter JOINT POLICY STATEMENT] For references to “hold-up,” see *id.* at 4, 6 n.13.

47. 547 U.S. 388 (2006).

concurrency authored by Justice Kennedy,⁴⁸ reflects holdup concerns that had been expressed in the academic literature⁴⁹ and the FTC's 2003 report (see Table 1). Additionally, amicus briefs filed in the *eBay* case with the Court (including a brief in support of the defendant filed by fifty-two intellectual property professors⁵⁰) referred to "patent holdup" and "patent thickets" and called for imposing limits on injunctive relief.⁵¹ The litigation involved a small patent-holding entity that had brought an infringement suit against eBay, the leading e-commerce site. Prior to *eBay*, the Federal Circuit had held that as a "general rule," patentees were entitled to a permanent injunction after defending the presumption of validity and showing infringement.⁵² The Court rejected any such presumption and ruled that courts had discretion to award (or not award) injunctive relief based on a four-factor "equitable" test.⁵³ However, the majority opinion emphasized that judicial determinations under the *eBay* standard should not take into account the type of patent holding entity⁵⁴ and three concurring justices added that the historical presumption should stand in most cases.⁵⁵ By contrast, the concurrence by Justice Kennedy and three other Justices made specific reference to the holdup problem, observing that "[a]n industry has developed in which firms use patents not as a basis for producing and selling goods but, instead, primarily for obtaining licensing fees."⁵⁶

In post-*eBay* patent litigation, the Kennedy concurrence has prevailed. The most comprehensive empirical study (through 2015) shows that courts have interpreted *eBay* so as to effectively create a two-tier patent system in which (i) entities that "practice" a patent are typically entitled to injunctive

48. *Id.* at 396–97 (Kennedy, J., concurring).

49. *See* Shapiro, *supra* note 16, at 124–26; Baumol & Swanson, *supra* note 24, at 19–21.

50. Brief Amici Curiae of 52 Intellectual Property Professors in Support of Petitioners, *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (No. 05–130), 2006 WL 1785363.

51. *See, e.g., id.* at 6–8; Brief of Time Warner Inc. et al. in Support of Petitioners at 8–12, *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (No. 05–130), 2006 WL 235010; Brief of Business Software Alliance et al. in Support of Petitioners at 5–12, *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (No. 05–130), 2006 WL 207730; Brief for Amicus Curiae Computer & Communications Industry Association in Support of Petitioners at 2–3, 7–8, *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (No. 05–130), 2006 WL 235011.

52. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1247 (Fed. Cir. 1989).

53. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391–92 (2006).

54. *See id.* at 393.

55. *See id.* at 395 (2006) (Roberts, J., concurring).

56. *See id.* at 396 (2006) (Kennedy, J., concurring) (citing FED. TRADE COMM'N, *supra* note 42).

relief; while (ii) non-practicing entities are typically only entitled to a continuing royalty for future infringement.⁵⁷ This de facto application of *eBay* stands in tension with long-standing precedent rejecting a working requirement for patent holders.⁵⁸

Even more dramatically, some lower court judges have expressed views suggesting that the logic of *eBay* should be extended to embrace even cases of “classic” infringement involving a practicing patentee and a direct competitor. In the headline patent litigation between Apple (the patentee–plaintiff) and Samsung, the two leading competitors in the smartphone market, the district court judge denied injunctive relief to Apple, even after a showing of validity and infringement, on the ground that irreparable harm (one of the *eBay* factors to be considered in determining whether injunctive relief should be granted) was not shown, principally because the patent holder had not sufficiently demonstrated a “causal nexus” between Samsung’s infringement of certain patented features of Apple’s iPhone product and Apple’s alleged harm.⁵⁹ While the Federal Circuit overturned the district court’s denial of injunctive relief,⁶⁰ it did so in a split decision, with the Chief Judge arguing in favor of upholding the district court decision.⁶¹ Hence, it is now reasonable to contemplate that a court would deny injunctive relief even to a practicing patent holder that has proved infringement of a valid patent by a direct competitor.⁶² There is no clearer illustration of the depropertization phenomenon.

57. See Christopher B. Seaman, *Permanent Injunctions in Patent Litigation After eBay: An Empirical Study*, 101 IOWA L. REV. 1949 (2016). In the most striking result, Seaman finds that the average grant rate for petitions for permanent injunctive relief after *eBay* was 72.5% overall but only 16% for non-practicing patent holders. *Id.* at 1983, 1988. This compares with a 95% grant rate in the period prior to *eBay*. *Id.* at 1969.

58. *Cont’l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 422–30 (1908) (rejecting argument that use of a patent is a condition for enforcement against infringers); Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1075 & n.45 (2008) (noting well-settled rejection of a “working requirement” in patent law).

59. *Apple, Inc. v. Samsung Elecs. Co.*, No. 12-CV-00630-LHK, 2014 WL 7496140, at *6–16, *23 (N.D. Cal. Aug. 27, 2014).

60. *Apple Inc. v. Samsung Elecs. Co.*, 809 F.3d 633 (Fed. Cir. 2015).

61. *Id.* at 656–63 (Prost, C.J., dissenting).

62. To be clear, it is still the case that, in general, a patentee engaged in litigation with a direct competitor does retain a high expectation of permanent injunctive relief in the event it can defend validity and prove infringement. See Seaman, *supra* note 57, at 1990 (showing that direct competitors are issued injunctions in patent infringement cases 84% of the time, as compared to 21% of the time in cases involving non-direct competitors). The discussion above is merely intended to show that, in a headline patent litigation involving direct competitors in a multicomponent context, permanent injunctive relief was initially denied.

2. “Patent Ambush” Enforcement Actions (1995, 2002, 2008)

In several widely-followed enforcement actions, the FTC has taken actions against firms that allegedly failed to disclose “standard essential patents” (“SEPs”) relating to technology being incorporated into a new standard through an industry SSO. There have been three principal actions in ICT markets, involving: (i) Dell, the prominent original equipment manufacturer (“OEM”) in the personal computer (“PC”) industry, which was filed in 1995 and settled in 1996 through a consent decree prohibiting Dell from enforcing its patent claims;⁶³ (ii) Rambus, a semiconductor design firm in the memory chip market, which was filed in 2002 and finally adjudicated in 2008 (in Rambus’ favor);⁶⁴ and (iii) Negotiated Data Solutions (known as “N-Data”), an entity formed to acquire certain patents relating to network data transmission, which was filed and settled by a consent decree in 2008 prohibiting N-Data from enforcing its patents unless it offered a license based on the commitment made by the original owner to the SSO.⁶⁵ These cases are generally cited as “holdup” scenarios in which the patentee strategically fails to disclose its patent position, which then enables it to pursue opportunistic litigation against “locked-in” firms that have made investments in adopting the standard.

The most widely-discussed “patent ambush” litigation is the FTC’s action against Rambus, which has become almost a poster child for patent holdup in IP policy discussions.⁶⁶ The FTC alleged that Rambus deceptively failed to disclose to the SSO its intention to file or amend patent applications on its memory chip design, thereby enabling Rambus to evade the SSO’s

63. Dell Comput. Corp., 121 F.T.C. 616 (1996) (consent order).

64. Rambus Inc. v. FTC, 522 F.3d 456 (D.C. Cir. 2008).

65. Decision and Order, *In re* Negotiated Data Solutions LLC, FTC File No. 051-0094, Docket No. C-4234 (Jan. 23, 2008). Note that I omit from this discussion litigations brought by private parties that involve “patent ambush” theories in the SSO context.

66. *See, e.g.*, Mark A. Lemley & Carl Shapiro, *A Simple Approach to Setting Reasonable Royalties for Standards-Essential Patents*, 28 BERKELEY TECH. L.J. 1135, 1137 n.3 (2013) (claiming that “disclosure-only policies have fallen into disfavor” with SSOs “in part because of abuse of those policies by companies like Rambus”); Jorge L. Contreras, *From Private Ordering to Public Law: The Legal Frameworks Governing Standards-Essential Patents*, 30 HARV. J.L. & TECH. 211, 217 & n.35 (2017).

“reasonable and nondiscriminatory” (“RAND”)⁶⁷ royalty standard and to demand “exorbitant” royalties after the standard had been set.⁶⁸

Several important facts are typically omitted that complicate, if not undermine, this simple “good guy, bad guy” account of the Rambus litigation. First, this is a case the government *lost*—twice. In the FTC proceedings, the administrative law judge ruled *against* the Commission⁶⁹ as did the D.C. Circuit in the subsequent appellate proceedings.⁷⁰ Second, in a concurrent civil litigation brought by a large chip manufacturer, Rambus successfully argued that it had withdrawn from the formal standard-setting process prior to the onset of any disclosure obligation.⁷¹ Third, in a concurrent antitrust prosecution by the government, the four largest memory chip manufacturers that had been allegedly “victimized” by Rambus paid criminal fines totaling hundreds of millions of dollars, for participation in a price-fixing conspiracy in the worldwide “DRAM” (memory chip) market during 1999–2002.⁷² In 2010, European Union antitrust authorities reached similar findings, including an attempt by these and other chip manufacturers to “coordinate and monitor prices” for “Rambus DRAMs.”⁷³ Taking these omitted facts into account, the Rambus

67. Some commentators and practitioners use the term “FRAND” (fair, reasonable, and nondiscriminatory) in lieu of RAND. As is generally understood in the academic literature, I treat the two terms as substantively equivalent. See Thomas H. Chia, *Fighting the Smartphone War with RAND-Encumbered Patents*, 27 BERKELEY TECH. L.J. 209, 209 n.3 (2012).

68. Complaint, *In re Rambus Inc.*, FTC File No. 011-0017, Docket No. 9302, at 13 ¶ 46 (June 18, 2002).

69. Initial Decision, *In re Rambus Inc.*, FTC File No. 011-0017, Docket No. 9302, at 334 (Feb. 24, 2004).

70. *Rambus, Inc. v. Federal Trade Commission*, 522 F.3d 456 (D.C. Cir. 2008).

71. *Rambus, Inc. v. Infineon Technologies*, 318 F.3d 1081, 1105 (Fed. Cir. 2003).

72. Press Release, U.S. Dep’t of Justice, Samsung Agrees to Plead Guilty and to Pay \$300 Million Criminal Fine for Role in Price Fixing Conspiracy (Oct. 13, 2005), www.justice.gov/archive/atr/public/press_releases/2005/212002.htm; Laurie J. Flynn, *Samsung to Pay Large Fine in Price-Fixing Conspiracy*, N.Y. TIMES (Oct. 14, 2005), <http://www.nytimes.com/2005/10/14/technology/samsung-to-pay-large-fine-in-pricefixing-conspiracy.html> (noting fines paid by Samsung, Hynix, and Infineon in price-fixing prosecution). In civil antitrust litigation based on the same facts, Rambus settled with Infineon and Samsung but lost at trial to Hynix and Micron. See Ryan Smith, *Rambus Loses Major Antitrust Case Against Hynix & Micron*, ANANDTECH (Nov. 16, 2011, 11:38 PM), www.anandtech.com/show/5122/rambus-loses-major-antitrust-case-again-hynix-micron. In 2013, Rambus settled separately all patent and antitrust claims with Hynix and Micron through a patent cross-licensing agreement. See John Ribeiro, *Rambus, Micron Settle Patent, Antitrust Disputes*, PCWORLD (Dec. 9, 2013, 9:15 PM), www.peworld.com/article/2071400/rambus-micron-settle-patent-antitrust-disputes.html.

73. Commission Decision COMP/38511 of May 19, 2010 (EC), http://ec.europa.eu/competition/antitrust/cases/dec_docs/38511/38511_1813_5.pdf.

case is not an especially compelling illustration of patent holdup. In fact, without further detailed inquiry, the evidence set forth in the Rambus litigation saga appears to support just as strongly the possibility that it was the small patentee who was “held up” by large downstream manufacturers—a possibility to which I will return subsequently.⁷⁴

3. *Business Review Letters (2006, 2007, 2015); IEEE Royalty Rate Policy Shift (2015)*

Private parties often have the ability, through unilateral or coordinated action, to influence the effective application of the patent system through lobbying efforts and contractual arrangements.⁷⁵ Through a modification-by-contract strategy, holders of large patent portfolios, as well as significant intermediate users of the technologies covered by those portfolios, can use the standard-setting process to influence the terms on which those technologies are made available to the downstream “implementers” market. In the most conventional form, SSOs typically require that all firms whose technology is included in the standard commit to disclose all patents “essential” to that technology and to license those patents to all interested parties on RAND terms.⁷⁶ Since the precise meaning of RAND is unclear (as evidenced by litigation over these points⁷⁷), even patentees whose technology has been included in a standard retain significant pricing freedom in licensing transactions.

To address this uncertainty, some SSOs have sought guidance from the antitrust agencies as to whether the SSO may require (or, in another variation, may invite) patent holders to commit publicly to what the patent holder identifies as the “most restrictive” royalty and non-royalty licensing terms it would demand. Through the business review letter procedure (a type of non-binding “pre-clearance” mechanism⁷⁸), the DOJ issued letters in 2006, 2007 and 2015 that signaled tolerance for this practice, subject to certain limitations.⁷⁹ In 2015, the Institute for Electrical and Electronics

74. See *infra* Section IV.B.3.

75. See Jonathan M. Barnett, *Property as Process: How Innovation Markets Select Innovation Regimes*, 119 YALE L.J. 384, 388–89 (2009).

76. See, e.g., IEEE, IEEE-SA STANDARDS BOARD OPERATIONS MANUAL 38–39 (2017), http://standards.ieee.org/develop/policies/opman/sb_om.pdf.

77. See *infra* Section II.4.

78. 28 C.F.R. § 50.6 (2017).

79. See Letter from Thomas O. Barnett, Assistant Att’y Gen., U.S. Dep’t of Justice, to Robert A. Skitol, Drinker, Biddle & Reath, LLP (Oct. 30, 2006), www.justice.gov/sites/default/files/atr/legacy/2006/10/31/219380.pdf (responding to request from VITA with respect to standard setting process); Letter from Thomas O. Barnett, Assistant Att’y Gen., U.S. Dep’t of Justice, to Michael A. Lindsay, Dorsey & Whitney LLP (Apr. 30, 2007),

Engineers (the “IEEE”), a major SSO, relied on a business review letter to make rule changes that provide the basis for regulating the royalties assessed by the holders of patents relating to technology included in the 802.11 Wi-Fi standard.⁸⁰

The SSOs argued, and the DOJ accepted, that this type of collective rate-setting may address holdup concerns that arise following market adoption of the relevant standard. However, this same practice may have oligopsonistic effects that discourage investment by R&D-specialist firms in the upstream technology input segment.⁸¹ This may be in part why the Standards Development Organizations Advancement Act of 2004, which otherwise limits antitrust liability for certain cooperative standard development efforts, explicitly does not cover any agreement to “set or restrain prices of any good or service.”⁸² In particular, collective pre-specification of royalty rates raises concerns (as the DOJ has acknowledged⁸³) that large intermediate users of technology inputs could strategically employ the SSO infrastructure to collectively depress the price paid to upstream producers of R&D inputs. The same concern arises with respect to leading patent pools in the ICT market, which are dominated by vertically integrated companies that do not appear to be salient innovation sources in the technology supply chain, as indicated by comparatively low R&D intensities.⁸⁴ As I discuss subsequently, additional factors suggest that these oligopsony risks are most salient in the smartphone market with

<https://www.justice.gov/sites/default/files/atr/legacy/2007/04/30/222978.pdf> (responding to request from Institute of Electrical and Electronics Engineers, Inc. with respect to standard setting process); Letter from Renata B. Hesse, Acting Assistant Att’y Gen., U.S. Dep’t of Justice, to Michael A. Lindsay, Dorsey & Whitney LLP (Feb. 2, 2015), <https://www.justice.gov/file/338591/download> (responding to request from Institute of Electrical and Electronics Engineers, Inc. with respect to certain amendments to the standard setting process).

80. Press Release, IEEE, IEEE Statement Regarding Updating of Its Standards-Related Patent Policy (Feb. 8, 2015), http://www.ieee.org/about/news/2015/8_february_2015.html.

81. On this point, see J. Gregory Sidak, *The Antitrust Division’s Devaluation of Standard-Essential Patents*, 104 GEO. L.J. ONLINE 48, 68 (2015).

82. Pub. L. No. 108-237, 118 Stat. 661 (codified at 15 U.S.C. §§ 4301 et seq.).

83. See Hesse, *supra* note 79, at 7 (recognizing concerns that change to SSO policy, which permits pre-specification of royalty rates by SSO members, could facilitate economic interests of “parties desiring lower royalty rates”); Letter from Charles A. James, Assistant Att’y Gen., U.S. Dep’t of Justice, to Ky P. Ewing, Vinson & Elkins L.L.P. 12 (Nov. 12, 2002), www.justice.gov/sites/default/files/atr/legacy/2006/04/27/200455.pdf.

84. See Jonathan M. Barnett, *From Patent Thickets to Patent Networks: The Legal Infrastructure of the Digital Economy*, 55 JURIMETRICS 1, 28–29, 34–35 (2014).

respect to which patent holdup and stacking concerns are most commonly expressed.⁸⁵

4. *Judicial Erosion of Injunctions: RAND Litigations (2013–2017)*

In several recent litigations, federal courts have addressed two key questions concerning the remedies available to the holders of SEPs subject to a RAND commitment: first, how RAND royalties should be calculated in damages determinations; and second, whether SEP holders that are subject to a RAND commitment may seek injunctive relief against infringers.⁸⁶ Referencing holdup and stacking concerns,⁸⁷ courts in these litigations have taken notable steps toward “depropertizing” the patent grant by both royalty–valuation methodologies that discount market licensing practices and in general induce a downward bias in damages determinations for RAND–encumbered patents.⁸⁸ To focus the discussion, this subsection will focus on the former development.

85. *See infra* Section IV.B.3.c.

86. TCL Commc’n Tech. Holdings, Ltd. v. Telefonaktiebolaget LM Ericsson, No. CV 15-2370 JVS(DFMX), 2017 WL 6611635 (C.D. Cal. Dec. 21, 2017); Apple Inc. v. Motorola, Inc., 757 F.3d 1286 (Fed. Cir. 2014), *overruled on other grounds by* Williamson v. Citrix Online, LLC, 792 F.3d 1339 (Fed. Cir. 2015); Ericsson, Inc. v. D-Link Sys., Inc., 773 F.3d 1201 (Fed. Cir. 2014); Realtek Semiconductor Corp. v. LSI Corp., 946 F. Supp. 2d 998 (N.D. Cal. 2013); *In re Innovatio IP Ventures, LLC Patent Litig.*, No. 11 C9308, 2013 WL 5593609 (N.D. Ill. Oct. 3, 2013); Microsoft Corp. v. Motorola, Inc., 795 F.3d 1024 (9th Cir. 2015). In an additional case, the court applied RAND royalty determination methodologies even though the patent holder had specifically refused to provide the SSO with a “letter of assurance” undertaking a RAND commitment. *See Commonwealth Sci. & Indus. Research Org. v. Cisco Sys., Inc.*, 809 F.3d 1295, 1304–05 (Fed. Cir. 2015).

87. *See, e.g.*, TCL Commc’n Tech. Holdings, 2017 WL 6611635, at *15, *25–26 (justifying a “top-down” approach to determining RAND royalty because it reduces stacking and holdup risks); *Microsoft Corp.*, 795 F.3d at 1031 (“The tactic of withholding a license unless and until a manufacturer agrees to pay an unduly high royalty rate for a SEP is referred to as ‘hold-up.’”); *In re Innovatio IP Ventures, LLC Patent Litig.*, 2013 WL 5593609, at *8 (“[O]ne of the primary purposes of the RAND commitment is to avoid patent hold-up . . .”). Another court acknowledged the relevance of holdup and stacking effects but held that actual evidence of such effects in a particular case is required in order to instruct a jury to take those effects into account for purposes of the damages determination. *See Ericsson*, 773 F.3d at 1209, 1233–34.

88. *See* Richard A. Epstein & Kayvan B. Noroozi, *Why Incentives for “Patent Holdout” Threaten to Dismantle FRAND, and Why It Matters*, 32 BERKELEY TECH. L.J. 1831 (2017); David J. Teece & Edward F. Sherry, *A Public Policy Evaluation of RAND Decisions in U.S. Courts*, 1 CRITERION J. ON INNOVATION 113, 124 (2016).

In 2012, the Ninth Circuit expressed the view that injunctive relief is generally unavailable to holders of RAND-encumbered patents⁸⁹ and Judge Richard Posner of the Court of Appeals for the Seventh Circuit, sitting by designation in a district court proceeding, issued a ruling that was understood to take a similar view.⁹⁰ The Federal Circuit rejected any such categorical interpretation of Judge Posner's denial of injunctive relief, stating: "To the extent that the district court applied a per se rule that injunctions are unavailable for SEPs, it erred."⁹¹ Other courts have taken a similarly attenuated position, holding that a RAND commitment implicitly includes a commitment not to seek an injunction against an infringing party but only so long as that party is willing to pay what is deemed to be the RAND rate.⁹² Even though this view safeguards some possibility of injunctive relief, it delivers little certainty to holders of RAND-encumbered patents as a practical matter, since the possibility of injunctive relief is predicated on whatever rate it is expected that a court would determine in litigation to be a "reasonable" rate. Failure to accurately forecast that moving judicial benchmark can result in a financial penalty for the patent holder: one court held that a jury could reasonably award attorney's fees to the *defendant-infringer* on the ground that even *seeking* injunctive relief against a licensee willing to pay a royalty within the "RAND range" was contrary to the RAND commitment.⁹³ Citing the risk of holdup (and

89. See *Microsoft Corp. v. Motorola, Inc.*, 696 F.3d 872, 877, 884 (9th Cir. 2012). A lower court has expressed sympathy with that view, see *In re Innovatio IP Ventures, LLC Patent Litigation*, 921 F. Supp. 2d 903, 915–17 (N.D. Ill. 2013). Additionally, in the *Apple v. Motorola* litigation, Chief Judge Prost of the Federal Circuit expressed the view that the holder of a SEP should not be entitled to injunctive relief, even if the infringer had engaged in bad-faith licensing negotiations. See *Apple*, 757 F.3d at 1342–43 (Prost, C.J., concurring in part, dissenting in part).

90. *Apple Inc. v. Motorola, Inc.*, 869 F. Supp. 2d 901, 914–15 (N.D. Ill. 2012). A close reading of the district court's opinion suggests that Judge Posner took the more qualified view that injunctive relief is unavailable to holders of RAND-encumbered patents unless the alleged infringer refuses to accept a RAND-compliant license. See *id.*

91. See *Apple*, 757 F.3d at 1331–32.

92. See *Microsoft Corp.*, 795 F.3d at 1048 n.19; *Realtek Semiconductor Corp.*, 946 F. Supp. 2d at 1006–07; see also *Microsoft Corp. v. Motorola, Inc.*, 963 F. Supp. 2d 1176, 1190 (W.D. Wash. 2013) (holding that the RAND commitment does not bar injunctive relief in all cases, but seeking injunctive relief may constitute breach of the SEP holder's implied duty of good faith and fair dealing in connection with its RAND commitment). The Federal Circuit has taken a somewhat more generous view, holding that injunctions may issue for SEPs "where an infringer unilaterally refuses a FRAND royalty or unreasonably delays negotiations to the same effect." *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1332 (Fed. Cir. 2014).

93. *Microsoft Corp.*, 963 F. Supp. 2d at 1193–95. The court's ruling relied on a doctrine adopted by some states, which supports shifting attorney's fees when a litigant has

referring to legal scholarship in support of that view⁹⁴), the Federal Circuit upheld this fee-shifting award.⁹⁵ Given the inherent uncertainty over a court's ultimate definition of the RAND royalty range (which then casts doubt over which licensees can be safely deemed as "willing"), the prospect of a fee-shifting award discourages SEP-holders from even seeking injunctive relief and, in turn, encourages recalcitrant licensees to resist offers from the SEP holder as "unreasonable".

Patent holders' current state of uncertainty is exacerbated by "soft law" in the form of statements issued by the antitrust agencies, which have expressed the view that a SEP holder could be subject to liability under the antitrust laws for seeking injunctive relief against a "willing licensee" (again, defined based on a vaguely defined "RAND range"). This view is reflected in two FTC consent decrees in 2013,⁹⁶ an amicus brief filed by the FTC in a 2012 Federal Circuit litigation,⁹⁷ and a joint statement in 2013 by the Antitrust Division and the USPTO.⁹⁸ In 2013, the National Research Council, in a report commissioned by the USPTO, similarly took the view (subject to a minority dissent) that SSOs should adopt policies that limit severely the circumstances under which SEP holders can seek injunctive relief.⁹⁹ This judicial and regulatory suppression of the injunctive remedy "flips the table" in patent litigation (and hence, in any accompanying settlement negotiations) in favor of alleged infringers, who (in the case of a RAND-encumbered patent) are not only shielded against the threat of

breached a covenant not to sue. Remarkably, no Washington court had considered this doctrine, but the federal court took the view that, if a Washington court had the opportunity to consider adopting this doctrine, it would likely do so, taking into account the underlying contractual duty of good faith and fair dealing. See *id.* at 1193–94.

94. *Microsoft Corp.*, 795 F.3d at 1051–52.

95. See *id.* at 1049–52.

96. Decision and Order, *In re Robert Bosch GmbH*, FTC File No. 121-0081, Docket No. C-4377, at 14 (Apr. 23, 2013); Decision and Order, *In re Motorola Mobility LLC & Google Inc.*, FTC File No. 121-0120, Docket No. C-4410, at 4, 7 (July 24, 2013).

97. Brief of Amicus Curiae Federal Trade Commission Supporting Neither Party at 1, *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286 (Fed. Cir. 2014) (Nos. 2012–1548, 2012–1549), 2012 WL 6655899.

98. JOINT POLICY STATEMENT, *supra* note 46.

99. NAT'L RESEARCH COUNCIL, PATENT CHALLENGES FOR STANDARD-SETTING IN THE GLOBAL ECONOMY: LESSONS FROM INFORMATION AND COMMUNICATIONS TECHNOLOGY 96–97 (2013) ("There is a consensus among competition authorities that injunctive relief in connection with a FRAND-encumbered SEP should be a remedy of last resort. They have uniformly taken the position that potential licensees who are willing to enter into a license agreement on FRAND terms must have the opportunity to have disputes between the parties resolved before any injunctive relief can be pursued against them.").

injunctive relief but can wield the sword of antitrust and other damages theories against the patent holder.

5. *Administrative Erosion of Injunctions: Motorola Mobility/Google Consent Decree (2013)*

There remains an important venue in which the “*eBay* effect”—that is, limitations on courts’ latitude to issue injunctive relief in favor of patent holders—has met an important roadblock. This is the International Trade Commission, which, as an administrative entity, has been deemed by the Federal Circuit not to be bound by the *eBay* precedent.¹⁰⁰ The ITC offers patent holders the powerful remedy of a “Section 337” exclusion order, which instructs the U.S. Customs Service to block the importation of products that are deemed to infringe upon a patent that has been held to be valid and infringed.¹⁰¹ This remedy is especially powerful because it can cover a general class of products, rather than being confined to the specific product made by a particular infringing defendant.¹⁰² Several constituencies have responded by advocating action to plug this hole in *eBay*’s suppression of the injunction remedy: in 2012, FTC Commissioner Edith Ramirez testified before Congress that the ITC should adopt an approach that “reconciles” the application of injunctive relief with the case law under *eBay* in the case of SEPs;¹⁰³ in 2012, a group of law and economics professors, filed the equivalent of an amicus brief with the ITC, making a similar argument;¹⁰⁴ in 2013, the DOJ and USPTO issued a joint statement to the same effect.¹⁰⁵

100. *Spansion, Inc. v. Int’l Trade Comm’n*, 629 F.3d 1331, 1359 (Fed. Cir. 2010).

101. 19 U.S.C. § 1337 (2012).

102. Ryan Davis, *Pitfalls Abundant, but Avoidable, for ITC Newcomers*, LAW360 (Sept. 15, 2009, 1:39 PM), <https://www.law360.com/articles/117770/pitfalls-abundant-but-avoidable-for-itc-newcomers> (“General exclusion orders . . . bar imports of an entire class of product regardless of manufacturer”); Gary M. Hnath, *General Exclusion Orders Under Section 337*, 25 NW. J. INT’L L. & BUS. 349, 351 (2005) (“A general exclusion order is broader, and prevents any infringing articles from entering the United States, regardless of source. Thus, a general exclusion order is not limited to the parties named as respondents at the ITC, and is the strongest and most effective remedy available under Section 337.”).

103. Press Release, Fed. Trade Comm’n, *FTC Testimony Expresses Concern that Owners of “Standard-Essential” Patents May Obtain Injunctions Enabling Them to Hold Up Other Firms* (July 11, 2012), <https://www.ftc.gov/news-events/press-releases/2012/07/ftc-testimony-expresses-concern-owners-standard-essential-patents>.

104. Colleen V. Chien et al., *RAND Patents and Exclusion Orders: Submission of 19 Economics and Law Professors to the International Trade Commission* (Santa Clara Univ. Legal Studies Research Paper, Paper No. 07-12, 2012), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2102865.

105. JOINT POLICY STATEMENT, *supra* note 46.

In 2013, these calls translated into action. First, the U.S. Trade Representative, acting on behalf of the President, exercised its statutory authority to block implementation of an ITC exclusion order against infringing devices being imported by Apple (in connection with patent litigation involving Samsung).¹⁰⁶ Second, the FTC acted. In the consent decree relating to the FTC's investigation of Google's acquisition of Motorola Mobility (and Motorola's portfolio of thousands of SEPs subject to RAND commitments),¹⁰⁷ Google, as the acquiror firm, was prohibited from seeking injunctive relief against alleged infringers of its newly-acquired patent portfolio outside of limited circumstances in which the potential licensee refuses to accept a license consistent with the RAND standard or on any other terms (including terms set by a court or arbitrator acting pursuant to the RAND standard).¹⁰⁸ Given these limitations, no potential licensee would explicitly reject any such offer (or would take the position that any royalty proposed by the patent holder is inconsistent with the RAND commitment) and thereby trigger the narrow set of circumstances under which injunctive relief would still be theoretically possible under the consent decree.

III. REVISITING THE CONCEPTUAL TRIPLET: WEAK EVIDENCE, WEAK THEORY

Academic claims concerning the adverse effects of a strong patent system have not stayed within the academy. Rather, as described above, courts and agencies have translated those theories into practical actions that have significantly limited the availability of injunctive relief for certain groups of patent holders and limited the monetary remedies that certain patent holders can seek in litigation. Given these important implications, it is appropriate to take a close look at whether these propositions, which have typically been presented in the context of stylized theoretical settings, have ever matured into descriptively reliable statements about real-world markets. Remarkably, *all* available empirical evidence fails to confirm these widely endorsed theories. This mismatch between theory and evidence demands that we revisit the explicit and implicit assumptions behind those

106. Letter from Michael B. G. Froman, U.S. Trade Representative, to the Honorable Irving A. Williamson, Chair, Int'l Trade Comm'n (Aug. 3, 2013), https://ustr.gov/sites/default/files/08032013%20Letter_1.PDF.

107. Decision and Order, *In re* Motorola Mobility LLC & Google Inc., FTC File No. 121-0120, Docket No. C-4410, at 8 (July 24, 2013).

108. *See id.*

theories; upon closer review, it is clear that those assumptions are unlikely to be typically realized in real-world technology markets.

A. PATENT THICKETS REVISITED

The patent thicket thesis is most commonly attributed to an article by Professors Rebecca Eisenberg and Michael Heller published in 1998,¹⁰⁹ which Heller has expanded upon in portions of a book-length treatment published in 2008¹¹⁰ and which Eisenberg has significantly qualified in a subsequent paper.¹¹¹ The original article is undoubtedly influential: it has been cited widely in the academic literature,¹¹² two federal court opinions,¹¹³ and congressional deliberations on patent reform.¹¹⁴ At this stage, we are in a good position to assess the papers' descriptive force, since it has been subjected to empirical scrutiny using various methodologies and in different markets and periods. It is beyond the scope of this contribution to provide a detailed and comprehensive review (which I and other authors have done elsewhere to varying extents¹¹⁵). However I will describe the key findings.

1. *Biomedical Research*

Multiple studies have used survey and other methods to identify patent thicket or “anticommons” effects in the biomedical research community.

109. See Heller & Eisenberg, *supra* note 16.

110. See HELLER, *supra* note 16.

111. See Eisenberg, *supra* note 16.

112. As of December 31, 2017, Google Scholar reports that the Heller and Eisenberg article has been cited in 3,001 academic publications and working papers.

113. Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office, 702 F. Supp. 2d 181, 208 (S.D.N.Y. 2010); Bd. of Trs. of Leland Stanford Junior Univ. v. Roche Molecular Sys., Inc., 563 U.S. 776, 795–96 (2011). A dissenting Federal Circuit judge took note of the theory but observed that it has not been supported empirically. See *Momenta Pharm., Inc. v. Amphastar Pharm., Inc.*, 686 F.3d 1348, 1374–75 (2012) (Rader, C.J., dissenting).

114. See, e.g., 153 CONG. REC. H10250 (“[T]he much more insidious and troubling kinds of poor quality patents are the ones that are granted which impede commerce or further invention because they create a patent thicket so wide and so dense that an entire industry or segment of our economy becomes subservient to a single patent from a single innovator.”).

115. For a broad review of evidence relating to the thicket thesis, both in contemporary and historical markets, see Jonathan M. Barnett, *The Anti-Commons Revisited*, 29 HARVARD J.L. & TECH. 127 (2015) & David J. Teece, *The “Tragedy of the Anticommons” Fallacy: A Law and Economics Analysis of Patent Thickets and FRAND Licensing*, 32 BERKELEY TECH. L.J. 1489 (2017). For a comprehensive review of empirical studies of “thicket effects” in the biomedical environment, see Charles R. McManis & Brian Yagi, *The Bayh-Dole Act and the Anticommons Hypothesis: Round Three*, 21 GEO. MASON. L. REV. 1049 (2014).

This research segment is important because it is the field with respect to which the “anticommons thesis” was originally asserted, at the time reflecting concerns that increased patenting in the biomedical research field¹¹⁶ would generate transactional thickets that would impede research. The survey studies are remarkably consistent in finding little to no evidence that these concerns have ever materialized.¹¹⁷ Interviewees widely reported the use of workarounds to potential patent thickets, including nonenforcement by the patentholder,¹¹⁸ nominal fees being assessed by the patent holder,¹¹⁹ design arounds,¹²⁰ licenses or informal industry understandings.¹²¹ This literature can be summarized by the conclusion of a leading study: “[L]egal excludability due to patents does not appear in practice to impose an important impediment to academic research in biomedicine”¹²²

116. These concerns were due in part to passage of the Bayh-Dole Act, Pub. L. No. 96-517, 94 Stat. 3019 (1980), which enabled institutional recipients of federal research funding to seek patents on innovations developed using that funding.

117. See John P. Walsh, Ashish Arora & Wesley M. Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285, 285 (Wesley M. Cohen & Stephen A. Merrill eds. 2003) (based on survey of limited sample of industry and academic researchers, finding little evidence that access restrictions or other anticommons effects attributable to patents delayed or stopped research projects or had significant effects on knowledge-sharing among researchers); John P. Walsh, Charlene Cho & Wesley M. Cohen, *View from the Bench: Patents and Material Transfers*, 308 SCIENCE 2002, 2002 (2005) (based on survey of 414 academic biomedical researchers, finding that only one percent of interviewees reported any delay in research, and none reported having halted research, due to access constraints attributable to patents); Wesley M. Cohen & John P. Walsh, *Real Impediments to Academic Biomedical Research*, in 8 INNOVATION POLICY AND THE ECONOMY 1, 12 (Adam B. Jaffe, Josh Lerner & Scott Stern eds., 2008) (based on surveys of biomedical researchers, finding that patents are only one of multiple, and are rarely a determinative, means available to researchers to block access to research results, data, materials or processes, and finding little evidence of anticommons effects); Zhen Lei et al., *Patents Versus Patenting: Implications of Intellectual Property Protection for Biological Research*, 27 NATURE BIOTECHNOLOGY 36, 36 (2009) (reporting survey findings that scientists “do not [generally] encounter an anticommons or a patent thicket,” but do experience “frictions” due to technology transfer agreements, which are perceived to be associated with an environment in which patenting is promoted).

118. See Cohen & Walsh, *supra* note 117, at 12; Walsh, Cho & Cohen, *supra* note 117, at 2002; Lei et al., *supra* note 117, at 37, 39.

119. See Walsh, Cho & Cohen, *supra* note 117, at 2002.

120. See Cohen & Walsh, *supra* note 117, at 12; Walsh, Arora & Cohen, *supra* note 117, at 323.

121. See Walsh, Arora & Cohen, *supra* note 117, at 325–27; Cohen & Walsh, *supra* note 117, at 3.

122. See Cohen & Walsh, *supra* note 117, at 17.

2. *Evidence for Market Self-Correction: Collective Rights Organizations and Patent Pools*

A related line of scholarly inquiry has considered whether markets have capacities to anticipate patent roadblocks and to take steps to prevent it. This has important implications for the thicket thesis: if markets have robust self-correction capacities, then it would be unlikely that thickets would ever arise or persist in practice.¹²³ In an early contribution that predates the “anticommons” literature, Professor Robert Merges had argued that firms use contractual arrangements to preempt or resolve IP roadblocks through pooling and cross-licensing mechanisms.¹²⁴ As a principal example, Merges showed how the market for performance rights in musical compositions had avoided transactional blockage by developing collective rights societies for efficiently administering copyrights held by large numbers of dispersed holders.¹²⁵ Building on this line of inquiry in subsequent research, I identified over one hundred documented IP (mostly patent) pooling arrangements from 1900 through 2014, finding that content and technology markets have regularly formed IP pools, except during a roughly three-decade period following World War II during which antitrust policy effectively prohibited them.¹²⁶ In other work, I documented intricate contractual and organizational solutions to potential patent thickets that have been devised by external pooling entities, as well as industry consortia, in the ICT markets starting in the late 1990s.¹²⁷ These transactional innovations support the deployment of data compression, data transmission and other technologies that lie behind everyday fixtures of the digital economy, including Blu-Ray players, Firewire and Bluetooth systems, MP3 players, LAN systems, cable television set-top boxes, and online streaming of audio and visual content.¹²⁸ Contrary to the thicket thesis, widely dispersed ownership of large numbers of patents relating to critical

123. Professor Teece pithily articulates the market correction argument by noting that even if there may be an anticommons, “there is no ‘tragedy’” that results from it. *See* Teece, *supra* note 115, at 1501.

124. *See* Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rules and Collective Rights Organizations*, 84 CALIF. L. REV. 1293, 1295 (1996) (“IPR owners in various industries have demonstrated the workability of these private transactional mechanisms.”).

125. *See id.* (explaining how “collective copyright licensing organizations such as ASCAP and BMI” had efficiently administered widely held copyrights).

126. *See* Barnett, *supra* note 115, at 147–51.

127. *See* Barnett, *supra* note 84.

128. *See id.*

technologies has not impeded rapid dissemination of these technologies to the end-user market.

3. *Historical Research: Revisiting the “Clear Cases” of Patent Thickets*

Ron Katznelson, John Howells, and I have revisited classic patent litigations that are widely cited to illustrate how strong patents can pose transactional obstacles that slow down technological progress. Some of these classic litigations include the litigation over the Wright patent in the early aircraft industry,¹²⁹ litigation over the “De Forest” and other patents in the early radio communications industry,¹³⁰ and litigation over the “Selden” patent in the early automotive industry.¹³¹ The Howells and Katznelson studies find that intensive patent litigation in the early aircraft and radio communications industries had little effect on entry opportunities or market growth, in large part because the principal stakeholders took steps to reach a mutually agreeable settlement through cross-licensing and other arrangements.¹³² I confirmed those findings through a review of the authors’

129. For examples of scholars and agencies asserting that the Wright patent litigation impeded innovation and growth in the aircraft industry, see Joel I. Klein, Acting Assistant Att’y Gen., Dept. of Justice, Cross-Licensing and Antitrust Law (May 2, 1997), <https://www.justice.gov/atr/speech/cross-licensing-and-antitrust-law>; HELLER, *supra* note 16, at 30–31; and Michele Boldrin & David K. Levine, *The Case Against Patents*, 27 J. ECON. PERSP. 3, 10 (2013).

130. For examples of scholars and agencies asserting that litigation over radio communications patents impeded industry growth, see NAT’L ACAD. OF SCI., A PATENT SYSTEM FOR THE 21ST CENTURY 26 (Stephen A. Merrill, Richard C. Levin and Mark B. Myers eds., 2004); Mark Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 727–28 (2012); Roberto Mazzoleni & Richard R. Nelson, *The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate*, 27 RES. POL’Y 273, 280 (1998); Robert P. Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 84–89 (1994).

131. For examples of agencies or scholars asserting that the Selden patent litigation blocked innovation in the automotive industry, see FED. TRADE COMM’N, *supra* note 42, at 3; Tim Wu, *Intellectual Property, Innovation, and Decentralized Decisions*, 92 VA. L. REV. 123, 136–37 (2006).

132. See John Howells & Ron Katznelson, *The Myth of the Early Aviation Patent Hold-Up—How a U.S. Government Monopsony Commandeered Pioneer Airplane Patents*, 24 INDUS. & CORP. CHANGE 1, 2 (2014); John Howells & Ron D. Katznelson, *The Coordination of Independently-Owned Vacuum Tube Patents in the Early Radio Alleged Patent “Thicket”* 20–21 (Nov. 20, 2015) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2450025. In the case of the aircraft and radio communications industries, the government promoted the formation of patent pools (in the radio industry, through the formation of the Radio Corporation of America). However, in both cases, historical evidence shows that the stakeholders had already reached, or were actively negotiating, an alternative licensing or other transactional solution to the patent dispute. See Barnett, *supra* note 115, at 170–72, 179–82.

primary sources (as well as additional sources) and, consistent with the market self-correction thesis, described how the early petroleum refining and automotive industries had similarly addressed potential thickets through pooling and cross-licensing arrangements. Contrary to widespread assumptions, the extended patent infringement litigation between Ford Motor Co. and the holder of the Selden patent, which claimed the internal combustion engine, had no apparent effect on the expansion of the U.S. motor vehicle market or the economic performance of Ford, which thrived throughout this period and regularly released product and process innovations into the market.¹³³ In the petroleum refining industry, intensive patent litigation involved even more entities and extended over a substantially longer period. Again contrary to the thicket thesis, this economically critical industry showed the signs of a healthy innovation market throughout this period: accelerating R&D expenditures, robust competition for market share, and declining royalty rates.¹³⁴ These historical studies all converge toward a common interpretation: markets are adept at anticipating transactional blockage and taking steps to preempt it, so that intensive patent acquisition and enforcement have little persistent adverse effect on innovation, even without taking into account positive effects on innovation incentives and transactional opportunities.

4. *Reevaluation: Why Evidence for Patent Thickets Is So Weak*

In hindsight, it is perhaps unsurprising to learn that markets are so adept at identifying and preempting potential patent thickets. This result derives from pure self-interest: a thicket prevents patent holders from earning a return on their R&D investment, giving them a powerful incentive to avoid litigation and, following Coasean logic,¹³⁵ reach a mutually agreeable allocation of property rights and split of the surplus value that is unlocked as a result. So long as antitrust or other regulatory interventions do not impede contract enforcement, stakeholders tend to exhibit robust capacities to resolve potentially conflicting patent claims for mutual advantage. Relatedly, given the rapid product life cycle of technology-intensive markets and actual or potential competition from alternative technologies, patent holders incur a large opportunity cost by failing to reach an agreement that enables the market to deploy and commercialize the relevant technology.

Of course, markets' self-correction capacities in any particular case are sensitive to transaction costs. Hence, it would be expected that Coasean

133. See Barnett, *supra* note 115, at 127–29.

134. See *id.*

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

bargaining would perform well, and thickets would be unlikely to persist, in low transaction–cost settings involving small numbers of repeat–play patent holders with approximately homogenous IP portfolios. These holders can more easily enter into patent cross–licensing arrangements or industry understandings that avoid the complexities of formal enforcement, side payments, and ongoing royalty payments. Contrary to expectations, however, the thicket thesis does not even seem to hold true in high transaction–cost settings involving large numbers of holders with heterogeneous IP portfolios. Even in those settings, profit–motivated transactional entrepreneurs devise pooling and licensing solutions that can suppress actual or potential thickets among multiple patent holders.¹³⁶ Since the effective lifting of the de facto prohibition on patent pools following release of the 1995 revised antitrust guidelines on IP licensing¹³⁷ and a business review letter issued by the DOJ in 1997 (in connection with a proposed patent pool),¹³⁸ this externally administered structure has become the most prevalent pooling structure in ICT markets.¹³⁹ This type of transactional engineering may explain why contemporary ICT markets have enjoyed rapid and widespread deployment of new technologies concurrent with the intensive acquisition and enforcement of patents.

B. PATENT HOLDUP AND STACKING REVISITED

The patent holdup scenario describes a *possible* state of affairs in which the holder of a patent on one component of a multicomponent technology package is able to secure payment in excess of the economic contribution of that component toward the larger product package. The royalty stacking scenario similarly describes a *possible* state of affairs that represents a straightforward application of Cournot’s double marginalization problem. In both cases, however, the practically relevant question is the frequency with which these scenarios actually arise and persist in real–world markets. I address that question in two steps. First, I examine the evidence presented in the original and most widely–cited article on holdup and stacking by

136. See Barnett, *supra* note 115, at 140, 160–63.

137. U.S. DEP’T OF JUSTICE & FED. TRADE COMM’N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (1995), <https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/0558.pdf>.

138. See Letter from Joel I. Klein, Assistant Att’y Gen., U.S. Dep’t. of Just., to Gerrard R. Beeney, Sullivan & Cromwell 1, 16 (June 26, 1997), <https://www.justice.gov/sites/default/files/atr/legacy/2006/10/17/215742.pdf> (indicating no intention to initiate antitrust enforcement against proposed patent licensing arrangement).

139. See Barnett, *supra* note 115, at 186 tbl. 3.

Professors Mark Lemley and Carl Shapiro.¹⁴⁰ Second, I examine the more systematic evidence that has subsequently been presented by other researchers, especially in the smartphone market in which stacking effects have been asserted most frequently. Both steps support a single conclusion: available empirical evidence does not support the view that holdup and stacking effects are significant and persistent in technology markets.

1. *Evidence in the “2007 Article”*

Lemley and Shapiro’s 2007 article is undoubtedly influential: it has been cited widely by not only academics¹⁴¹ but policymaking entities, including three federal court opinions,¹⁴² an FTC amicus brief,¹⁴³ two agency business review letters,¹⁴⁴ and various legislative deliberations on patent reform, including a 2007 Senate committee report.¹⁴⁵ While other commentators have made related claims before and since,¹⁴⁶ it is clearly the

140. See Lemley & Shapiro, *supra* note 21. Two other contemporaneously published articles, one authored separately by Lemley and another coauthored by Shapiro, set forth similar claims. See Lemley, *supra* note 21; Farrell et al., *supra* note 22, at 613. Related patent holdup concerns had been addressed in a 2005 publication, see Swanson & Baumol, *supra* note 24, at 19–21, and in a 2001 publication authored by Shapiro, see Shapiro, *supra* note 16, at 124–26. The phrase “patent holdup” seems to derive from “patent ambush,” a phrase that apparently originated in a 1999 publication and referred specifically to a case in which a patent holder participates in a standard-setting process and deceptively fails to disclose its patent position to other participants. See William J. Baer & David A. Balto, *Antitrust Enforcement and High-Technology Markets*, 5 MICH. TELECOMM. & TECH. L. REV. 73, 82 (1999).

141. As of December 31, 2017, it had been cited in 1,118 publications or working papers, according to Google Scholar.

142. Hynix Semiconductor Inc. v. Rambus Inc., 609 F. Supp. 2d 951, 966 (N.D. Cal. 2009); Microsoft Corp. v. Motorola, Inc., 795 F.3d 1024, 1031 (9th Cir. 2015); NetAirus Techs., LLC v. Apple, Inc., No. LACV1003257JAKEX, 2013 WL 11237200, at *6 (C.D. Cal. Oct. 23, 2013). The last opinion cites the Lemley and Shapiro article but states that it does not rely on the article “for any conclusions reached in [the] Order” because “Apple, along with a number of other technology companies, provided funding for the research Lemley & Shapiro report in the article.” *Id.* at *6 n.7.

143. Brief of Amicus Curiae Federal Trade Commission Supporting Neither Party at 7, 13, Apple Inc. v. Motorola, Inc., 757 F.3d 1286 (Fed. Cir. 2014), (Nos. 2012–1548, 2012–1549), 2012 WL 6655899.

144. See Letter from William J. Baer, Assistant Att’y Gen., U.S. Dep’t of Justice, to Garrard R. Beeney, Sullivan & Cromwell LLP (Mar. 26, 2013), <https://www.justice.gov/sites/default/files/atr/legacy/2013/03/28/295151.pdf> (with respect to Intellectual Property Exchange International, Inc.); Hesse, *supra* note 79 (with respect to Institute of Electrical and Electronics Engineers).

145. S. REP. NO. 110-259, at 7 n.24 (2008).

146. A search in the Westlaw “Secondary Sources—Law Reviews & Journals” database for articles that mention “patent holdup,” “patent hold-up,” “patent hold up,” “royalty stacking” or “royalty stack” identified 1,029 articles (as of January 15, 2018). For

key reference point in current discussion on these issues. The article consists of two parts: (i) a theoretical model of holdup and stacking effects (which other commentators have analyzed extensively¹⁴⁷), and (ii) empirical evidence presented in support of the model. Lemley and Shapiro conclude that the “evidence suggests that there are indeed very real problems associated with royalty stacking”¹⁴⁸ and, in particular, state that “problems of holdup and royalty stacking can be severe in the case of private standard setting.”¹⁴⁹

A closer look supports at best a far more ambiguous conclusion. Lemley and Shapiro present three types of evidence. First, holdup is illustrated by anecdotal examples which, while dramatic,¹⁵⁰ cannot be used as a compelling basis for concluding that this is a common scenario or that any specific reported settlement is exorbitant absent reference to some reliable measure of intrinsic value. Second, stacking is supported by evidence from a sample of reasonable royalty awards in forty–seven infringement litigations during 1982–2005, showing that the average rate was approximately 10% for components, 13.1% for all inventions, and 14.7% for integrated product claims.¹⁵¹ This evidence suffers from small sample size and selection effects, which are likely to bias upwards the royalty rate

other contributors that made similar claims previously or contemporaneously to the Lemley and Shapiro article, see *supra* note 140. For representative examples of contributors who have made similar claims subsequently, see Contreras & Gilbert, *supra* note 29; Colleen V. Chien & Mark A. Lemley, *Patent Holdup, the ITC, and the Public Interest*, 98 CORNELL L. REV. 1 (2012); Timothy Simcoe, *Private and Public Approaches to Patent Hold-Up in Industry Standard Setting*, 57 ANTITRUST BULL. 59 (2012); Daryl Lim, *Misconduct in Standard Setting: The Case for Patent Misuse*, 51 IDEA 559 (2011); Robert A. Skitol & Kenneth M. Vorrasi, *Patent Holdup in Standards Development: Life After Rambus v. FTC*, 23 ANTITRUST 26 (2009); Mark A. Lemley & Philip J. Weiser, *Should Property or Liability Rules Govern Information?*, 85 TEX. L. REV. 783 (2007). For substantially more qualified views, see Colleen V. Chien, *Holding Up and Holding Out*, 21 MICH. TELECOMM. & TECH. L. REV. 1, 26–33 (2014) (acknowledging holdup by patentees and holdout by infringers); Thomas F. Cotter, *Patent Holdup, Patent Remedies and Antitrust Responses*, 34 J. CORP. L. 1151, 1154 (2008) (recognizing that overly broad definitions of holdup can capture legitimate patent enforcement activity and recommending error–cost approach for addressing potential patent holdup).

147. See *supra* note 13.

148. See Lemley & Shapiro, *supra* note 21, at 1994. Writing separately and concurrently, Professor Lemley asserted: “Time and time again, we have seen this sort of royalty stacking problem arise.” See Lemley, *supra* note 21, at 152.

149. Lemley & Shapiro, *supra* note 21, at 2016.

150. The most notable anecdotal example was the \$613 million payout by RIM to a patent holding entity suing with respect to a component of the then–dominant Blackberry device. See Lemley & Shapiro, *supra* note 21, at 2009 & n.36.

151. See Lemley & Shapiro, *supra* note 21, at 2032–34.

given other research showing that litigated patents tend to represent the most valuable patents¹⁵² (as would be expected based on standard litigation models). Further, even apparently high royalty rates may not be exorbitant in any individual case without making reference to a reliable valuation metric.¹⁵³ Third, the authors provide case studies of alleged royalty stacking in various IT markets, in particular communications markets that operate under the 3GPP and 3GPP2 (also known as WCDMA and CDMA2000) standards and markets that operate under the Wi-Fi 802.11 standard.¹⁵⁴ The authors present the most detailed evidence with respect to the “3G” wireless communications market so I will examine that evidence closely, especially since it involves the smartphone market in which holdup and stacking concerns have been most widely discussed.

This case study evidence consists of a three-part argument that (i) observes large numbers of patents held by multiple entities relating to a particular wireless standard (in this case, “3G”); (ii) refers to individual cases of double-digit royalty rates or other third-party reports of unusually high royalty rates; and (iii) implicitly multiplies the number of patents in (i) by reported rates in (ii) to conclude that collective royalty rates are likely “exorbitant.”¹⁵⁵ This argument is unpersuasive for several reasons. First, the cited royalty rates typically consist of individual reports that may not be indicative of the relevant market as a whole, given different values of individual patents or different bargaining positions of individual licensors and licensees. Second, reported or announced rates may not reflect ultimately agreed-upon rates, which may be reduced through negotiation (as noted by Lemley and Shapiro¹⁵⁶), especially by licensees that have

152. See Jean O. Lanjouw & Mark A. Schankerman, *Characteristics of Patent Litigation: A Window of Competition*, 32 RAND J. ECON. 129, 141 (2000) (“[L]itigated patents have both more claims and more valuable claims.”).

153. See Geradin et al., *supra* note 14, at 160.

154. “CDMA” stands for code-division multiple access. Andrew T. Dufresne, *The Exhaustion Doctrine Revived? Assessing the Scope and Possible Effects of the Supreme Court’s Quanta Decision*, 24 BERKELEY TECH. L.J. 11, 37 n.200 (2009). It is a type of wireless communications technology, which was developed (mostly by Qualcomm) as an alternative to time-division multiple access (TDMA) and frequency-division multiple access (FDMA) wireless technologies. *Id.* For further discussion, see HSIAO-HWA CHEN, *THE NEXT GENERATION CDMA TECHNOLOGIES* 1–2, 181–82 (2007).

155. See Lemley & Shapiro, *supra* note 21, at 2025–27 (observing that thousands of patents apply to wireless technology standards and are held by forty-one companies, citing third-party reports of double-digit royalty rates for patents relating to mobile phones with online functions, and presenting evidence as example of royalty stacking).

156. See Lemley & Shapiro, *supra* note 21, at 2026.

significant IP portfolios to use as a bargaining chip.¹⁵⁷ The combination of these two factors raises the possibility that some licensees may pay nominal or zero royalties to some SEP holders. Third, as mentioned above, there is no economically meaningful sense in which a specific royalty rate is “exorbitant” without reference to a reliable market benchmark.

To be sure, Lemley and Shapiro sometimes acknowledge these complexities, observing that “[i]t is not clear what the total cost of these stacked royalties is.”¹⁵⁸ Nonetheless the 2007 article, and specifically its assertion that stacking is an empirically salient issue, does rely to a significant extent on reports of royalty rates of 20% for “internet functionality” features in a smartphone (after cross–licensing offsets),¹⁵⁹ and over 30% for a dual–band smartphone (then sold widely in the European market), including 22.5% for W-CDMA technology (a type of “3G” wireless communications technology, also known as the “UMTS” standard) and 15–20% for GSM technology (a type of “2G” wireless communications technology).¹⁶⁰ Lemley and Shapiro further note that these estimates may be underinclusive to the extent that they do not reflect royalties owing to holders of patents that were not declared “essential” to the relevant standard.¹⁶¹ The clear implication is that handset manufacturers may operate under an aggregate royalty burden in excess of 30%, and perhaps substantially higher.¹⁶² While Lemley and Shapiro did note in part that cross–licensing offsets may adjust these rates downward,¹⁶³ that detail has often if not typically been ignored or minimized in subsequent scholarly

157. See Damien Geradin, *What’s Wrong with Royalties in High-Technology Industries?*, in *COMPETITION POLICY AND PATENT LAW UNDER UNCERTAINTY* 462, 471 (Geoffrey A. Manne & Joshua D. Wright eds., 2011) (“In fact, vertically integrated firms with significant portfolios of essential patents will, thanks to their ability to cross-license, face a much lower royalty burden than pure manufacturers holding no IP.”).

158. See Lemley & Shapiro, *supra* note 21, at 2026.

159. See *id.* (citing Rudi Bekkers & Joel West, *The Effect of Strategic Patenting on Cumulative Innovation in UMTS Standardization* 10, 22 (DIME Working Papers on Intellectual Prop. Rights, Working Paper No. 9, 2006), http://www.dime-eu.org/files/active/1/IPR-WORKING-PAPER-9_BekkersWest.pdf).

160. See Lemley & Shapiro, *supra* note 21, at 2027 (citing Michael W. Thelander, *The IPR Shell Game*, SIGNALS AHEAD, June 6, 2005, at 1, 7).

161. See Lemley & Shapiro, *supra* note 21, at 2027.

162. Writing separately and concurrently, Lemley described a call for essential patents by a SSO relating to the 3G wireless platform, which resulted in responses “totaling over 6000 ‘essential’ patents and the cumulative royalty rate turned out to be 130%.” See Lemley, *supra* note 21, at 152.

163. See Lemley & Shapiro, *supra* note 21, at 2026.

and popular discussions, as well as amicus briefs filed in litigation,¹⁶⁴ which focused on the global assertion that stacking is an empirically significant phenomenon.¹⁶⁵

Closer scrutiny shows that taking into account cross–licensing makes a critical difference. Given cross–licensing opportunities, there is great doubt that major handset manufacturers incurred double–digit royalty rates during the relevant period. The 2006 working paper that is cited by Lemley and Shapiro for the 20% figure mentioned above, authored by Professors Rudi Bekkers and Joel West, does report estimated total royalties of 20% for UMTS/WCDMA technology¹⁶⁶ (most likely the “internet functionality” to which Lemley and Shapiro had referred¹⁶⁷), supported by a citation to a press release relating to an unpublished report by a private consulting

164. See, e.g., Brief of Amicus Curiae Law Professors Thomas F. Cotter, Shubha Ghosh, A. Christal Sheppard, & Katherine J. Strandburg in Support of Apple Inc. and Affirmance in Motorola, Inc.’s Cross-Appeal, *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286 (Fed. Cir. 2014), (Nos. 2012–1548, 2012–1549), 2013 WL 1151016. The brief states that holdup risk is “increasingly pervasive,” *id.* at *7, and like Lemley and Shapiro, cite to the same Bekkers and West paper (in the form published in 2009) to demonstrate double–digit total royalty rates in the smartphone market, *id.* at *11 n.7, but omit (as noted in the Bekkers and West paper) that cross–licensing substantially reduces those rates for major device manufacturers. See Rudi Bekkers & Joel West, *The Limits to IPR Standardization Policies as Evidenced by Strategic Patenting in UMTS*, 33 TELECOMM. POL’Y 80, 92 (2009).

165. For an example of scholarly commentary that asserts double–digit aggregate royalty stacks in the smartphone market, see Robert G. Harris, *Patent Assertion Entities & Privateers: Economic Harms to Innovation and Competition*, 59 ANTITRUST BULL. 281, 294 (2014). The author makes no allowance for cross–licensing and relies on the same 2005 consulting research study cited by Lemley and Shapiro in their case study of the “3G” wireless market (see *supra* note 160 and accompanying text). As I note subsequently (see *infra* note 176 and accompanying text), that research study notes that double–digit royalties are typically *not* incurred by device manufacturers with significant IP portfolios that can be used for cross-licensing purposes. For an example of popular commentary that makes the same assertion, see Jack Schofield, *Patent Insanity: Royalty Fees Could Reach \$120 on a \$400 Smartphone*, ZDNET (May 31, 2014, 9:49 PM), <http://www.zdnet.com/article/patent-insanity-royalty-fees-could-reach-120-on-a-400-smartphone/>. The author refers to a working paper published in 2014 by other authors, who rely on announced, rather than finally negotiated and actually paid, royalty rates. That paper “finds” an approximately 30% estimated aggregate royalty rate in the smartphone market and then notes—but does not adjust for—the possibility of negotiation and cross–licensing by individual licensees. See Ann Armstrong, Joseph J. Mueller & Timothy D. Syrett, *The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Modern Smartphones* (WilmerHale Working Paper, 2014), https://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf.

166. See Bekkers & West, *supra* note 159, at 22.

167. See Lemley & Shapiro, *supra* note 21, at 2026.

group.¹⁶⁸ However, Bekkers and West note that those rates may be adjusted downward after cross-licensing offsets¹⁶⁹ and that “leading GSM vendors paid *little or nothing* due to cross-licensing.”¹⁷⁰ Similarly, in the 2009 published version of the same paper, Bekkers and West note that the 20% royalty for UMTS-related patents are the rates paid by “*non-IPR holders*” and that “an undetermined number of firms reduce or avoid royalties through cross-licenses.”¹⁷¹ In another publication in 2006, Professor West had written separately that (i) in the GSM cellular market, major European handset manufacturers “were believed *exempt* from patent royalties through cross-licensing”¹⁷² and (ii) in the UMTS/WCDMA market, Qualcomm, which was the nearly exclusive supplier of CDMA chipsets, assessed royalties of 4.5% against handset manufacturers.¹⁷³ Similarly, the consulting study cited by Lemley and Shapiro to support the assertion that European dual-band (GSM and UMTS/W-CDMA) smartphone manufacturers may incur over 30% in total royalties¹⁷⁴ noted that, with respect to GSM technology, “those companies that have essential patents are not subject to those rates due to cross-licensing arrangements”¹⁷⁵ and, with respect to UMTS/W-CDMA technology, the maximum expected royalty rates applied to companies “that lack any IPR.”¹⁷⁶ Hence, the best reading of the available evidence seems to be that the then-largest European handset manufacturers, such as Ericsson and Nokia, which held significant IP portfolios that could be used to secure cross-licensing offsets,¹⁷⁷ likely

168. See Bekkers & West, *supra* note 159, at 22 (citing Press Release, PA Consulting Grp., Essential Patent Rights in 3G Wireless Will Win or Lose Companies Millions (Sept. 11, 2002). The press release (but not the underlying report) can be found at the Cambridge Network. See *Essential Patent Rights in 3G wireless Will Win or Lose Companies Millions, Says PA Consu...*, CAMBRIDGE NETWORK (Nov. 9, 2002), www.cambridgenetwork.co.uk/news/essential-patent-rights-in-3g-wireless-will-win-or-lose/.

169. See Bekkers & West, *supra* note 159, at 7.

170. See *id.* at 22 (emphasis added).

171. See Bekkers & West, *supra* note 164, at 92.

172. See Joel West, *Does Appropriability Enable or Retard Open Innovation?*, in OPEN INNOVATION: RESEARCHING A NEW PARADIGM 109, 126–27 (Henry Chesbrough, Wim Vanhaverbeke & Joel West eds., 2006) (emphasis added). Bekkers and West also note this in their 2006 working paper. See Bekkers & West, *supra* note 159, at 22.

173. West, *supra* note 172, at 126–27. In a 2001 business case study, Professor West had mentioned the same 4.5% figure with respect to Qualcomm’s CDMA licensing. See Joel West, *Qualcomm in China (A)*, 6 ASIAN CASE RES. J. 85, 95 (2002).

174. See Lemley & Shapiro, *supra* note 21, at 2027 (citing Thelander, *supra* note 160, at 1, 7).

175. See Thelander, *supra* note 160, at 6.

176. See *id.* at 7.

177. See Bekkers & West, *supra* note 159, at 10, tbl. 3 (documenting that, during the UMTS standardization process, Nokia and Ericsson, two large handset manufacturers,

paid (i) 0% for “2G” GSM technology and (ii) approximately 4.5% for “3G” UMTS/WCDMA technology.¹⁷⁸ Clearly that total “royalty stack” does not approach the double-digit rates that the 2007 Lemley and Shapiro article had suggested were sometimes being incurred in the case of dual-band mobile telephones.

2. *Recent Evidence*

Lemley and Shapiro arguably describe a theoretically plausible set of circumstances in which patent holdup and royalty stacking may arise.¹⁷⁹ However, they did not provide persuasive empirical evidence that this is a frequently or even occasionally realized scenario. Of course, it may be the case that subsequent evidence has validated their argument. Based on available evidence, however, that possibility has not yet been realized, even though the number of SEPs and SEP holders has increased dramatically during the rollout of “3G” and “4G” wireless communications technologies during the past decade.¹⁸⁰ While no study described below definitively resolves the empirical debate, it is striking that *every* study, as well as several industry reports described below, fails to find persuasive evidence of holdup and stacking effects in the smartphone and other patent-intensive IT markets in which those effects should, as a theoretical matter, be most salient.

were among four firms that held the largest number of “essential” patents with respect to the standard); Thelander, *supra* note 160, at 5 fig. 1, 7 fig. 4 (showing that Nokia and Ericsson were among the three largest holders of GSM and UMTS/W-CDMA patents declared as being “essential” to the governing standardization body).

178. As described subsequently, that estimated single-digit total royalty burden is consistent with recent findings based on systematic empirical studies of smartphone markets. *See infra* Section III.B.2.d.

179. Scholars who have focused on Lemley and Shapiro’s theoretical models have reached varying conclusions about the plausibility of these circumstances, often finding that they are restricted to a relatively narrow set of cases. *See supra* note 13. I am largely abstracting away from these critiques.

180. *See* Alexander Galetovic & Kirti Gupta, *Royalty Stacking and Standard Essential Patents: Theory and Evidence from the World Mobile Wireless Industry* 19–20 (Hoover Inst. Working Grp. on Intellectual Prop., Innovation, & Prosperity, Working Paper No. 15012, 2016), <https://hooverip2.org/wp-content/uploads/ip2-wp15012-paper.pdf> (“During the last 20 years the number of SEP holders for 3G and 4G standards grew from 2 in 1994 to 130 in 2013 and the number of SEPs rose from fewer than 150 in 1994 to more than 150,000 in 2013.”).

a) Industry Reports: Royalty Rates in the “3G” Smartphone Market

Multiple industry reports provide reason to contemplate the possibility—more rigorously tested, as I describe subsequently,¹⁸¹ by empirical researchers—that the total royalty burden in the 3G smartphone market does not typically venture into the double-digit range commonly asserted in scholarly and policy discussions. First, that range is consistent with public statements by two leading handset makers at the time of the initial rollout of “3G” cellular devices: (i) in 2007, Ericsson’s chief technology officer stated that the total royalty rate burden for WCDMA technology is typically 4–5%;¹⁸² and (ii) in 2007, Nokia reported a total royalty rate burden for UMTS/WCDMA handsets of 3%.¹⁸³ Second, reports in the business press noted in 2006, 2009, and 2015 that Qualcomm, the industry’s principal licensor of CDMA-based chipsets to handset manufacturers, typically licenses its CDMA patents at approximately 5% of the handset’s wholesale price.¹⁸⁴ At a 2009 conference, Qualcomm’s Chief Operating Officer reportedly stated that Qualcomm assessed a royalty rate of 4–5% on its 3G CDMA licenses.¹⁸⁵ While the credibility of these statements should be discounted to some extent given potential strategic considerations, a 5% figure (applied to a truncated royalty base, which reduces even further the effective royalty rate) was also reported in connection with Qualcomm’s settlement of a Chinese government “anti-monopoly” investigation in 2015,¹⁸⁶ and rates of 5.25–5.75% have been

181. See *infra* Sections III.B.2.b–d.

182. See Geradin et al., *supra* note 14, at 154 (citing statement by president of Ericsson that the IPR rate for WCDMA and HSPA technologies is higher than 4–5% “on only a few occasions”).

183. Press Release, Nokia, Nokia Has Paid Less Than 3 Per Cent Gross Royalty Rate for WCDMA Handsets (Apr. 12, 2007), https://www.nokia.com/en_int/news/releases/2007/04/12/nokia-has-paid-less-than-3-per-cent-gross-royalty-rate-for-wcdma-handsets

184. See Mark Halper, *Nokia Battles Qualcomm Over Royalties*, FORTUNE (Dec. 19, 2006, 4:17 PM), http://archive.fortune.com/magazines/fortune/fortune_archive/2006/12/25/8396726/index.htm; Tammy Parker, *Qualcomm Focused on Bilateral Deals for LTE IPR*, TELECOMS.COM (Feb. 9, 2009, 1:16 PM), <http://telecoms.com/opinion/qualcomm-focused-on-bilateral-deals-for-lte-ipr/>; Don Clark, *Qualcomm’s Main Profit Driver is Under Pressure*, WALL ST. J. (Apr. 13, 2015, 7:36 PM), <https://www.wsj.com/articles/qualcomms-main-profit-driver-is-under-pressure-1428967051>.

185. See Scott Moritz, *Tech Rumor of the Day: Qualcomm*, THESTREET (June 24, 2009, 1:29 PM), <https://www.thestreet.com/story/10526160/1/tech-rumor-of-the-day-qualcomm.html>.

186. See Qualcomm, Annual Report (Form 10-K), at 10–11 (Nov. 4, 2015) (noting that Qualcomm had agreed with Chinese authorities to assess a royalty rate of 5% for 3G

reported in connection with Qualcomm licenses to Korean firms.¹⁸⁷ While the Qualcomm figure cannot fully reflect the aggregate royalty burden in the “3G” market given required patented inputs held by other suppliers, there is reason to believe that royalties payable to those other suppliers may not be significant given Qualcomm’s nearly exclusive position as the supplier of CDMA chipsets used in “3G” smartphones.¹⁸⁸ As discussed further below,¹⁸⁹ these anecdotal reports of royalty rates in the smartphone market turn out to be largely consistent with recent empirical studies.

b) Price Data in SEP-Reliant Industries

Professors Galetovic, Haber, and Levine examine “SEP-reliant” industries for evidence that these industries suffer from slower declines in quality-adjusted prices compared to “non-SEP-reliant” industries.¹⁹⁰ If the holdup and stacking hypotheses are correct, then the “excessive” royalties imposed by SEP-patent holders would raise prices for intermediate and end-users, slowing adoption and impeding entry. Yet the evidence shows the opposite is true.¹⁹¹ In this comparison, which mostly covers 1997–2013, SEP-reliant industries¹⁹² have faster quality-adjusted price declines relative to non-SEP-reliant industries.¹⁹³ To address the possibility that those differentials might reflect underlying industry-specific differences in innovative capacity, the authors compare quality-adjusted price declines in SEP-reliant and non-SEP-reliant industries that are subject to Moore’s

CDMA or WCDMA devices and 3.5% for 4G devices that do not use CDMA or WCDMA, but applied to a royalty base of 65% of the net sale price).

187. See DAVE MOCK, *THE QUALCOMM EQUATION* 177 (2005).

188. See DAVID S. EVANS, ANDREI HAGIU & RICHARD SCHMALENSEE, *INVISIBLE ENGINES: HOW SOFTWARE PLATFORMS DRIVE INNOVATION AND TRANSFORM INDUSTRIES* 191 n.13 (2006). Evans et al. note that Qualcomm owns “virtually all patents for CDMA”, all patents for CDMA2000, the “3G” standard promoted by Qualcomm, and 20% of the patents for WCDMA, an alternative “3G” standard promoted by European firms such as Ericsson and Nokia. See *id.*

189. See *infra* Section III.B.2.d.

190. See Alexander Galetovic, Stephen Haber & Ross Levine, *An Empirical Examination of Patent Holdup*, 11 J. COMPETITION L. & ECON. 549 (2015).

191. *Id.* at 554 (“In examining the dynamics of quality-adjusted prices, we do not find support for the SEP holdup hypothesis. On the contrary, we find that products that are SEP-reliant have experienced faster price declines than any other good in the Consumer Price Index (CPI) over the past 16 years.”)

192. *Id.* at 551–52. These include, for example, smartphone, computing, and certain other electronics industries. *Id.* at 552.

193. *Id.* at 552–53. Non-SEP-reliant industries that Galetovic et al. examined include, for example, the automotive industry. *Id.*

Law¹⁹⁴ (used as a proxy for innovative intensity).¹⁹⁵ The same result holds: SEP-reliant industries still experience faster quality-adjusted price declines than non-SEP-reliant industries.¹⁹⁶ While not definitive, this evidence is inconsistent with the holdup and stacking hypotheses which anticipate that intensive and fragmented patenting would result in higher quality-adjusted prices. In SEP-intensive markets, the opposite has occurred.

c) Indirect Indicators of Holdup and Stacking

In a 2015 paper and a 2016 paper coauthored with Professor Galetovic, Dr. Kirti Gupta assessed indirect indicators of potential holdup and stacking effects in the “3G” and “4G” mobile wireless communications markets.¹⁹⁷ Both papers are motivated by a simple question. If there *were* significant holdup and stacking effects, then we would expect to observe one or more of the following effects: (i) end-users experience increasing quality-adjusted prices (as a result of stacked royalties being passed on by handset manufacturers); (ii) handset manufacturers experience reduced profit margins (as a result of stacked royalties that cannot be passed on to consumers); or (iii) participants in standard-setting reduce R&D or reduce participation in SSOs.

None of these effects are observed. During 2004–2013, firms in the mobile wireless industry (and, in particular, manufacturers of standard-compliant products) exhibit increasing R&D investment,¹⁹⁸ increasing participation in standard-setting efforts,¹⁹⁹ and little change in gross profit margins.²⁰⁰ If we look for adverse effects at the consumer market level, there too the readings are negative: during 2000–2013, the flow of new wireless products increased (as measured by releases of new consumer devices in the 3G and 4G smartphone markets),²⁰¹ the number of unique manufacturers of mobile wireless devices increased,²⁰² and there was

194. Moore’s Law states that the number of transistors in an integrated circuit doubles approximately every two years. See Christian Chessman, A “Source” of Error: Computer Code, Criminal Defendants, and the Constitution, 105 CALIF. L. REV. 179, 180 (2017) (noting that Moore’s Law “has remarkably held true for the last fifty years”).

195. Galetovic et al., *supra* note 190 at 571–72.

196. *See id.*

197. Galetovic & Gupta, *supra* note 180; Kirti Gupta, *Technology Standards and Competition in the Mobile Wireless Industry*, 22 GEO. MASON L. REV. 865 (2015).

198. *See* Gupta, *supra* note 197, at 889–90; Galetovic & Gupta, *supra* note 180, at 3–5.

199. *See* Gupta, *supra* note 197, at 888–89.

200. *See id.* at 891–92; Galetovic & Gupta, *supra* note 180, at 24–25.

201. *See* Gupta, *supra* note 197, at 892–93.

202. *See id.* at 893–94.

frequent turnover in market share among leading manufacturers.²⁰³ In a 2016 paper, Keith Mallinson similarly observed a continuous flow of new models and continuous entry of new manufacturers in the smartphone market, as well as a decline in smartphone prices coupled with an increase in functionality.²⁰⁴ These indicators are simply not symptomatic of an industry in which patent holdup and stacking are endemic and royalty burdens are “exorbitant,” which should raise prices, slow down innovation, and discourage entry.

d) Estimating the “Royalty Stack”

In two papers published in 2015 and 2016, respectively, Keith Mallinson and J. Gregory Sidak have sought to estimate the aggregate “royalty stack” associated with SEPs in a smartphone device.²⁰⁵ In a 2018 publication, Alexander Galetovic, Stephen Haber, and Lew Zaretski developed a dataset for purposes of estimating the total royalty payments earned by licensors on SEPs and non-SEP patents in the mobile phone market.²⁰⁶ These empirical efforts go to the heart of the stacking thesis, which holds that the royalty stack inflates the price of the end-user product, thereby endangering the economic viability of the relevant market or pricing it out of the reach of many consumers. All three analyses reach results that are inconsistent with this thesis. The papers use publicly available data (principally, licensing revenues disclosed in securities filings by IP licensors) on, or make estimates of, the revenues of large public firms, patent pools, and smaller private firms derived from licensing out patents in

203. See *id.* at 893–94.

204. See Keith Mallinson, *Don’t Fix What Isn’t Broken: The Extraordinary Record of Innovation and Success in the Cellular Industry under Existing Licensing Practices*, 23 GEO. MASON L. REV. 967, 894–990, 993–94 (2016).

205. See J. Gregory Sidak, *What Aggregate Royalty Do Manufacturers of Mobile Phones Pay to License Standard-Essential Patents?*, 1 CRITERION J. ON INNOVATION 701 (2016); Mallinson, *supra* note 204; Keith Mallinson, *Cumulative Mobile-SEP Royalty Payments No More Than Around 5% of Mobile Handset Revenues*, WISEHARBOR (Aug. 19, 2015), <http://www.wisearbor.com/pdfs/Mallinson%20on%20cumulative%20mobile%20SEP%20royalties%20for%20IP%20Finance%202015Aug19.pdf>. Mallinson first presented the methodology for estimating the aggregate royalty burden in smartphone markets in a 2014 online publication. See Keith Mallinson, *Stacking the Deck in Analysis of Smartphone Licensing Costs*, IP FIN. (Sept. 19, 2014), <http://www.ip.finance/2014/09/stacking-deck-in-analysis-of-smartphone.html>.

206. See Alexander Galetovic, Stephen H. Haber & Lew Zaretski, *An Estimate of the Average Cumulative Royalty Yield in the World Mobile Phone Industry: Theory, Measurement and Results*, TELECOMM. POL’Y (forthcoming 2018).

the mobile phone market.²⁰⁷ Based on certain conservative assumptions and slightly different methodologies, all three studies reach the conclusion that royalties paid to SEP owners (or patent owners more broadly) in 2013, 2014, 2015 and 2016 for mobile handset devices fell within a range of 3–5.6% of global handset revenues.²⁰⁸ While there cannot be complete confidence in these estimated royalty ranges due to the confidentiality of specific licensing agreements and the varying quality of different data sources, these studies provide the best currently available estimate of the actual royalty stack borne by manufacturers and consumers in smartphone markets.

3. *Reevaluation: Why Evidence for Holdup and Stacking Is So Weak*

If evidence for the stacking and holdup theories is so weak, it is sensible to revisit those theories and in particular the assumptions on which those theories implicitly rely. That analysis shows that the welfare-depleting outcomes anticipated by the stacking and holdup theories rely on at least four assumptions that are typically not satisfied in real-world technology markets.

a) Faulty Assumption I: One-Shot Play

Firms invest heavily in the R&D required to launch a new technology standard, a high-risk process that can take up to a decade and is not assured to result in market adoption.²⁰⁹ And they anticipate doing that process all over again: in the mobile phone and smartphone market, “2G” is followed by “3G,” “4G,” and now “5G” is in development.²¹⁰ Hence, patent holders

207. All three papers rely on licensing revenues disclosed in audited financial statements filed by publicly traded patent licensors, maximum possible royalty rates based on patent pools’ publicly listed fee schedule, and inferred royalties earned by private IP licensors. *See id.* at 7–9; Sidak, *supra* note 205, at 703–19; Mallinson, *supra* note 205, at 4–5. Note that the bulk of the royalties paid in the mobile phone market are earned by five publicly traded patent holders and the data for those providers’ licensing revenues is the most reliable, *see* Sidak, *supra* note 205, at 718 tbl. 9; Mallinson, *supra* note 205 at 1–2; Galetovic, Haber & Zaretski, *supra* note 206, at 10.

208. Specifically, Mallinson estimates a total royalty rate payable to SEP owners in 2014 equal to approximately 5% of handset revenues, Mallinson, *supra* note 205, at 1; Sidak finds a total royalty rate payable to SEP owners in 2013 and 2014 equal to 4–5% of handset revenues, Sidak, *supra* note 205, at 701–02; and Galetovic, Haber & Zaretski find a total royalty rate payable to SEP and non-SEP owners in 2016 ranging from 3.4%–5.6% (depending on certain assumptions) of handset revenues, *supra* note 206, at 10–12.

209. On this point, *see* Gupta, *supra* note 197, at 869–74.

210. *See* Rana Pratap & Rahul Vijh, *5G Mobile Networks: The Next Big Battleground*, IPWATCHDOG (Mar. 31, 2016), <http://www.ipwatchdog.com/2016/03/31/5g-mobile->

have incentives to demand modest royalty rates in order to seed the market, elicit widespread adoption of the new standard, and establish a credible commitment to “reasonable” rates in order to promote adoption of upgrades and new standards in the future. Put differently: even powerful patent holders select *long-term* profit maximizing, not *short-term* profit maximizing, strategies. Repeat players would be foolish to forfeit a long-lived stream of gains, achieved by maintaining “good faith” pricing policies with intermediate users and end-users, in order to maximize short-term royalty streams. This is especially true in the SSO context in which firms seek to contribute not just to the initial release of a single standard, but to subsequent releases of that standard, and other standards in the future.²¹¹

b) Faulty Assumption II: Licensees Have No Foresight

Stacking and holdup theories implicitly assume that licensees have little foresight and do not calculate total future licensing costs in connection with adoption of a particular technology. A review of the practitioner literature shows that this is flatly untrue: the IP licensing trade literature discusses how to protect against “stacking” by using contract clauses that set a cap on the total royalty burden.²¹² Given licensee foresight into potential holdup and stacking behavior, it follows that licensors must set royalty rates in order to commit against that behavior and elicit adoption of their technology. This explains why leading handset makers and chipset providers in telecommunications markets reportedly strive to maintain a constant royalty rate over time²¹³ and some patent pools offer “post-netting” policies that reduce a licensee’s royalty rate to reflect royalty obligations to other technology holders.²¹⁴ Perceived “excessive” royalty

networks-next-big-battleground/id=67632/ (describing the evolution in smartphone technology from 2G through 5G).

211. See Joshua D. Wright, *SSOs, FRAND, and Antitrust: Lessons from the Economics of Contracts*, 21 GEO. MASON L. REV. 791, 879 (2014); Gupta, *supra* note 197, at 869-74.

212. See, e.g., Erik Verbraeken, *Drafting of Royalty Clauses: 30 Ways to Head for Windfall or Pitfall*, LES NOUVELLES 169-70 (Sept. 2011), http://lesnouvelles.lesi.org/lesnouvelles2011/les-Nouvelles_PDF-0911/3-Drafting-Of-Royalty-Clauses.pdf; Sharon Finch, *Royalty Rates: Current Issues and Trends*, 7 J. COM. BIOTECHNOLOGY 224, 229-30 (2001).

213. Qualcomm, the leading chipmaker in the handset market, claims to have maintained its royalty at a constant 5% of the handset’s wholesale price, see Parker, *supra* note 184.

214. I am referring to the practice of some patent pool administrators (for example, the One-Blue pool, which encompasses technology relating to Blu-Ray players), who commit to “post-netting” policies that reduce the royalty rate owed by any individual licensee if that licensee is already subject to royalty obligations with a pool member pursuant to an independent bilateral licensing agreement. See Ruud Peters, *One-Blue: A Blueprint for*

rates for any particular release trigger market punishment by promoting infringement and discouraging adoption, thereby endangering investment of time and resources in the R&D required to launch and then build upon a new technology.

c) Faulty Assumption III: Licensors Have No Competition

The stacking and holdup models not only must assume that sophisticated licensees lack foresight, but further assume that patent holders uniformly hold a unique technology to which there is no reasonable alternative in the near to mid-term. This is often, and perhaps even typically, not the case.

First, new technology standards often face competition from other existing standards (for example, the “war” between Blu-Ray and HD-DVD in the optical disc market), in which case patent holders have incentives to set especially low royalty rates in order to elicit adoption. This can be observed in the smartphone market, in which multiple overlapping standards have competed for adoption upon the release of “3G” and “4G” wireless technologies, which in turn must compete to attract handset manufacturers, telecom carriers, and end-users, who are already invested in the existing older technology and incur switching costs in abandoning it.²¹⁵ Standards competition at the intermediate user and end-user levels necessarily limits the pricing freedom of an upstream firm that cannot recoup and earn a return on its R&D investment without significant end-user adoption of its new technology.

Second, even well-established technology standards typically face some competition or can reasonably anticipate being confronted with competitive entry in the near to mid-term.²¹⁶ Consider Qualcomm, which holds what is widely recognized as an indispensable portfolio of patents underlying the CDMA technology used in “3G” smartphones. Stacking theory would contemplate that Qualcomm would set its royalty rate with complete disregard for other licensors’ pricing policies. That is not the case. First, even in the case of 3G CDMA technologies, in which Qualcomm holds a dominant patent position, it is reported that some telecom operators had initially adopted an alternative technology in which Qualcomm did not have a patent position.²¹⁷ Second, Qualcomm’s pricing decisions are

Patent Pools in High-Tech, INTELL. ASSET MGMT. 40 (Sept./Oct. 2011), http://www.oneblue.com/data/downloadables/4/5/iam-magazine_september-october-2011_article-oneblue.pdf.

215. See Mallinson, *supra* note 204, at 991–92.

216. See Barnett, *supra* note 84, at 41–43. On inter-standard competition in technology markets, see Gupta, *supra* note 197, at 871–72.

217. See MOCK, *supra* note 187, at 231.

necessarily influenced by the fact that, concurrently with the release of “3G” devices, industry players were already developing “4G LTE” technology, a future market in which Qualcomm did not expect to have a comparably dominant patent position. Hence, in 2008, Qualcomm announced that, in the 4G LTE market, it would reduce its royalty rate to approximately 3.25% to reflect its less dominant patent position as compared to the 3G CDMA market.²¹⁸ While that statement must be discounted to reflect potential strategic considerations, it is consistent with the notion that even powerful patent holders must take into account users’ concerns over future opportunism.

d) Faulty Assumption IV: Licensors Cannot Signal

Stacking models assume that licensors cannot signal pricing intentions to each other in order to avoid or mitigate double marginalization inefficiencies. Based on this expected market failure, conventional wisdom proposes either that antitrust regulators permit SSOs to set prespecified royalty caps; or judicial regulators “correct” market pricing through royalty caps in the form of reasonable royalty determinations. But this ignores a far less costly and more subtle market mechanism that mitigates stacking outcomes through signaling behavior. Leading patent holders in the wireless market periodically issue press releases indicating expected royalty rates. The rollout of the 4G LTE wireless standard illustrates this type of behavior. As shown in Table 2, major upstream technology providers issued statements indicating expected royalties in connection with the release of 3G and 4G LTE devices.²¹⁹

218. Press Release, Qualcomm, LTE/WiMax Patent Licensing Statement (Dec. 2008), <https://www.qualcomm.com/media/documents/files/lte-wimax-patent-licensing-statement.pdf>. As of 2015, industry commentary is consistent with this commitment, indicating that Qualcomm typically assesses a royalty of 3.5% on 4G devices. See Junko Yoshida, *China Deal Squeezes Royalty Cuts from Qualcomm*, EETIMES (Feb. 10, 2015, 10:15 AM), https://www.eetimes.com/document.asp?doc_id=1325631.

219. The statements below were initially sourced through Eric Stasik, *Royalty Rates and Licensing Strategies for Essential Patents on LTE (4G) Telecommunication Standards*, LES NOUVELLES 115 (Sept. 2010), <https://pdfs.semanticscholar.org/6eb5/1955ffbc2af76ff610dd7779e439a2b3825c.pdf>.

Table 2: Licensor Statements Relating to 3G and 4G Wireless Technology Royalties

| Firm | Date | Statement |
|----------------|------|---|
| Nokia | 2002 | Advocates industry-wide commitment to 5% cumulative royalty for W-CDMA technology. ²²⁰ |
| Alcatel-Lucent | 2008 | Commits to single-digit maximum aggregate royalties for LTE essential IPR in handsets. ²²¹ |
| Ericsson | 2008 | Same as above. ²²² |
| Qualcomm | 2008 | Commits to not increase royalties on 4G LTE above existing royalties on 3G CDMA devices. ²²³ |
| Nokia | 2010 | “To avoid unfavorable effects of royalty stacking,” Nokia pledges not to charge royalties greater than 2%. ²²⁴ |

While this signaling practice among upstream providers in the wireless markets deserves further empirical study (in particular, it is undetermined whether these signals are credible indicators of future licensing practice), it appears at least to be a plausible strategy by which firms with significant patent positions in a common standard can signal their pricing intentions, which in turn mitigates any double marginalization inefficiencies that could arise from uncoordinated pricing by multiple monopoly suppliers. This possibility is made more likely by the fact that a small group of five firms earns a majority percentage of licensing fees from SEPs used in mobile handsets,²²⁵ four of which issued statements as shown above. Consistent

220. Press Release, Nokia, Nokia Advocates Industry-Wide Commitment to 5% Cumulative IPR Royalty for WCDMA (May 8, 2002), https://www.nokia.com/en_int/news/releases/2002/05/08/nokia-advocates-industry-wide-commitment-to-5-cumulative-ipr-royalty-for-wcdma.

221. Press Release, Ericsson, Wireless Industry Leaders Commit to Framework for LTE Technology IPR Licensing (Apr. 14, 2008, 12:44 PM), <https://www.ericsson.com/en/press-releases/2008/4/wireless-industry-leaders-commit-to-framework-for-lte-technology-ipr-licensing>

222. *See id.*

223. Press Release, *supra* note 218.

224. *See* Stasik, *supra* note 219 (citing Press Release, Nokia, Nokia Licensing Policy on Long Term Evolution and Service Architecture Evolution Essential Patents, July 21, 2009, <http://web.archive.org/web/20101015065029/http://www.nokia.com/press/ipr-information/statement/nokia-licensing-policy-on-long-term-evolution-and-service-architecture-evolution-essential-patents> (last visited Dec. 31, 2017)).

225. These are Qualcomm, Ericsson, Nokia, Alcatel-Lucent, and InterDigital. *See* Sidak, *supra* note 205, at 718 tbl. 9; Mallinson, *supra* note 205, at 1–2.

with signaling models used in the context of tacit collusion to maintain pricing discipline among cartel members, small-numbers and repeat-play environments provide the most hospitable conditions in which signaling can plausibly influence third-party pricing behavior to mitigate double marginalization outcomes.

IV. RE-APPRECIATING THE IMPORTANCE OF INJUNCTIVE REMEDIES

So far three propositions have been established. First, courts and agencies rely to some significant extent on thicket, holdup, and stacking theories. Second, that reliance has translated into policy actions that have significantly limited the availability of injunctive relief and other remedies for important portions of the patentee population—including, it should be noted, certain firms that specialize in the upstream R&D that drives technology markets. Third, available data do not support the view that thicket, holdup, and stacking theories correspond to empirically salient phenomena. Given these propositions, it logically follows that we should revisit the policy actions that have been undertaken (and actions that are being discussed) on the basis of these theories. In particular, we should revisit the wisdom of any significant curtailment in patentees' ability to rely on injunctive relief against unconsented third-party use.

A. BACKGROUND AND APPROACH

Some observers date the historically strong regime of patent protection not to the establishment of the Federal Circuit in 1982 but rather to the shutdown in 1990 of Kodak's instant camera business as a result of its loss in a patent infringement litigation brought by Polaroid.²²⁶ Contemporary reports noted that the ruling “sent a message” that infringement resulted not just in a monetary penalty but a potential business shutdown.²²⁷ For commentators concerned with thicket, holdup, and stacking effects, the Kodak decision in 1990 planted the seeds for the “exorbitant” Blackberry settlement in 2006, to which the *eBay* decision effectively responded later that same year. As discussed above, the lower courts' application of *eBay*, coupled with actions undertaken by the antitrust agencies and court decisions relating to the determination of RAND royalties, have imposed significant limitations on patent holders' ability to seek injunctive relief.

226. See *Polaroid Corp. v. Eastman Kodak*, 641 F. Supp. 828 (D. Mass. 1985).

227. For contemporary observations to this effect, see Nancy J. Perry, *The Surprising New Power of Patents*, FORTUNE (June 23, 1986), http://archive.fortune.com/magazines/fortune/fortune_archive/1986/06/23/67747/index.htm.

This is a potentially dramatic step since injunctive relief supplies the legal bedrock on which patent licensing negotiations take place. In more recent contributions to the policy conversation, this risk has been emphasized by a handful of scholarly commentators²²⁸ and prominent policymakers (including the new head of the Antitrust Division in the Department of Justice²²⁹ and the acting Chair of the Federal Trade Commission²³⁰). Specifically, efforts to counteract perceived risks of holdup by patent owners inherently give rise to the potentially countervailing risk of *holdout* by third-party infringers, who strategically “renegotiate” royalties through protracted litigation in lieu of market negotiation. As discussed below, patent holdout is part of a broader set of market distortions that can arise from erosion of the injunction remedy in patent-intensive technology environments. Given those countervailing effects, policy actions that circumscribe the injunctive right (and truncate the damages spectrum) merit a careful balancing of the social costs and benefits associated with those actions.

B. COST-BENEFIT ANALYSIS

The literature on thicket, holdup, and stacking effects identifies the potential benefits from retracting injunctive relief and limiting patent damages—namely, a reduction in the opportunistic use of patents, and patent litigation in particular, to extract settlements that do not reflect the intrinsic value of the patented technology. If that were the *only* effect, then limiting injunctive relief would reduce intermediate users’ exposure to holdup and stacking effects, potentially resulting in some combination of dynamic efficiency gains in the form of more innovation and static efficiency gains in the form of reduced prices. Based on currently available evidence, however, these gains would appear to be limited since neither

228. See Epstein & Noroozi, *supra* note 88, at 20–23; J. Gregory Sidak, *The Meaning of FRAND, Part II: Injunctions*, 11 J. COMP. L. & ECON. 201, 234–37 (2015); F. Scott Kieff & Anne Layne-Farrar, *Incentive Effects from Different Approaches to Holdup Mitigation Surrounding Patent Remedies and Standard-Setting Organizations*, 9 J. COMP. L. & ECON. 1091, 1099–1100 (2013); Richard A. Epstein, F. Scott Kieff & Daniel F. Spulber, *The FTC, IP and SSOs: Government Hold-Up Replacing Private Coordination*, 8 J. COMP. L. & ECON. 1, 26–27 (2012); John M. Golden, *Principles for Patent Remedies*, 88 TEX. L. REV. 505, 580 (2010). For discussions that address both holdup and holdout concerns, see Chien, *supra* note 146; Cotter, *supra* note 146.

229. See *supra* note 41 (arguing that antitrust policy with respect to standard-setting organizations has overemphasized the risk of patent holdup and overlooked the risk of patent holdout when patent owners lack an injunctive remedy).

230. See Maureen K. Ohlhausen, *The Federal Trade Commission’s Path Ahead*, 2 CRITERION J. ON INNOVATION 31, 33–34 (2017) (noting weak evidence for patent holdup and recognizing possibility of patent holdout by infringers).

holdup nor stacking appears to be a regular and persistent occurrence in patent-intensive markets. The potential countervailing effect of retracting injunctive relief and limiting patent owners' remedies menu is a dynamic efficiency *loss* in the form of reduced innovation given a patent holder's reduced ability to extract a return on its R&D investment, which now must be negotiated under a reduced threat of infringement litigation. Relatedly, and what has not been sufficiently discussed in an otherwise rich literature on patent remedies,²³¹ eroding injunctive relief endangers the viability of knowledge transfer transactions among specialized parties that can execute different stages of the commercialization process most efficiently. Specifically, eroding the property-rights infrastructure in intangible goods markets is likely to give rise to efficiency losses in the form of three forms of resource misallocation: (i) asset mispricing; (ii) organizational distortion; and (iii) oligopsonistic collusion. While empirical inquiry is required to more precisely identify the likelihood and magnitude of these distortionary effects, I discuss preliminary illustrations of these effects based on the organizational and lobbying behavior of various participants in the mobile wireless market in which holdup and stacking concerns have been most commonly expressed.

1. *Legal Mispricing*

It is often stated (including in Justice Kennedy's concurrence to the *eBay* opinion) that a monetary remedy, in the form of a reasonable royalty, is sufficient to make whole an infringed-upon patentee, so long as the patentee is engaged in R&D solely or primarily for licensing purposes.²³² The rationale is simple: the licensor receives the income it would have received in a voluntarily negotiated transaction, thereby preserving its return on innovation, and the licensee can still enjoy access to the underlying technology, thereby reducing the deadweight losses inherent to any property rights protection for nonrivalrous goods. From an efficiency perspective, that would appear to be a "win-win" scenario. There are four reasons why this logic is faulty in any real-world litigation environment, in which case monetary remedies are likely to chronically yield distorted valuations relative to market negotiations.

231. For excellent reviews of the literature and the full range of policy tradeoffs, see THOMAS F. COTTER, *COMPARATIVE PATENT REMEDIES: A LEGAL AND ECONOMIC ANALYSIS* 39–75 (2013); Golden, *supra* note 228, at 525–51.

232. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 395–97 (2006) (Kennedy, J., concurring).

a) Informational Disadvantage

It is unlikely that a court will calculate the hypothetical royalty accurately, given that it operates at an informational disadvantage relative to market participants, who engage in licensing activities on a day-to-day basis.²³³ As F.A. Hayek famously observed, the key efficiency advantage of market-based transactions, as compared to any command-and-control mechanism, is that transacting parties harness information concerning the trade in question, thereby enabling that information to be embedded in the market price.²³⁴ The retraction of injunctive relief drives the pricing of some significant portion of intellectual assets from the market to the state, either due to infringement litigation brought by the patent holder or a strategic refusal to license on the part of an infringing user, who prefers to negotiate pricing through the costly and lengthy litigation process.²³⁵ Absent credible evidence of willful infringement, the alleged infringer is immune from the threat of treble damages and may rationally choose to compel the patentee to enforce its patent through litigation. Given courts' inherent informational disadvantage, compounded by the high costs of the litigation process, this shift from market pricing ("MP") to legal pricing ("LP") most likely imposes a social cost in the form of some deviation away from the most feasibly efficient pricing of those assets.

It may be objected that, in holdup and stacking cases, LP improves upon MP by precluding licensees from paying an "excessive" premium to the patent holder relative to an efficient pricing benchmark. Even granting that possibility, however, the strength of this objection depends on two factors: (i) the relative incidence of "legitimate" holdup and stacking scenarios, in which case LP outperforms MP by the assumption just made above, and (ii) the relative incidence of "illegitimate" claims of holdup and stacking (an inherent by-product of expanding access to LP), in which case LP almost certainly underperforms MP. Taking these factors into account, this objection is not especially compelling given available evidence suggesting that the incidence of holdup and stacking behavior is low. If that is the case, then the predominant effect of removing injunctive relief may be strategic recourse to LP by well-resourced intermediate users, resulting in a mispricing effect relative to a more secure property-rights environment.

233. For similar views, see COTTER, *supra* note 231, at 53–55.

234. See F.A. Hayek, *The Use of Knowledge in Society*, 4 AM. ECON. REV. 519, 525–27 (1945).

235. On the strategic use of patent litigation to set licensing terms in lieu of market negotiation, see Epstein & Noroozi, *supra* note 88, at 20–23; Sidak, *supra* note 228, at 234–37 (2015); Kieff & Layne-Farrar, *supra* note 228, at 1099–1100; Epstein, Kieff & Sulber, *supra* note 228, at 26–27 (2012); Golden, *supra* note 228, at 580.

b) Transaction Costs

Even if the royalty could be calculated correctly by courts, licensors must incur costs both to litigate and then collect on the royalty award from the noncooperative licensee. Hence, LP must outperform MP by a significant amount in order to overcome the inherently lower costs of market negotiation as compared to the adjudicative process. Litigation costs would almost certainly dwarf the costs typically incurred in the licensing negotiations that take place on a day-to-day basis in technology markets. Since courts in patent cases (like U.S. courts in civil litigation generally) do not generally shift attorneys' fees except if willful infringement can be shown,²³⁶ the royalty award is unlikely to make the patentee whole, resulting in chronic undercompensation. Additionally, given that the increased availability of LP will induce strategic refusals to license by well-resourced intermediate users (who will be advised to avoid making statements or taking actions that could be construed as willful infringement, which would raise the possibility of treble damages), total litigation costs are compounded as well-resourced intermediate users rationally elect LP over MP to negotiate the terms of access to required R&D inputs held by upstream entities.

c) Non-Price Terms

Even if the royalty could be calculated correctly *and* legal costs were shifted to prevailing patent holders, the royalty award would still not reflect the myriad of non-price terms that may be included in a negotiated license.²³⁷ In an unusual post-*eBay* opinion in which a court awarded injunctive relief to a nonpracticing patent holder (in this case, a research institute), the court astutely justified its ruling in part on the ground that a monetary damages award in the form of a "reasonable royalty" would not reflect the non-price terms that are typically part of a negotiated license transaction.²³⁸ Specifically, the court stated: "[A] royalty payment does not necessarily include other non-monetary license terms that are as important

236. The general principle that parties bear their own costs is known as the "American Rule." Hannah Jiam, *Fee-Shifting and Octane Fitness: An Empirical Approach Toward Understanding "Exceptional"*, 30 BERKELEY TECH. L.J. 611, 613 (2015) (discussing the American Rule and the Supreme Court's recent changes to it in patent law). For the governing statute, see 15 U.S.C. §284 (2012).

237. For similar observations, see J. Gregory Sidak, *Mandating Final-Offer Arbitration of FRAND Royalties for Standard-Essential Patents*, 18 STAN. TECH. L. REV. 1, 14 (2014).

238. *See id.*

to a licensor”²³⁹ Similarly, for purposes of determining the “reasonable royalty” damages awarded in the most recent RAND royalty decision, the court devoted extensive effort to evaluating experts’ efforts to translate comparable licenses into a royalty rate that reflects cross–licenses, legal releases and other non–monetary forms of consideration.²⁴⁰ While it is conceivable that courts could craft damages awards that would take into account the mix of price and non–price terms to perfectly mimic the fine details of market negotiations, that seems well beyond the realm of feasibility in real–world litigations.

d) Negative Feedback Effects

Even recognizing the inherent limitations of judicial pricing, it might nonetheless be argued that courts over time would improve in their ability to determine the “reasonable” royalty and thereby mimic efficient market transactions. The opposite is likely to be the case. Let’s assume that courts rely on market rates in determining the royalty that would have been determined in a hypothetical negotiation between patentee and infringer, following one factor in the governing “Georgia-Pacific” standard.²⁴¹ That might give comfort that LP would mimic MP, while surgically addressing periodic opportunistic uses of patents for holdup purposes. However, if (i) the availability of injunctive relief is limited and the patentee’s shutdown threat is therefore diluted, (ii) courts make errors in distinguishing between legitimate and opportunistic holdup and stacking claims, and (iii) litigation costs are significant and courts do not generally shift attorneys’ fees or award treble damages, then, even in scenarios not involving holdup or stacking behavior, well–resourced infringing parties will strategically shift pricing away from the markets and to the courts. The result would not only be an increase in the transaction costs associated with administering the patent system but a progressive contraction in the pool of pricing data from which courts can draw in making reasonable royalty determinations. Moreover, even the remaining pool of market transactions would yield

239. *Commonwealth Sci. Indus. Research Org. v. Buffalo Tech. Inc.*, 492 F. Supp. 2d 600, 606 (E.D. Tex. 2007) (“[A] royalty payment does not necessarily include other non-monetary license terms that are as important to a licensor”).

240. *See TCL Comm’n Tech. Holdings, Ltd. v. Telefonaktiebolaget LM Ericsson*, No. CV 15-2370 JVS(DFMX), 2017 WL 6611635, at *54–55, *61–89 (C.D. Cal. Dec. 21, 2017).

241. *See Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *modified and aff’d*, 446 F.2d 295 (2d Cir. 1971), *cert. denied*, 404 U.S. 870 (1971) (establishing the “Georgia-Pacific” standard and, in particular, factor two which refers to “rates paid by the licensee for the use of other patents comparable to the patent in suit”).

distorted pricing data given the absence of a credible threat of injunctive relief, which would result in an across-the-board discount on all patents.

2. *Organizational Distortion*

Any firm engaged in innovation must execute a sequence of tasks to deliver its innovations in a commercially viable form to the target consumption market and earn a return on its R&D investment. With respect to each task, the firm faces the “make/buy” decision that is familiar from the institutional economics literature in the tradition of Ronald Coase and Oliver Williamson.²⁴² From an efficiency perspective, we are indifferent to the firm’s make/buy decision at any specific point on the supply chain—namely, whether it executes a particular commercialization function internally or delegates it to more efficient outside providers. However, we are *not* indifferent as to whether the firm makes *efficient* make/buy decisions—that is, whether it makes decisions that minimize the total costs of commercializing its new technology and bringing it to market, thereby maximizing the net social gain generated by its R&D investment. In informational asset markets, firms face a challenge in achieving this goal. As noted initially by Kenneth Arrow, that is because transactions involving informational assets expose the holder to expropriation risk in the course of negotiating or executing those transactions with a potentially adverse counterparty.²⁴³ Absent strong reputational constraints that are only likely to apply in small-numbers, repeat-play settings, there is an inherent risk that the counterparty will use any disclosed information for its competitive advantage.

Broadly speaking (and again, excluding strong reputational constraints), there are two means by which to significantly mitigate this transactional conundrum: (i) vertical integration; and (ii) secure IP rights.²⁴⁴ The latter solution has a distinct advantage over the former: namely, vertical integration precludes contracting with outside parties, thereby foreclosing “buy” choices, while secure IP rights enable the innovator firm to select freely across the full spectrum of transactional options at any given point on

242. For the seminal sources, see WILLIAMSON, *supra* note 23; R. H. Coase, *The Nature of the Firm*, 4 *ECONOMICA* 386 (1937).

243. This is commonly known as Arrow’s “information paradox.” See Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY* 609 (1962).

244. There is a third option, consisting of various graduated disclosure mechanisms, in which the disclosing party gradually releases information about its innovation to a potential transacting partner. This cannot apply in circumstances involving “lumpy” technologies in which the underlying innovation is not amenable to step-by-step disclosure. I abstract away from this possibility because it is only likely to apply in specialized circumstances.

the supply chain. If that is the case, then any deviation from secure patent coverage—for example, limiting the availability of injunctive relief—may give rise to organizational distortions that skew innovators' choices toward vertically integrated commercialization structures as a solution to holdup. If complete vertical integration is not the cost-minimizing structure, then weakening or eliminating patent protection would have precisely the result typically attributed to *strengthening* patents—that is, it would inflate entry costs by compelling firms to undertake commercialization through integrated structures, which may *increase* the prices demanded from intermediate and end-users in the relevant market. Conversely (and paradoxically), strengthening patent protection would then have the opposite effect.

This risk of organizational distortion, and attendant increases in access costs, are particularly salient in the SEP-intensive technology markets in which thicket, holdup, and stacking concerns have been most commonly expressed. That is because some firms that are responsible for much of the innovation in these industries have adopted R&D—mostly vertically disintegrated structures that rely on contractual interactions with downstream partners to achieve commercialization and extract value from their R&D investments. The “fabless” segment of the semiconductor industry exemplifies this tie between patents, organizational choice, and innovation.²⁴⁵ Fabless firms, which primarily have capacities in semiconductor chip design, contract with stand-alone “foundries” for manufacturing functions. The fabless structure lowers entry costs by relieving the chip design firm from incurring, or having to raise sufficient capital to fund, the billions of dollars required to construct and maintain a new chip fabrication facility.²⁴⁶ However, it exposes the design firm to expropriation risk by the foundry and therefore relies on some combination of patents and know-how to sufficiently reduce expropriation risk and allow the transaction to move forward.

Two of the primary targets of FTC and private antitrust and patent-related litigation alleging holdup and “excessive” royalty demands are fabless firms: Qualcomm, the leading supplier of CDMA chipsets to the smartphone market, and Rambus, a smaller firm that has specialized in the design of memory chips that are licensed to chip manufacturers. These firms have mostly adopted vertically disintegrated models in which the firm concentrates principally on R&D activities while licensing IP into the

245. For a more extended analysis, see Jonathan M. Barnett, *Intellectual Property as a Law of Organization*, 84 S. CAL. L. REV. 785, 838–52 (2011).

246. *See id.*

downstream market or outsourcing the manufacturing and other tasks that must be executed to complete the pathway to market.²⁴⁷ As of 2015, Rambus earned 92% of its revenues from technology and patent licenses, the majority of which covers technology developed internally in a process of vertical disintegration.²⁴⁸ Qualcomm's history illustrates a progressive movement up the technology supply chain. In 1999, Qualcomm sold its wireless infrastructure business²⁴⁹ and handset manufacturing business,²⁵⁰ after which it has focused on the upstream R&D required to design and supply chipsets to handset manufacturers. Hence, Qualcomm is uniquely dependent on licensing revenues from its patent portfolio to fund and capture a return on its R&D investment. As shown in the Table 3, this upstream-heavy structure is reflected by the fact that both Qualcomm and Rambus maintain high R&D intensities that significantly exceed the R&D intensities of almost all other leading firms in the semiconductor and computing markets, especially firms that are principally active in mid-stream and downstream portions of the technology supply chain.

247. See Qualcomm, Annual Report (Form 10-K), at 9 (Nov. 4, 2015) (noting that the company relies on "independent third-party suppliers to perform the manufacturing and assembly, and most of the testing, of our integrated circuits based on our proprietary designs"); Rambus Inc., Annual Report (Form 10-K), at 5 (Feb. 20, 2015) (noting that a majority of the company's revenues are derived from patent licenses).

248. Rambus Inc., Annual Report (Form 10-K), at 5 (Feb. 20, 2015).

249. See Mark LaPedus, *Qualcomm, Ericsson Settle CDMA Squabble as Part of Larger Agreement*, EE TIMES (Mar. 25, 1999, 6:19 PM), https://www.eetimes.com/document.asp?doc_id=1120987.

250. See Loring Wirbel, *Qualcomm Sells CDMA Phone Division to Kyocera*, EE TIMES (Dec. 22, 1999, 7:48 PM), https://www.eetimes.com/document.asp?doc_id=1230103.

Table 3: R&D Intensities for Selected Leading IT Firms²⁵¹

| Firm | R&D Intensity (Fiscal Year 2016) | Primarily Upstream Activities? |
|-------------------|-------------------------------------|-----------------------------------|
| Rambus | 38.6% | Y |
| Marvell | 35.9% | Y |
| Nvidia | 21.2% | Y |
| Intel | 21.5% | N |
| Qualcomm | 21.9% | Y |
| Dolby | 21.6% | Y |
| Broadcom (Avago) | 18.7% | Y |
| Google (Alphabet) | 15.5% | N |
| Oracle | 16.3% | N |
| Microsoft | 14.5% | N |
| Cisco | 12.6% | N |
| Samsung | 7.3% | N |
| IBM | 7.5% | N |
| Panasonic | 5.9% | N |
| Sony | 5.9% | N |
| Toshiba | 6.1% | N |
| LG | 4.5% | N |
| HP | 2.5% | N |

The upstream, R&D—mostly structure of entities such as Qualcomm and Rambus contrasts with the vertically integrated structures maintained by semiconductor incumbents such as Intel, the world’s largest semiconductor manufacturer, which have been challenged by the entry of “fables” chip design firms that no longer need to match incumbents’ integrated

251. Figures calculated by author, based on disclosures in each firm’s most recent 10-K or 20-F filing with the SEC or, in the case of certain foreign companies, the annual report available on the firm’s website (in each case, for the 2016 fiscal year). R&D intensity is based on the standard definition of R&D expenditures as a share of total revenues. A firm was deemed to be “primarily engaged in upstream activities” if its revenue model relied principally on licensing IP assets to third parties, rather than using IP assets in conjunction with internal manufacturing and distribution operations. This determination reflects the author’s judgment, informed by the firm’s most recent annual reports. A broader understanding of “upstream activities” might reasonably capture firms such as Microsoft, Google, Cisco, and Oracle, which exhibit mid-range R&D intensities as shown above, and Intel, an integrated chip manufacturer that exhibits high R&D intensity reflecting its extensive design capacities.

manufacturing infrastructure. These entrants' disintegrated structures rely on a secure patent portfolio backed up by a credible litigation threat. By implication, weakening the security of patent rights would be expected to induce firms to integrate forward and internalize commercialization functions that had formerly been executed externally. This assertion does not seem to be merely theoretical. In 2015, Rambus announced that, given the change in the enforcement climate for patents in the United States, it had shifted strategy and would undertake to develop chips that it would sell directly into the market under its own brand, rather than solely or primarily licensing designs to firms located downstream in the semiconductor ecosystem.²⁵² Other leading fabless chip designers, such as Qualcomm and Broadcom, have recently entered into acquisition transactions involving firms with chip manufacturing capacities.²⁵³ While other factors may account for these transactions, at least one stated factor in Rambus' forward integration strategy is a decline in the ability to enforce its patent portfolio, which may have induced the firm to acquire complementary non-IP assets by which to extract returns from its R&D investment.²⁵⁴

3. *Oligopsony Risk and Rent Diversion*

It is commonly asserted that standard-setting arrangements raise the risk of collusion, enabling participants to use royalty streams to coordinate on the pricing of standardized inputs. Both SSOs and their close organizational relative patent pools, adopt structural features that are designed to limit collusion risk.²⁵⁵ In the case of SSOs, participants are specifically directed to refrain from engaging in discussions over the specific royalties that participant firms will charge for the use of technology

252. See Don Clark, *Rambus Expands with Its Own Chip Brand*, WALL ST. J. (Aug. 17, 2015, 12:00 AM), <https://www.wsj.com/articles/rambus-expands-with-its-own-chip-brand-1439784003>.

253. In October 2016, Qualcomm announced its acquisition of NXP Semiconductor, which has chip manufacturing capacities. See Don Clark & Tim Higgins, *Qualcomm to Buy NXP Semiconductors for \$39 Billion*, WALL ST. J. (Oct. 27, 2016, 6:37 PM), www.wsj.com/articles/qualcomm-to-buy-nxp-semiconductors-1477565063. In 2015, Avago Technologies, which has chip manufacturing locations, announced its acquisition of Broadcom, a leading fabless chip design firm. See Jeffrey McCracken, Alex Sherman & Ian King, *Avago to Buy Broadcom for \$37 Billion in Biggest Tech Deal Ever*, BLOOMBERG (May 28, 2015, 1:25 PM), <https://www.bloomberg.com/news/articles/2015-05-27/avago-said-near-deal-to-buy-wireless-chipmaker-broadcom>.

254. Clark, *supra* note 252 ("Rambus said the products, designed to boost the performance of server systems, are the latest step in a multiyear strategy to leave behind a business model linked to litigation.").

255. See Barnett, *supra* note 84, at 16.

incorporated in the standard.²⁵⁶ This effort to reduce collusion risk accounts in part for the vagueness of the RAND commitment undertaken by SSO members. In the case of patent pools, which explicitly set a common blanket royalty rate, the most widely used structures incorporate a variety of mechanisms designed to address this higher level of collusion risk. Most notably, contemporary patent pools are typically administered by independent third parties that have no business stake in the downstream market but *do* have a long-term stake in maintaining a reputation for “fair play,” which can then support the creation of new pools and the associated stream of transaction fees.²⁵⁷ Additionally, at least in the case of the leading pool administrator, MPEG LA, the pool operates under a nondiscrimination commitment, which means that any increase in the royalty rate is borne by all licensor-contributors to the pool, who therefore do not have a uniform interest in raising rates (and, if they are a net recipient of licensed technology from the pool, would have *no* interest in doing so).²⁵⁸

This risk of sell-side collusion through pooling arrangements certainly deserves serious consideration. However, SSOs and pooling arrangements also carry the risk of buy-side collusion.²⁵⁹ That is: there is a risk that these cooperative arrangements may set the price of technology inputs *too low*, rather than being set too high as is commonly alleged by commentators who raise holdup and stacking concerns. Three pieces of evidence support paying attention to this risk.

a) Pool Composition

In a previous study of pooling arrangements in the ICT market, I observed that whether measured by number of contributed patents or governance rights, the leading pools (specifically, the pools administered by the MPEG LA organization) are dominated by vertically integrated firms that have relatively low R&D intensities (all of those firms are among the laggards in Table 3).²⁶⁰ That suggests that these firms are net technology

256. See, e.g., Masoudi, *supra* note 25 (“[T]he IEEE policy permits its members to consider such costs only in generalized or non-collaborative ways. The policy ‘prohibits discussion of specific licensing terms within . . . standards development meetings’ . . .”).

257. See Barnett, *supra* note 84, at 21, 41–43.

258. See *id.* at 37–38.

259. For the only dedicated exploration of this possibility, see J. Gregory Sidak, *Patent Holdup and Oligopsonistic Collusion in Standard-Setting Organizations*, 5 J. COMPETITION L. & ECON. 123, 124 (2009) (“This rule-of-reason approach, however, is problematic because it conflicts with both the body of economic research on bidder collusion and with the antitrust jurisprudence on information exchange and facilitation of collusion.”).

260. See Barnett, *supra* note 84, at 28–29, 34.

users, in which case pools could be an attractive mechanism by which these firms can depress royalty rates, thereby reducing their technology input costs and enabling them to earn greater margins through the downstream manufacturing and distribution functions in which they excel. Corroborative evidence derives from the absence of Qualcomm (again, a regular target of litigation that targets “excessive” patent royalty rates) in patent pooling arrangements.²⁶¹ Given that Qualcomm holds critical technologies for CDMA technologies used in “3G” and “4G” wireless standards, it has little to gain from participating in patent pools that typically assign royalties based on simple numerical proportions, rather than a value-based standard.²⁶² But the decision of the highest-value patent holders not to participate in pooling arrangements may indicate that these pools threaten to operate as a collective buying mechanism by which to depress royalty rates below the level at which upstream R&D firms can earn a commensurate return. If that is the case, then there is no inherent reason to be alarmed over apparently high royalty demands being made by the highest-value patent holders, which may simply reflect an attempt by those holders to counteract the buying power of large net technology users and earn a return that reflects the value contributed by their R&D investment to the relevant technology package.

b) Lobbying Behavior

The oligopsony scenario is further supported by the revealed preferences of technology firms in recent SEP-related litigations concerning the determination of reasonable royalties for damages purposes and the availability of injunctive relief for RAND-encumbered patents. Those preferences can be imperfectly identified through the positions expressed in amicus briefs filed in those litigations. For purposes of the Table 4, a firm is deemed to favor the patentee if it expresses support for injunctive relief or a royalty determination methodology that would tend to advantage patentees; conversely, a firm is deemed to disfavor the patentee if it advocates limiting injunctive relief or expresses support for a royalty determination methodology that would tend to disadvantage patentees.²⁶³

In general, firms’ revealed preferences on injunctive relief and royalty determination methodologies track the predominant location of a firm on the supply chain. More specifically, firms primarily active at upstream

261. *See id.* at 34–35, 46–47.

262. *See id.* at 42–43.

263. Note that, in some cases, a firm may have been deemed to substantively favor the interests of patentees or infringers even if the firm’s amicus brief stated that it favored “neither party.”

portions of the supply chain (e.g., Qualcomm, Dolby and, in the smartphone market, Ericsson and Nokia) tend to take a position that would result in a higher royalty determination and/or preserve the availability of injunctive relief; firms that are primarily active at midstream or downstream portions (e.g., Dell, Verizon, T-Mobile, HP) or are fully integrated (Intel) tend to take a position that would result in a lower royalty determination and/or limit the availability of injunctive relief. There are some exceptions (for example, some upstream chip design firms disfavor the patentee in certain litigations²⁶⁴) but there is at least a suggestive correlation between IP preferences and organizational form. That suggests that calls to limit injunctive relief or reduce royalty rates, based on holdup and stacking concerns, may merely promote the private interests of downstream entities in reducing technology input costs, rather than a public interest in protecting consumers by constraining “exorbitant” payments to patent holders.

Table 4: Amicus Briefs Filed by Large Firms in “RAND” Royalty Litigations²⁶⁵

Legend: CD = chip design; CM = chip manufacturer; H = hardware; IPL = IP licensor; S = software; OEM = original equipment manufacturer

| Filer | <i>Apple v. Motorola</i> (2014): Favors Patentee? | <i>Ericsson v. D-Link</i> (2014): Favors Patentee? | <i>Microsoft v. Motorola</i> (2015): Favors Patentee? | <i>CSIRO v. Cisco</i> (2015): Favors Patentee? | Principal Activities on Supply Chain ²⁶⁶ |
|----------|---|--|---|--|---|
| Dolby | | Y | | | IPL |
| Nokia | Y | Y | Y | Y | IPL, H, S |
| Ericsson | Y* ²⁶⁷ | | | Y | IPL, H |
| Qualcomm | Y | Y | Y | Y | IPL, CD |
| Broadcom | | N | | | CD |

264. The firms are Broadcom, Marvell, MediaTek and Xilinx.

265. Companies are arranged from approximately upstream to downstream positions on the technology supply chain. All briefs filed as part of: (i) *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286 (Fed. Cir. 2014); (ii) *Ericsson, Inc. v. D-Link Systems, Inc.*, 773 F.3d 1201 (Fed. Cir. 2014); (iii) *Microsoft Corp. v. Motorola Inc.*, 795 F.3d 1024 (9th Cir. 2015); and (iv) *Commonwealth Scientific and Industrial Research Organization v. Cisco Systems, Inc.*, 809 F.3d 1295 (Fed. Cir. 2015).

266. Information in this column reflects the author’s judgment based on the firm’s description of its business operations, business strategies, key competitors, and core market segments as set forth in its most recent annual report filed with the SEC or available on the firm’s website and, in some cases, in the business press.

267. Ericsson’s amicus brief was filed in a closely related litigation originating in another federal court and involving the same parties, see Brief of Amicus Curiae, Ericsson Inc. in Support of Affirmance for Defendant Cross-Appellant Motorola Mobility LLC, *Apple Inc. v. Motorola Mobility LLC*, Nos. 2013-1150, 2013-1182 (Fed. Cir. Dec. 3, 2013), 2013 WL 663218.

| | | | | | |
|-----------|---|---|---|---|------------|
| Marvell | | N | | | CD |
| MediaTek | | N | | | CD |
| Xilinx | N | | N | | CD |
| Intel | N | | N | N | CD, CM |
| RIM | Y | | | | S |
| Microsoft | N | N | | | S |
| Apple | | | N | N | H, S |
| Cisco | N | N | | | H, S |
| Vizio | | | N | | OEM (TV) |
| Dell | | | N | N | OEM (PC) |
| HP | N | N | N | N | OEM (PC) |
| Ford | N | | | | OEM (Auto) |
| Verizon | N | | | | Telecom |
| T-Mobile | | | N | | Telecom |

c) The Economic History of the Smartphone

The connection between private interests in reducing technology input costs, on the one hand, and publicly–interested statements in favor of protecting the market against holdup and stacking effects, on the other hand, is illustrated by the historical evolution of the mobile wireless market.

i) The Positive Royalty Shock

Prior to the advent of the wireless market, telecom operators in the U.S. and Western Europe were typically national monopolies, which performed R&D internally and purchased equipment from outside manufacturers.²⁶⁸ Patents were not emphasized by system operators, which enjoyed government–sanctioned national monopolies, or by equipment manufacturers, which had limited ability to capture rents in a market dominated by what were effectively legally protected procurement monopolies.²⁶⁹ In the European wireless telecom market, the “GSM” standard initially dominated (starting in the early 1990s), at which time the largest European handset manufacturers (specifically Ericsson, Nokia, Siemens, and Alcatel) and one American firm (Motorola)²⁷⁰ reportedly operated under cross–licensing arrangements that substituted technology–

268. See Rudi Bekkers, Geert Duysters & Bart Verspagen, *Intellectual Property Rights, Strategic Technology Agreements and Market Structure: The Case of GSM*, 3 RES. POL'Y 1141, 1144 (2002).

269. See *id.*

270. See *id.* at 1147.

sharing for royalty payments among the participating firms.²⁷¹ At approximately the same time, some of those manufacturers had formed a joint venture to develop an operating system for mobile phones, called Symbian, available to all joint venture members.²⁷² Both cooperative actions appear to have had a common objective: namely, to commoditize key upstream components of the mobile phone “stack” (the chipset and the OS), which would then enable the manufacturers to capture the bulk of available rents in the market.²⁷³ While this cross-licensing arrangement operated to the advantage of these five major firms (who then constituted approximately 85% of the European GSM market²⁷⁴), it effectively operated as an entry barrier into the European GSM market for other firms (in particular, Korean, Japanese and smaller European manufacturers), who could not access the required technology or could only do so after considerable delay or at significantly higher royalty rates.²⁷⁵

Once the “3G” (also known in Europe as the “UMTS”) wireless standard was developed in the early 2000s and endorsed by European regulators, GSM was substantially displaced by the technically superior CDMA technology (that had been pioneered by Qualcomm and in which it held a dominant patent position).²⁷⁶ Unlike the club of European handset makers that dominated the GSM market, Qualcomm has licensed its CDMA technology widely to hundreds of licensees across the wireless device

271. See West, *supra* note 172, at 126–27; Rudi Bekkers, Bart Verspagen & Jan Smits, *Intellectual Property Rights and Standardization: The Case of GSM*, 26 TELECOMM. POL’Y 171, 179–80 (2002).

272. See EVANS ET AL., *supra* note 188, at 194–95.

273. On this interpretation of the Symbian OS joint venture, see EVANS ET AL., *supra* note 188, at 270.

274. See Bekkers et al., *supra* note 268, at 1143.

275. See Whasun Jho, *Global Political Economy of Technology Standardization: A Case of the Korean Mobile Telecommunications Market*, 31 TELECOMM. POL’Y 124, 129 (2007) (noting that dominant European wireless firms would not supply Korean firms with access to required technology); Bekkers et al., *supra* note 271, at 180 (noting that cross-licensing among European firms posed entry barriers and Japanese terminal suppliers experienced a six-year delay in obtaining licenses to the necessary GSM technology). Bekkers et al., *supra* note 268, at 1147, 1158 (noting that inability to secure necessary licenses to GSM technology blocked Japanese and smaller European suppliers from the market or compelled those suppliers to pay a high royalty).

276. On the technical superiority of CDMA relative to GSM, and the transition from GSM to CDMA, respectively, see HARALD GRUBER, *THE ECONOMICS OF MOBILE TELECOMMUNICATIONS* 23, 243–44 (2005). On the transition from GSM to CDMA, and the value of Qualcomm’s CDMA portfolio, respectively, see Bekkers & West, *supra* note 164, at 81–82 and *id.* at 85, 90–91.

market.²⁷⁷ This is no accident: an upstream R&D holder has a natural incentive to license to all interested parties in order to maximize the size of its royalty base; by contrast, a vertically integrated firm may have no incentive to license a valuable IP asset to strategic competitors. As a result of Qualcomm's licensing activities, formerly dominant handset manufacturers like Ericsson and Nokia now faced a positive royalty burden,²⁷⁸ as well as competition from other manufacturers (most notably, Korean firms, Samsung and LG) that had entered the market by licensing Qualcomm's CDMA technology.²⁷⁹ Perhaps not coincidentally, it is precisely at this moment that Ericsson, Nokia, and other major device manufacturers lobbied European Union antitrust authorities to pursue "abuse of dominance" claims against Qualcomm for "exorbitant" licensing policies.²⁸⁰

ii) Lessons for Patent Policy Analysis

The history of the smartphone market, and the shift in industry rents associated with the emergence of Qualcomm's CDMA as the prevailing "3G" technology, illustrates an important baseline insight for policy discussions of stacking and holdup effects. Any sophisticated analysis must at a minimum recognize that lobbying efforts by manufacturers and other downstream entities, and associated publicly-interested arguments, to characterize patent royalty rates as a case of "holdup" may simply represent an effort to reallocate industry rents to the advantage of downstream

277. On Qualcomm's licensing practices, see Qualcomm, Annual Report (Form 10-K), at 7 (Nov. 2, 2016) (stating that Qualcomm has licensed its CDMA technology to more than 330 licensees, "including leading wireless device and infrastructure manufacturers"). On Qualcomm's licensing practices specifically in Korea, see Whasun Jho, *Global Political Economy of Technology Standardization: A Case of the Korean Mobile Telecommunications Market*, 31 TELECOMM. POL'Y 124, 129, 132 (2007).

278. See West, *supra* note 172, at 126–27.

279. See Jho, *supra* note 275, at 129 (noting that Qualcomm, unlike dominant European wireless firms, agreed in the 1990s to license wireless communications technology to Korean firms); *id.* at 135 (noting that, by 2003, Korean firms were among the world's leading handset manufacturers).

280. Press Release, European Comm'n, Commission Initiates Formal Proceedings Against Qualcomm (Oct. 1, 2007), http://europa.eu/rapid/press-release_MEMO-07-389_en.htm. The release notes that the Commission had initiated formal antitrust proceedings against Qualcomm based on "abuse of a dominant market position" as the holder of IP rights in the CDMA and WCDMA technologies that "form[] part of the 3G . . . standard" *Id.* The investigation was subsequently withdrawn. See Adam Cohen, *European Commission Closes Qualcomm Investigation*, WALL ST. J. (Nov. 25, 2009), <https://www.wsj.com/articles/SB10001424052748704779704574555083176252374>.

implementer entities and the disadvantage of upstream R&D suppliers.²⁸¹ This is at least facially the case, for example, with respect to substantial fines recently assessed by competition authorities in several jurisdictions against Qualcomm, including: (i) China, which assessed a \$975 million fine in 2015 against Qualcomm, in connection with which Qualcomm reduced its royalty rates for local device manufacturers;²⁸² (ii) South Korea, which assessed an \$835 million fine in 2016 against Qualcomm with respect to its licensing practices toward local device manufacturers;²⁸³ and (iii) Taiwan, which assessed a \$774 million fine in 2017 against Qualcomm with respect to its licensing practices toward local device manufacturers.²⁸⁴ There is obviously no inherent reason to believe that downstream manufacturers' interest in private value-maximization necessarily coincides with the public interest in social value-maximization. Restraining injunctive relief and reducing royalty rates for patent holders clearly has distributive implications for the division of wealth between upstream and downstream firms, favoring the latter over the former. But this reallocation of industry rents along the supply chain—which would otherwise be a matter of indifference from an efficiency perspective—may generate medium to long-term efficiency losses to the extent that shifting value toward downstream firms results in royalty streams that fail to sufficiently compensate upstream R&D suppliers (or compels those suppliers to adopt second-best integrated structures in response to an insecure property rights environment). If that is the case, then end-users would potentially enjoy a short-term static gain in the form of reduced prices (depending on competitive conditions at the intermediate user level) at the price of long-term losses in the form of reduced innovation. That would seem to be a short-sighted choice.

281. Relatedly, John Golden has cautioned that post-*eBay* legal reforms that preclude injunctive relief for patent licensors that lack manufacturing capacities privilege incumbents that already have those capacities. See Golden, *supra* note 228, at 556–57.

282. See Don Clark, *Qualcomm to Pay \$975 Million Antitrust Fine to China*, WALL ST. J. (Feb. 10, 2015, 4:37 AM), <https://www.wsj.com/articles/qualcomm-settles-china-probe-1423518143>. For further details on the agreed-upon royalty rate, see Qualcomm, Annual Report (Form 10-K), at 10–11 (Nov. 4, 2015).

283. See Eun-Young Jeong, *Qualcomm Faces \$835 Million Fine from South Korea Over Alleged Antitrust Violations*, WALL ST. J. (Dec. 28, 2016, 4:32 AM), www.wsj.com/articles/qualcomm-fined-more-than-850-million-in-south-korea-for-alleged-antitrust-violations-company-to-fight-decision-1482894283.

284. See *Qualcomm Fined Record \$773 Million Fine in Taiwan Antitrust Probe*, BLOOMBERG NEWS (Oct. 11, 2017, 4:41 AM), <https://www.bloomberg.com/news/articles/2017-10-11/qualcomm-fined-773-million-in-taiwan-for-antitrust-violations>.

C. WEIGHING THE RISKS

There are countervailing effects that result from maintaining secure expectations of injunctive relief as compared to a legal regime in which those expectations are insecure and patentees must rely on costly litigation in order to secure monetary damages through an institutional mechanism that is prone to error and delay. On the one hand, it may be the case that strong forms of patent protection give rise to some combination of thicket, holdup, and stacking effects that discourage innovation and inflate intermediate and end-user costs. On the other hand, weak forms of patent protection may result in some combination of asset mispricing, organizational distortion and oligopsony risk. Given these offsetting considerations, a priori it is impossible to anticipate the precise policy implications in any particular market segment of maintaining, or diluting, the menu of injunctive and monetary remedies available to patent holders.²⁸⁵ However, based on our current knowledge base, it *is* possible to state with relative confidence the likely range of policy consequences that would arise from doing so, at least in the SEP-intensive IT markets that have now been subjected to close empirical scrutiny. That knowledge base indicates that we have little reason to believe that thicket, holdup, and stacking effects are regularly and persistently occurring phenomena that impose significant social costs, especially in the SEP-intensive technology markets in which those concerns have been most commonly expressed. Subject to further empirical inquiry, we *do* have reason to believe that eroding the availability of injunctive relief in those market segments is likely to give rise to several socially harmful effects, including legal mispricing, organizational distortions, and rent-diversion effects that would perversely undercompensate upstream entities that have often been the most fertile sources of innovation in IT markets.

V. CONCLUSION

The frequency and vigor with which thicket, holdup, and stacking theories are promoted or adopted by some scholars, courts, and antitrust agencies does not match the weak evidence for these theories. If we take a broader view of technology markets, this lack of empirical support is unsurprising. While much of the academic literature has been foretelling the

285. For similar observations on the inherent indeterminacy of a socially optimal damages regime for patent holders, see COTTER, *supra* note 231, at 51; Golden, *supra* note 228, at 511–12, 529. Cotter ultimately argues for a general presumption in favor of injunctive relief, with latitude for courts to make exceptions and tailor remedies in cases that indicate a high risk of holdup or present other public interest considerations. See COTTER, *supra* note 231, at 74.

downfall of technology markets under the weight of a purportedly overgrown patent system, those same markets have thrived and expanded, delivering innovations that were once unimaginable and at prices that are affordable to a broad range of the consumer population. Over the course of several decades, remarkable innovations in computing and communications technologies—often standardized through the SSO process in which thickets, holdup and stacking are alleged to pose such serious risks—have not only drastically reduced communications costs but have done so at rapidly declining quality-adjusted prices, resulting in a social “win-win” of increasing innovation and decreasing prices. The mismatch between scholarly theory and empirical reality calls for a rethinking of actions by courts and regulators that have already partially displaced property-rule protections with liability-rule protections for intellectual assets. If information technology markets have grown and prospered under the “burden” of intensive patent issuance and enforcement (and principally in the jurisdiction in which patent protection has been most “burdensome”), then perhaps it is time to reconsider whether that property-rights system is such a burden after all.