
FINDING REASONABLE ROYALTY DAMAGES: A CONTRACT APPROACH TO PATENT INFRINGEMENT

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There is considerable controversy regarding the calculation of damages in patent infringement cases. To help resolve this controversy, the Article introduces a contract approach to patent infringement and develops a methodology for finding reasonable royalty damages. The contract approach complements approaches based on property and tort, thus providing a more complete understanding of damages. The Article introduces the concept of an “informed contract” as the basis for damages. The Article argues that an “informed contract” improves estimation of damages by taking into account information revealed during the period of infringement. The Article also introduces a “market value method” for calculating reasonable royalty damages based on patent transfer prices. The contract approach helps calculate reasonable royalty damages based on royalties in comparable patent licenses. The contract approach addresses various controversies over reasonable royalty damages.

Keywords: Patent, contract, infringement, damages, reasonable royalties.

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I. INTRODUCTION

Patents play a significant role in the extensive \$305 billion global market for Intellectual Property (“IP”).¹ Patents contribute to the intangible real assets of corporations and support a wide variety of transactions including licensing, cross-licensing, transfers, joint ventures, mergers, and financing of research and development (“R&D”). Patent applications worldwide per year reached 2,888,800, with grants of 1,240,000 million patents.²

Markets for IP depend on effective legal protections for patent owners.³ There is, however, considerable controversy in patent law regarding damages for patent infringement.⁴ As Peter Menell et al. observe, “One of the most vexing issues in patent law is the proper measure of damages.”⁵ The various legal and economic methodologies for determining reasonable royalty damages produce inconsistent results.⁶ These differences in measures of damages can have signif-

1. North American IP owners received payments of \$131 billion. WTO, WORLD TRADE STATISTICAL REVIEW 2016 122 (2016) (showing North American IP owners received payments of \$131 billion in 2015), https://www.wto.org/english/res_e/statis_e/wts2016_e/wts2016_e.pdf.

2. Data are for 2015. WIPO, WORLD INTELLECTUAL PROPERTY INDICATORS 2016 7, 28 (2016), <http://www.wipo.int/publications/en/details.jsp?id=4138&plang=EN>.

3. See Walter G. Park, *International Patent Protection: 1960-2005*, 37 RES. POL’Y 761, 766 (2008); David Riker, *Intellectual Property Rights and International Receipts of Royalties and Licensing Fees* 1 (USITC, Working Paper No. 2014-08C, 2014), <https://www.usitc.gov/publications/332/ec201408c.pdf>.

4. See Zelin Yang, *Damaging Royalties: An Overview of Reasonable Royalty Damages*, 29 BERKELEY TECH. L.J. 647, 648 (2014); see also Ray J. Epstein & Paul Malherbe, *Reasonable Royalty Patent Infringement Damages After Uniloc*, 39 AIPLA Q.J. 3, 5 (2011); Layne S. Keele, *Res’Q’ing Patent Infringement Damages After ResQNET: The Dangers of Litigation Licenses as Evidence of Reasonable Royalty*, 20 TEX. INTELL. PROP. L.J. 181, 183 (2011); Erick S. Lee, *Historical Perspectives on Reasonable Royalty Damages and Current Congressional Efforts for Reform*, 13 UCLA J.L. & TECH. 1, 1 (2009) (“[T]he issue of patent damages has become a major point of contention and the subject of debate by legal scholars, legislators, and heads of business.”); Christopher B. Seaman, *Reconsidering the Georgia-Pacific Standard for Reasonable Royalty Patent Damages*, 2010 BYU L. REV. 1661, 1661 (2010) (“Determining damages for infringement is one of the most important—and controversial—issues in current patent litigation.”).

5. PETER S. MENELL ET AL., FED. JUDICIAL CTR., PATENT CASE MANAGEMENT JUDICIAL GUIDE 7–17 (3rd ed. 2016), https://www.fjc.gov/sites/default/files/2017/PCMIG3d_2016_final.pdf.

6. Yang, *supra* note 4, at 648.

icant financial implications for patent owners and infringers. Measures of damages significantly affect IP licensing decisions and incentives for invention and innovation.⁷

To help resolve this controversy, I propose a *contract approach* to reasonable royalty damages for patent infringement. Royalties are the consideration in patent license contracts.⁸ The only way to understand reasonable royalties as a damage remedy is within the context of a patent license contract. I introduce the concept of an “informed contract” that is based on information revealed during the period of infringement. The court constructs an “informed contract” based on evidence in the patent case, thus providing greater accuracy in determining damages. I show how addressing damages from a contractual perspective helps address many of the issues in patent disputes.⁹

There are more than 5,000 patent case filings per year in the U.S.¹⁰ Reasonable royalty damages for patent infringement are essential to enforcing patents and compensating patent owners. Reasonable royalty damages are awarded either in addition to lost profits or instead of lost profits when there are no lost profits or lost profits cannot be measured.¹¹ In the U.S. from 2007–2016, firms that practice patents were involved in about four-fifths of infringement cases and received damages consisting of 21% lost profits only, 61% reasonable royalties only, and 19% a combination of lost profits and reasonable royalties.¹² The remaining one-fifth of infringement cases involved nonpracticing entities (firms, individuals, universities, and other nonprofits) that only can receive reasonable royalty damages.¹³

Determining damages for infringement has reached something of an impasse. The courts have struck down various traditional methods of calculating reasonable royalty damages such as the 25% of profits rule without identifying alternative methods.¹⁴ The “hypothetical negotiation” approach has proven to be

7. *Id.* at 652.

8. See Daniel F. Spulber, *Intellectual Contract and Intellectual Law*, J. TECH. L. & POL’Y, (forthcoming 2018).

9. Elsewhere I introduce the concepts of “Intellectual Contract” and “Intellectual Tort” within the context of new framework that I refer to as “Intellectual Law”. *Id.* at 1.

10. CHRIS BARRY ET AL., PWC, 2017 PATENT LITIGATION STUDY: CHANGE ON THE HORIZON? 4 (May 2017), <https://www.pwc.com/us/en/forensic-services/publications/assets/2017-patent-litigation-study.pdf> [hereinafter 2017 PATENT LITIGATION STUDY].

11. Laura B. Pincus, *Computation of Damages in Patent Infringement Actions*, 5 HARV. J.L. & TECH. 95, 120 (1991) (“Damages in the form of a reasonable royalty are generally awarded when the calculation of lost profits is considered too speculative, or when no actual damage in the form of lost sales has occurred or has been proven.”).

12. 2017 PATENT LITIGATION STUDY, *supra* note 10, at 11.

13. *Id.*

14. See Jonathan S. Masur, *The Use and Misuse of Patent Licenses*, 110 NW. U.L. REV. 115, 119 (2015) (“But the result has been to leave courts almost entirely at sea and at the mercy of the parties’ experts attempting to assess damages.”). The courts are rejecting arbitrary heuristics, although some argue in favor of heuristics as a means of lowering legal costs. See Thomas Cotter, *Patent Damages Heuristics*, 25 TEX. INTELL. PROP. L.J. 159, 162–63, 211 (forthcoming 2018).

problematic and impractical.¹⁵ Also, the courts have become more active as gatekeepers with increased scrutiny of expert testimony.¹⁶ According to the Supreme Court in *Daubert*, the trial judge must decide whether an expert's "reasoning or methodology properly can be applied to the facts in issue."¹⁷ In spite of the greater focus on evidence for reasonable royalty damages, the legal controversy has only intensified.

In my view, the patent law controversy stems from a conflict between property and tort approaches. Many advocate a property approach to infringement. Roger Blair and Thomas Cotter state that "[a] substantial number of the law and economics scholars who have written on this subject appear to agree that it is generally preferable to protect intellectual property rights through the use of property, as opposed to liability, rules."¹⁸ Stewart Sterk points out that "[a]lthough intellectual property doctrine has borrowed much from real property doctrine, it has not yet recognized the important role of negligence principles in cases where the title and scope of rights are less than crystal clear."¹⁹ In contrast, many others argue that patent law takes a tort approach and places various limits

15. Masur, *supra* note 14, at 122–23.

16. See Catherine E. Brixen & Christine E. Meis, *Codifying the Daubert Trilogy: The Amendment to Federal Rule of Evidence 702*, 40 JURIMETRICS 527, 528 (1999); Michael H. Graham, *The Expert Witness Predicament: Determining "Reliable" Under the Gatekeeping Test of Daubert, Kumho, and Proposed Amended Rule 702 of the Federal Rules of Evidence*, 54 U. MIAMI L. REV. 317, 356 (2000); Michael C. McCarthy, *Helpful or Reasonably Reliable Analyzing the Expert Witness's Methodology Under Federal Rules of Evidence 702 and 703*, 77 CORNELL L. REV. 350, 353 (1991); Craig Lee Montz, *Trial Judges as Scientific Gatekeepers After Daubert, Joiner, Kumho Tire, and Amended Rule 702: Is Anyone Still Seriously Buying This?*, 33 UWLA L. REV. 87, 90 (2001).

17. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 592–93 (1993); see also FED. R. EVID. 104 ("The court must decide any preliminary question about whether a witness is qualified, a privilege exists, or evidence is admissible."); FED. R. EVID. 702 ("A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case."); *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 141 (1999); *IP Innovation, L.L.C. v. Red Hat, Inc.*, 705 F. Supp. 2d 687, 691 (E.D. Tex. 2010) ("The parties are reminded that expert testimony on the topic of damages will not be allowed absent a firm basis in accepted economic principles with an eye to the facts of this record."). According to the Federal Rules of Evidence, Rule 702. Testimony by an Expert Witnesses:

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.

FED. R. EVID. 702

18. Roger D. Blair & Thomas F. Cotter, *An Economic Analysis of Damages Rules in Intellectual Property Law*, 39 WM. & MARY L. REV. 1585, 1615 (1997); see also Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1525 (2006) ("Patent infringement is a strict liability offense."); Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293, 1294 (1996); Robert P. Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 75 (1994).

19. Stewart E. Sterk, *Strict Liability and Negligence in Property Theory*, 160 U. PA. L. REV. 2129, 2156 (2012).

on strict liability for infringement.²⁰ Ted Sichelman observes that “patent remedies mirror traditional tort law remedies by attempting to restore the patentee to the status quo ante—namely, the state of the world in which there is no infringement of the patent.”²¹ Keith Hylton considers enhanced damages for patent infringement and notes “[t]he torts literature on which I rely typically examines damages awards in the context of a lawsuit between a victim and an ‘injurer.’”²²

But a patent license agreement is a *contract*. Indeed, patent license agreements are perhaps the most common type of contract.²³ Patent license agreements are subject to contract law.²⁴ Patent license agreements are contracts for the purpose of commercializing inventions.²⁵ According to the Code of Federal Regulations:

A patent license is, in effect, a contractual agreement that the patent owner will not sue the licensee for patent infringement if the licensee makes, uses, offers for sale, sells, or imports the claimed invention, as long as the licensee fulfills its obligations and operates within the bounds delineated by the license agreement.²⁶

I argue that the court in a patent case should construct an “informed contract” based on available evidence. In practice, the court does exactly that, naturally filling in many of the terms of an “informed contract.” The court’s construction of an “informed contract” typically reflects what actually happened in the course of infringement.²⁷ The court’s interpretation of the “informed contract” provides a sound economic and legal basis for determining reasonable royalty damages.

The contract approach proposed here views infringement as a failure to contract. Infringement disputes can be avoided or resolved by a patent license

20. See Roger D. Blair & Thomas F. Cotter, *Strict Liability and Its Alternatives in Patent Law*, 17 BERKELEY TECH. L.J. 799, 800 (2002) (“Patent infringement is often characterized as a strict liability tort, and in some ways it is. But it is not strict liability in the purest sense, or at least not in the sense in which the term is used in general tort law.”).

21. Ted Sichelman, *Purging Patent Law of Private Law Remedies*, 92 TEX. L. REV. 517, 519 (2013); see also John C. Jarosz & Michael J. Chapman, *The Hypothetical Negotiation and Reasonable Royalty Damages: The Tail Wagging the Dog*, 16 STAN. TECH. L. REV. 769, 786 (2013) (“[R]easonable royalty damages are a form of general damages intended to compensate for the tort of patent infringement.”).

22. Keith N. Hylton, *Enhanced Damages for Patent Infringement: A Normative Approach*, 36 REV. LITIG. 417, 421 (2017).

23. Bharat N. Anand & Tarun Khanna, *The Structure of Licensing Contracts*, 48 J. INDUS. ECON. 103, 103 (2000).

24. Phillip B.C. Jones, *Violation of a Patent License Restriction: Breach of Contract or Patent Infringement?*, 33 IDEA 225, 226 (1992) (“[A] patent licensing agreement is a contract which is governed by principles of state contract law.”).

25. *Licensing Agreement*, BLACK’S LAW DICTIONARY (2d ed. Online), <https://thelawdictionary.org/licensing-agreement/> (defining licensing agreement as “[w]ritten contract between the owner/licensor of a patent, copyright, trademark, know-how, service mark, or other intellectual property, and a licensee to use, make, or sell copies of the original Commercialization of a technology is a major purpose for licensing agreements. These contracts typically (1) limit the licensee’s scope or field, (2) make the license exclusive or nonexclusive, (3) demands royalties or other compensation if further licensing occurs by the licensee.”).

26. U.S. PATENT AND TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 301 (9th ed. 2017), <https://www.uspto.gov/web/offices/pac/mpep/s301.html#d0e17687>.

27. See discussion *infra* Section II.C.

contract between the patent holder and the technology implementer.²⁸ This implies that remedies for infringement should be grounded in contract law. Remedies based on contracts apply whether infringement is intentional or inadvertent.²⁹ Because patent license contracts include royalties, the structure of licensing contracts helps in finding reasonable royalty damages.

The contract approach offered in this Article provides methodologies for finding reasonable royalty damages and suggests what evidence should be obtained in the patent case. Based on the contract approach, I introduce a “market value method” for calculating reasonable royalty damages. The market value of a patent or patent portfolio changes continually, just as do stock prices and the prices of other financial assets.³⁰ The contract approach suggests how to adjust the purchase price of the patent or the purchase price of comparable patents to calculate reasonable royalty damages. The “market value method” is based on economic analysis because it relies on market information. The “market value method” compensates the patent holder for the expected value of licensing royalties lost due to infringement. This method addresses evidence requirements because it uses observable market information and can be applied even when there are no comparable contracts. Reasonable royalty damages are calculated as a share of the market value of the patent that takes into account the number of infringers and the characteristics of “informed contracts.” This method extends readily to multiple patents and patent portfolios. The “market value method” also is useful for reasonable royalty damages when there are standard essential patents (“SEPs”).

Also, the contract approach is helpful in finding comparable license contracts. The contract approach suggests how to adjust royalties such that damages are compensatory. The provisions of the “informed contract” constructed by the patent case and other information about the extent of infringement, the patented technologies, and technology standards help to adjust estimates of the patent holder’s opportunity costs and the infringer’s benefits.

The contract approach leads to a better understanding of the economic function of patent license contracts. The contract approach provides guidance to the courts regarding the calculation of reasonable royalty damages. The contract approach preserves the injunctive relief of the property approach. The contract approach addresses compensation of the patent holder as in the tort approach. The contract approach thus complements the conflicting property and tort approaches to reasonable royalty damages and should help resolve the patent law controversy.

The contract approach completes the legal picture for several reasons. The contract approach draws upon market institutions because parties to patent license agreements generally determine royalties in the context of the overall con-

28. See Spulber, *supra* note 8, at 17.

29. *Id.* at 12.

30. *Id.* at 15.

tract. The contract approach to infringement also conforms to the statute by addressing compensation.³¹ The proposed “informed contract” accounts for the economic effects of infringement and applies evidence obtained by the patent case. The contract approach builds on legal precedent by recognizing the failure to contract of the patent holder and infringer.

The “informed contract” approach differs fundamentally from the flawed “hypothetical negotiation.” The “hypothetical negotiation” is the main instrument for calculating reasonable royalty damages.³² The idealized “hypothetical negotiation” places impossible demands on the court because it requires determining the knowledge and expectations of the patent holder and infringer had they entered into a negotiation before the infringement began.³³ The “hypothetical negotiation” is likely to be inconsistent with the evidence in the patent case because the patent holder and the infringer acted in the absence of an agreement.³⁴ The “hypothetical negotiation” is unrealistic because it is based on the fiction of a willing licensor and a willing licensee.³⁵ Scott Kieff and Anne Layne-Farrar observed that infringement destroys both the patent holder’s option to say “no” to a license request and the patent holder’s option to say “yes” exclusively or on distinct terms to some party other than the infringer.³⁶ The “informed contract” should compensate the patent holder for the loss of these options.

31. 35 U.S.C. § 284 (2012) (“Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.”).

32. See FED. TRADE COMM’N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 19–20 (2011), <https://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patent-report.pdf>, (“Patent law appropriately implements this concept by awarding reasonable royalty damages based on what a willing licensor and willing licensee would have agreed to in a hypothetical negotiation.”); see also Jarosz & Chapman, *supra* note 21, at 772 (“[T]he hypothetical negotiation construct was originally introduced simply as one of many considerations to estimate such damages. It has since evolved into the primary tool used to determine reasonable royalty damages.”).

33. See, e.g., *Fujifilm Corp. v. Benun*, 605 F.3d 1366, 1372 (Fed. Cir. 2010) (“To determine a reasonable royalty, a jury must find the royalty that would have been agreed to in a hypothetical negotiation between a willing licensee and willing licensors at the time infringement began.”); *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1121 (S.D.N.Y. 1970).

The [‘willing buyer and willing seller’] rule is more a statement of approach than a tool of analysis. It requires consideration not only of the amount that a willing licensee would have paid for the patent license but also of the amount that a willing licensor would have accepted. What a willing licensor and a willing licensee would have agreed upon in a supposititious negotiation for a reasonable royalty would entail consideration of the specific factors previously mentioned, to the extent of their relevance.

Georgia-Pacific Corp., 318 F. Supp. at 1121.

34. See Jarosz & Chapman, *supra* note 21, at 785–86.

35. *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1554 n.13 (Fed. Cir. 1995) (en banc) (“The hypothetical negotiation is often referred to as a ‘willing licensor/willing licensee’ negotiation. However, this is an inaccurate, and even absurd, characterization when, as here, the patentee does not wish to grant a license.”).

36. See generally F. Scott Kieff & Anne Layne-Farrar, *Incentive Effects from Different Approaches to Holdup Mitigation Surrounding Patent Remedies and Standard-Setting Organizations*, 9 J. COMPETITION L. & ECON. 1091 (2013).

The “informed contract” includes *ex-post* information revealed by evidence in the patent case.³⁷ The “informed contract” is not limited by the *ex-ante* knowledge of the parties at the time infringement began. The “informed contract” takes into account information revealed after infringement began, including patent validity, technology standards, market outcomes, and the extent of the infringement.

The “informed contract” provides a conceptual foundation for reasonable royalty damages. Economic analysis suggests that current information allows better estimates of damages from infringement.³⁸ This conforms to the legal requirement that reasonable royalties provide compensation for damages.³⁹ The “informed contract” is objective because it relies on evidence rather than conjectures about the subjective knowledge and perceptions of the patent holder and the infringer. As District Judge James F. Holderman states in *In re Innovatio*, “Nonetheless, by the time the damages phase of an infringement suit arrives, the court has determined infringement and validity, thus foreclosing the hypothetical negotiator from benefiting from any uncertainty as to future court rulings.”⁴⁰

The contract approach depends on the court’s *interpretation* of the “informed contract,” without requiring idealized intent of the two parties.⁴¹ In a patent case, the parties are bound by the informed contract as constructed by the court.⁴² The patent case builds a contract on the basis of what actually occurred.⁴³ Here, actions necessarily speak louder than words. The “informed contract” depends on evidence regarding the parties’ actions as discovered in the patent case. When did the infringement begin and end? Were the patents valid? How did the

37. For the discussion of the “retrospective or *ex post* model,” see The Sedona Conference, *Commentary on Patent Reasonable Royalty Determinations: A Project of The Sedona Conference Working Group on Patent Damages and Remedies*, at 22–23 (2016).

The Retrospective Model states: The royalty shall be determined by considering what (a) fully informed, (b) willing, and (c) reasonable persons (d) in the positions of the patent owner (or owners throughout the period of infringement) and the infringer would agree to at the time of trial as a fair price for the license, (e) taking into account all relevant facts and circumstances occurring before or during that period, while (f) factoring out any switching costs, lock-in costs, patent-holdup costs, or other similar costs that are not attributable to the value of the patented technology . . . a. ‘Fully informed’ means a licensor and licensee who both know all relevant facts available to them, not just the facts actually known to the individuals at the plaintiff and the defendant entities at the relevant times.

Id.

38. *Id.* at 9.

39. *Id.* at 25.

Another advantage of the Retrospective Model is that it better aligns with the plain language of the patent damages statute to provide adequate compensation for “the use made of the invention” by the infringer because it allows the trier-of-fact to consider *actual* infringing use, as opposed to only *projected* infringing use. By the same token, the Retrospective Model allows the trier-of-fact to award a reasonable royalty directly related to the actual harm caused by the accused infringer’s unauthorized use of the patented invention, instead of the expected harm of the infringement viewed from at a fixed point in time before any infringement has actually occurred.

Id.

40. See *In re Innovatio IP Ventures*, No. 11 C 9308, 2013 WL 5593609, at *58–59 (N.D. Ill. Oct. 3, 2012) (“[T]he court will not adjust the RAND rate in light of pre-litigation uncertainty about the essentiality of a given patent.”); see also *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 76 (Fed. Cir. 2012).

41. See discussion *infra* Section II.C.

42. See Oliver Wendell Holmes, Jr., *The Path of the Law*, 10 HARV. L. REV. 457, 463 (1897).

43. See *Panduit Corp. v. Stahlin Bros. Fibre Works*, 575 F.2d 1152, 1159 (6th Cir. 1978).

infringer use the IP? Was there any prior licensing and negotiation between the parties and other business relationships between the patent owner and the infringer? Did the patent owner license the IP to others? Did the patent owner have SEPs? Did the patent owner make fair, reasonable, and nondiscriminatory (“FRAND”) royalty commitments to standard-setting organizations (“SSOs”)?

The contract approach considers reasonable royalty damages in the context of the other provisions of the “informed contract,” as determined by the patent case. Instead of offering an untethered last-minute calculation of reasonable royalty damages, the contract approach builds on evidence gathered in the patent case. By the time the issue of reasonable royalty damages arises, the court and the litigants already have done much of the heavy lifting. In practice, patent license contracts involve negotiation of various provisions, including but not limited to royalties.⁴⁴ The terms of a patent license contract increase or decrease royalties depending on the economic value generated by the contract and the allocation of benefits between the patent holder and the implementer.⁴⁵ This provides guidance for the calculation of reasonable royalty damages based on the provisions of the “informed contract.” The contract approach offers further guidance to the court on what additional evidence should be gathered and how it should be used to obtain reasonable royalty damages.

The patent case discovers the critical elements of the “informed contract.” These include the following: (1) identification of the parties, description of their businesses and their business relationship with each other; (2) start date, duration of the agreement, and period of coverage; (3) definition of the IP; (4) grant of rights (IP limits, field of use, territory, degree of exclusivity, improvements to the technology); and (5) compensation. Taken together, these critical elements provide a context for reasonable royalty damages.

Although an “informed contract” does not involve a “meeting of the minds,” this situation is not limited to patent infringement because such a problem arises often in contractual disputes.⁴⁶ Oliver Wendell Holmes Jr. observes:

We talk about a contract as a meeting of the minds of the parties, and thence it is inferred in various cases that there is no contract because their minds have not met; that is, because they have intended different things or because one party has not known of the assent of the other. Yet nothing is more certain than that parties may be bound by a contract to things which neither of them intended, and when one does not know of the other’s assent.⁴⁷

Holmes points out that “[t]he parties are bound by the contract as it is interpreted by the court, yet neither of them meant what the court declares that they have said.”⁴⁸ The “informed contract” in a patent case depends on the interpretation of the court, just as in other contract cases.

44. See Spulber, *supra* note 8, at 47–49.

45. *Id.* at 17–19.

46. See Holmes, *supra* note 42, at 463–64.

47. *Id.*

48. *Id.*

In my opinion no one will understand the true theory of contract or be able even to discuss some fundamental questions intelligently until he has understood that all contracts are formal, that the making of a contract

The contract approach yields insights into various patent damage controversies including apportionment and the royalty base, particularly the entire market value rule (“EMVR”), and the Smallest Salable Patent-Practicing Unit (“SSPPU”) rule.⁴⁹ The contract approach also helps address several closely related issues arising from multiple inventions: royalty stacking, patent thickets, patent holdup, and SEPs.

II. THE CONTRACT APPROACH TO PATENT INFRINGEMENT

I introduce a contract approach to resolving patent infringement disputes. I find that applying contract rules to patent infringement helps bridge some of the gaps left by property and tort rules. The contract approach protects the patent holder’s interests and provides compensation for patent infringement. The contract approach is useful for characterizing interactions between market institutions and legal practice.

A. *The Patent License Contract Versus Patent Infringement*

The contract approach to infringement is fruitful because the patent license contract and patent infringement have opposite effects. A patent license contract is a *cooperative* technology transfer that generates joint economic benefits.⁵⁰ When transaction costs are low, the patent license contract should provide incentives for efficient performance and efficient utilization of IP. The provisions of a license contract adjust for the effects of patent law and other regulatory restrictions.⁵¹

In contrast, patent infringement is a *noncooperative* technology transfer that generates an externality.⁵² An externality is a transfer of costs or benefits outside of a market transaction.⁵³ Such a technology transfer typically benefits the infringer and harms the IP owner.⁵⁴ The benefits to the infringer can be incremental profits from further invention and innovative products, production processes, and transactions that are derived from the patented technologies.⁵⁵ The

depends not on the agreement of two minds in one intention, but on the agreement of two sets of external signs—not on the parties’ having meant the same thing but on their having said the same thing.

Id. at 464.

49. See generally Patricia Dyck, Note, *Beyond Confusion – Survey Evidence of Consumer Demand and the Entire Market Value Rule*, 4 Hastings Sci. & Tech. L.J. 209 (2011); Jonathan D. Putnam & Tim A. Williams, *The Smallest Salable Patent-Practicing Unit (SSPPU): Theory and Evidence* (2016), <https://ssrn.com/abstract=2835617>.

50. See Spulber, *supra* note 8, at 13.

51. *Id.* at 47.

52. See *id.* at 28.

53. Econ. Research Serv. U.S. Dep’t of Agric., *The Public Policy Background and the Economic Case for Intellectual Property*, USDA, https://www.ers.usda.gov/webdocs/publications/45080/17597_err15_b_1_.pdf?v=0 (last visited Dec. 29, 2018).

54. See generally World Intellectual Prop. Org., *Licensing of Intellectual Property Assets; Advantages and Disadvantages*, WIPO, <http://www.wipo.int/export/sites/www/sme/en/documents/pdf/licensing.pdf> (last visited Dec. 29, 2018).

55. *Id.*

harm to the patent owner can take the form of lost profits from business stealing effects and lost opportunities to license the technology to third parties.⁵⁶ The patent owner loses the royalties that would have been obtained from licensing to the firm that infringed the patent.⁵⁷

Because patent infringement involves an externality, it is likely to be economically inefficient for the parties involved, leading to excessive or conflicting usage of the IP. The infringing firm likely will make inefficient technology adoption decisions and use substitute and complementary resources inefficiently. Put differently, the social benefits of a technology transfer are less than the private benefits of the technology transfer of the infringer. This is because the calculation of social benefits deducts the private costs of the patent owner that result from infringement.

A patent license contract between the technology provider and adopter addresses the infringement externality and can improve economic incentives. The technology user has incentives to make better adoption decisions and invest more efficiently in invention and innovation.⁵⁸ This is consistent with Ronald Coase's characterization of bargaining as an efficient means of addressing social costs.⁵⁹ Efficiency of contracting also is consistent with extensive economic analysis of negotiation with full information.⁶⁰ Technology providers and adopters generally design contracts to mitigate the effects of transaction costs and incomplete information, which can be significant for IP.⁶¹

Patent license contracts can solve problems stemming from patent infringement. A patent license contract provides a way of settling or avoiding a patent infringement complaint.⁶² Once the infringement is discovered, the parties can

56. For discussions of lost profits, see James J. Anton & Dennis A. Yao, *Finding "Lost" Profits: An Equilibrium Analysis of Patent Infringement Damages*, 23 J.L. ECON. & ORG. 186, 187 (2007); Roy J. Epstein, *The Market Share Rule with Price Erosion: Patent Infringement Lost Profits Damages After Crystal*, 31 AIPLA Q.J. 1, 4 (2003); Jeffrey L. Harrison, *The Lost Profits Measure of Damages in Price Enhancement Cases*, 64 MINN. L. REV. 751, 753 (1980); Mark A. Lemley, *Distinguishing Lost Profits from Reasonable Royalties*, 51 WM. & MARY L. REV. 655, 656 (2009); Robert M. Lloyd, *Proving Lost Profits after Daubert: Five Questions Every Court Should Ask Before Admitting Expert Testimony*, 41 U. RICH. L. REV. 379, 380 (2007); Gregory J. Werden et al., *Economic Analysis of Lost Profits from Patent Infringement with and Without Noninfringing Substitutes*, 27 AIPLA Q. J. 305, 306 (1999).

57. Epstein, *supra* note 56, at 3–4.

58. Daniel F. Spulber, *How Patents Provide the Foundation of the Market for Inventions*, 11 J. COMPETITION L. & ECON. 271, 271 (2015).

59. See generally Ronald H. Coase, *The Problem of Social Cost*, 56 J.L. & ECON. 837 (2013).

60. See generally Ken Binmore, *Nash Bargaining Theory I-III*, in *THE ECONOMICS OF BARGAINING*, 27–46, 61–76, 239–56 (K. Binmore & P. Dasgupta eds., 1987); John C. Harsanyi, *A Bargaining Model for the Cooperative n-Person Game*, in 40 CONTRIBUTIONS TO THE THEORY OF MATHEMATICAL STUDIES (A. W. Tucker & R.D. Luce ed., 1959); ALVIN ROTH, *AXIOMATIC MODELS OF BARGAINING* (Springer-Verlag 1979); Ken Binmore, Ariel Rubinstein, & Asher Wolinsky, *The Nash Bargaining Solution in Economic Modelling*, 17 RAND J. ECON. 176 (1986); John C. Harsanyi, *A Simplified Bargaining Model for the n-Person Cooperative Game*, 4 INT'L. ECON. R. 80 (1963); John F. Nash, Jr., *The Bargaining Problem*, 18 ECONOMETRICA 155 (1950); John Nash, *Two Person Cooperative Games*, 21 ECONOMETRICA 128 (1953).

61. Richard Zeckhauser, *The Challenge of Contrasting for Technological Information*, 93 PROC. NAT'L. ACAD. SCI. U.S. AM., 12743, 12743 (1996).

62. *The ABCs of Licensing Intellectual Property*, NUTTER (Apr. 1, 2010), <https://www.nutter.com/ip-law-bulletin/the-abc-of-licensing-intellectual-property>.

then negotiate a patent license contract to resolve the disagreement. For example, Nokia and Apple settled a patent infringement dispute with a combination of patent license agreements and business contracts.⁶³ TiVo settled patent litigation against Samsung with a patent license agreement covering mobile, consumer electronics, and set-top box technologies.⁶⁴

Conversely, breach of a particular restriction that is part of a patent license contract can generate either a breach of contract suit or a patent infringement claim.⁶⁵ For example in *Tekelec*, the Fifth Circuit found Verint to have breached both a patent settlement and license contract for failing to make payments.⁶⁶ Also, Rydex successfully sued Graco for patent infringement after Graco breached their licensing contract.⁶⁷ These examples illustrate that violating a patent license agreement can be viewed either as breach of contract or as patent infringement.

Failure to complete the negotiation of a patent license contract when there is usage of the technology can result in a patent infringement complaint.⁶⁸ For example, MercExchange offered to license a patent to eBay and Half.com.⁶⁹ After some negotiation, the companies failed to reach an agreement, leading MercExchange to file a patent infringement suit against eBay and Half.com.⁷⁰ Failure to contract also resulted in Unwired Planet's patent infringement suit against Huawei.⁷¹

Failure to renew a patent license contract when there is usage of the technology can result in an infringement complaint. For example, Rovi, a subsidiary of TiVo, successfully filed a patent infringement complaint against former licensee Comcast before the International Trade Commission.⁷²

63. This was settled in 2017. See Danny Palmer, *Apple and Nokia Settle Patent Licensing Lawsuit*, ZDNET (May 23, 2017, 11:35 AM), <https://www.zdnet.com/article/apple-and-nokia-settle-patent-licensing-lawsuit/>.

64. Steve Brachmann, *TiVo Stock Pops 17 Percent in Trading After ITC Judge Issues Section 337 Final Initial Determination Against Comcast*, IPWATCHDOG (May 31, 2017), <http://www.ipwatchdog.com/2017/05/31/tivo-stock-pops-17-percent-after-itc-judge-issues-section-337-final-initial-determination-against-comcast/id=83868/>.

65. See Jones, *supra* note 24, at 229. (“[B]reach of a license restriction may give rise to a suit for breach of contract or an infringement suit.”); Omri Ben-Shahar, *Damages for Unlicensed Use*, 78 U. CHI. L. REV. 7, 9 (2011) (“This wrongful action by the licensee could be both a breach of the license contract, giving rise to the common law’s contract remedies, and an infringement of the licensor’s intellectual property, with remedies provided by statute.”). On historical jurisdictional issues, see Donald Shelby Chisum, *The Allocation of Jurisdiction between State and Federal Courts in Patent Litigation*, 46 WASH. L. REV. 633, 633 (1971).

66. *Tekelec, Inc. v. Verint Sys., Inc.*, 708 F.3d 658, 663 (5th Cir. 2013).

67. John C. Paul, D. Brian Kacedon, & R. Benjamin Cassady, *Licensee’s Breach of Agreement Provides Licensor with Ability to Sue Licensee for Infringement*, FINNEGAN LES INSIGHTS (Feb. 10, 2015), <https://www.finnegan.com/en/insights/licensee-s-breach-of-agreement-provides-licensor-with-ability-to.html?news=96fbfb22-5002-496d-921d-4d059ce52710>.

68. See, e.g., Jeff Gamet, *Ericsson Sues Apple after Failing to Reach Patent License Agreement*, MAC OBSERVER (Feb. 27, 2015, 11:20 AM), <https://www.macobserver.com/tmo/article/ericsson-sues-apple-after-failing-to-reach-patent-license-agreement>.

69. *eBay Inc. v. MerExchange, L.L.C.*, 547 U.S. 388, 390 (2006).

70. *Id.*

71. *Unwired Planet v. Huawei*, [2017] EWHC 711 (Pat) [154]–[155], (Eng.).

72. See Melissa Daniels, *Comcast, Manufacturers Infringe 2 Rovi Patents: ITC Judge*, LAW360 (May 31, 2017, 10:23 PM), <https://www.law360.com/articles/929807/comcast-manufacturers-infringe-2-rovi-patents-itc>.

B. Patent License as Contract

The contract approach is fundamental to explaining the nature of licensing royalties. The patent license agreement involves the standard contractual elements of offer, acceptance, and consideration.⁷³ Standard contract law applies to patent license agreements.⁷⁴ The parties choose the provisions of patent license contracts to maximize the joint value of the relationship.⁷⁵ The parties to a patent license contract choose the terms of the agreement in the context of their business relationships with each other and other businesses.⁷⁶

A patent license contract is a cooperative agreement designed to maximize the returns to combining the licensor's technology with the licensee's technology, efforts, products, investment, and complementary assets.⁷⁷ Royalties not only serve to divide the contractual pie; they help maximize the size of the pie.⁷⁸ Thus, patent license royalties are more than a payment for the transfer of an asset. Patent license royalties are payments to patent owners for the licensee's opportunity to use, improve, and add value to an asset.

Because patent license agreements are contracts that are specific to the licensor and the licensee, they typically must be negotiated.⁷⁹ For this reason, licensors do not announce "posted prices" for patent license agreements as sellers often do when providing standardized goods and services. This means that public policy concerns cannot be based exclusively on economic models of imperfect competition with posted prices. Instead, public policy toward patents must take into account bargaining over patent license agreements. Negotiation of patent license agreements eliminates the basis for concerns about royalty stacking and other problems typically associated with SEPs.⁸⁰

The patent license agreement, as with many other types of contracts, involves cooperative activities that take place over time. The licensee uses the patented technology for some specified period of time and pays royalties to the

judge. I provided Rovi with an expert report in the form of a rebuttal statement in this matter. Rovi acquired TiVo and changed its name to TiVo. See David Lieberman, *Rovi Changes Its Name to TiVo as it Closes Acquisition of DVR Pioneer*, DEADLINE (Sept. 8, 2016, 7:14 AM), <http://deadline.com/2016/09/rovi-buys-tivo-changes-name-1201815210/>.

73. See Spulber, *supra* note 8, at 5.

74. *Id.*

75. *Id.* at 19.

76. On relationships and contracts, see generally IAN R. MACNEIL, *CONTRACTS: EXCHANGE TRANSACTIONS AND RELATIONS* (2d ed. 1978); IAN MACNEIL, *THE RELATIONAL THEORY OF CONTRACT: SELECTED WORKS OF IAN MACNEIL* (David Campbell ed., 2001).

77. Daniel F. Spulber, *Patent Licensing and Bargaining with Innovative Complements and Substitutes*, 70 RES. ECON. 693, 693 (2016).

78. *Id.* at 708.

79. *Id.* at 694. Licensing contracts offered by patent pools are an exception that proves the rule. The patent pool and licensees usually do not negotiate licensing contract provisions including royalties. Patent owners within the patent pool, however, negotiate among themselves to obtain contract provisions including royalties. *Id.* at 710, n.23.

80. *Id.* at 708–09.

licensor over time.⁸¹ It may take time for the licensee to absorb the invention and to develop innovations based on the invention. It may take time for the licensee to obtain financing, invest in capital equipment and facilities, produce outputs, and sell and distribute products. The licensee earns revenues over some period of time and generally pays royalties based on output or sales over time.⁸² As with contracts generally, patent license contracts are prospective; the parties share costs, revenues, and risks over time.⁸³

Patent license agreements involve much more than renting an asset. For this reason, licensing royalties are not simply a division of the economic rents from exchange. This means that the patent license contract negotiation is about more than the choice of royalties. The parties choose contract terms that maximize the economic value of their relationship. They select contract terms to provide incentives for efficient performance. Royalty payments serve the overall purpose of the contractual relationship and should be viewed in that context. Examining the full scope of the contract negotiation gives a better idea of what are the resulting royalties and contract terms.

Some practitioners characterize the demand or “pull” for patent license contracts as having three sources: “carrots,” “sticks,” and “bundles.”⁸⁴ “Carrots” refer to voluntarily negotiated patent license contracts based solely on the benefits of the technology to the implementer.⁸⁵ “Sticks” refer to patent license contracts negotiated under the threat of litigation.⁸⁶ Niklas Östman observes: “Patent licenses are not your normal products. In fact they are extremely unusual as products. I have heard patent licenses be characterized as offering ‘peace of mind’, ‘insurance against being sued’, ‘freedom of operation’, ‘access to technology’ and many other things, including ‘relief from fear and pain.’”⁸⁷ Finally, “bundles” refer to contracts that combine patent license contracts with other non-patent inducements including various goods and services.⁸⁸

Legal penalties for infringement are necessary but not sufficient for patent license contracts to have market value just as property rights are necessary but not sufficient for an asset to have market value.⁸⁹ The threat of legal penalties

81. Joe Stone, *How to License a Patent & Royalties*, CHRON, <https://smallbusiness.chron.com/license-patent-royalties-80018.html> (last visited Dec. 29, 2018).

82. *Id.*

83. See Spulber, *supra* note 8, at 7.

84. This classification is attributed to Marshall Phelps who served as chief of global IP at IBM and Microsoft, see Niklas Östman, *How to Create the ‘Pull’ for Patent Licensing?*, LINKEDIN (Sept. 6, 2016), <https://www.linkedin.com/pulse/how-create-pull-patent-licensing-niklas-%C3%B6stman?trk=prof-post>; see also David L. Cohen, *Licensing Standard-Essential Patents on FRAND Terms* (2017), http://kidonip.com/wp-content/uploads/2017/07/Cohen_Paper.pdf.

85. *Patent Licensing and Enforcement*, IPOFFERINGS, <https://www.ipofferings.com/patent-licensing-enforcement.html> (last visited Dec. 29, 2018).

86. Östman, *supra* note 84.

87. *Id.*

88. Cohen, *supra* note 84, at 2.

89. *Id.* at 14.

only exists if firms infringe, that is, if there is some demand for inventions protected by patents.⁹⁰ This means that the patent is valid and the implementer obtains benefits from using the technology.⁹¹ Implementers benefit from the using the technology whether infringement is intentional or inadvertent.⁹² The market value of patent license contracts reflects the benefits to implementers, whether license contracts are “carrots,” “sticks,” or “bundles.”⁹³

The actual or implicit threat of litigation thus does not imply that royalties are the result of legal penalties. Companies have the option of using alternative technologies and can take steps to reduce the likelihood of inadvertent infringement.⁹⁴ The threat of litigation does not mean that patent owners making license offers are engaging in “hold-up” because patents must be both valid and infringed.⁹⁵ Implementers have the option of negotiating in good faith and avoiding “hold-out.”⁹⁶

There is considerable evidence that patented technology provides economic value.⁹⁷ There are many patent license contracts between patent holders and implementers.⁹⁸ At the same time, patent litigation is a very rare event.⁹⁹ Ron Katznelson examines the period from 1923–2013 and finds that patent lawsuits filed in U.S. District Courts as a fraction of U.S. patents in force are less than one-third of 1% for all years.¹⁰⁰ Because litigation is both risky and costly and because it may be difficult to detect infringement, only a small proportion of patents are involved in law suits.¹⁰¹

Some view SEPs as “sticks” because implementing the standard requires practicing the patents.¹⁰² SEPs, however, can be “carrots” because they offer ac-

90. *Id.* at 2.

91. *Id.*

92. *Id.*

93. *Id.*

94. *See* Spulber, *supra* note 58, at 308.

95. *See* Cohen, *supra* note 84, at 8–9.

96. FED. TRADE COMM’N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 29 (2011).

97. *Id.* at 2.

98. *See* Spulber, *supra* note 8, at 20.

99. *See generally* B. Zorina Khan, *Trolls and Other Patent Inventions: Economic History and The Patent Controversy in the Twenty-First Century*, 21 GEO. MASON L. REV. 825, 837 (2014); Jean O. Lanjouw & Mark Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. ECON. 129 (2001); Jean O. Lanjouw & Mark Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?*, 47 J.L. & ECON. 45, 58 (2004); Ron D. Katznelson, *A Century of Patent Litigation in Perspective* (November 17, 2014), <https://ssrn.com/abstract=2503140> or <http://dx.doi.org/10.2139/ssrn.2503140>.

100. Katznelson, *supra* note 99, at 7.

101. The costs of monitoring can affect incentives to infringe, see generally Claude Crampes & Corinne Langinier, *Litigation and Settlement in Patent Infringement Cases*, 33 RAND J. OF ECON. 258, 261 (2002).

102. *See* Cohen, *supra* note 84, at 2 (“The accumulation of laws, regulations, economic analysis and polite lies licensing executives like to tell each other when negotiating over an SEP license (i.e., the F/RAND framework) helps obscure the fact that if the threats are not credible, SEPs, like other patents, have little inherent value.”).

cess to technology that contributes to the innovation represented by the standard.¹⁰³ A producer need not implement a particular standard when there are multiple standards that compete in the marketplace. The producer will implement the most attractive standard in terms of technological benefits and market returns. Implementing the standard is a non-patent inducement to license the patent. SEPs can be demanded as part of “bundles” because the licensee both obtains a valuable patented technology and the ability to implement the standard.¹⁰⁴

SEPs also are “carrots” because there can be other SEPs that are competitive substitutes.¹⁰⁵ Royalties are competitive even after the standard is chosen.¹⁰⁶ SEPs also are “carrots” because not all patents declared to be SEPs are necessary for the standard.¹⁰⁷ Robin Stitzing et al. find systematic over declaration of SEPs.¹⁰⁸ They demonstrate empirically that in telecommunications, economic models explaining patent value are not sufficient to explain the technical essentiality of SEPs.¹⁰⁹

Contracts between patent holders and implementers can include both licenses and other products.¹¹⁰ Östman notes:

You can also combine patent licenses with other things like access to source code, other technology implementations, documentation, trade secrets or even product support. The classic example being the pharma industry, where patents are licensed in a big package together with the underlying research, clinical studies, FDA approvals, trademarks and even production knowhow.¹¹¹

For example, Nokia established contracts with Xiaomi, Apple, and Samsung covering a combination of patent licensing and business relationships.¹¹²

“Bundles” do not indicate that the patent license contracts have no market value. Rather, patent licenses are bundled with other business transactions because they are complementary, and the parties benefit from broader contracts.¹¹³

103. *Id.*

104. *Id.*

105. Östman, *supra* note 84.

106. *See* Spulber, *supra* note 8, at 12.

107. *See* Cohen, *supra* note 84, at 2.

108. Robin Stitzing et al., *Over-Declaration of Standard Essential Patents and Determinants of Essentiality*, NOKIA 12 (Sept. 4, 2018), <https://ssrn.com/abstract=2951617>.

109. *Id.* at 25 (“We find that the strongest predictor for essentiality is when the declaration of the SEP refers to a specific technical specification of the standard.”).

110. Östman, *supra* note 84.

111. *Id.*

112. Ingrid Lunden & Jon Russell, *Nokia and Xiaomi Ink Patent and Equipment Deal, Xiaomi Buys Nokia Patents*, TECHCRUNCH (July 5, 2017), <https://techcrunch.com/2017/07/05/nokia-and-xiaomi-ink-patent-and-equipment-deal-xiaomi-buys-nokia-patents/>.

Xiaomi will become a customer of Nokia’s for network equipment—specifically ‘network infrastructure equipment designed to deliver the high capacity, low power requirements expected by large web providers and datacenter operators’ and ‘optical transport solutions for datacenter interconnect, IP Routing based on Nokia’s newly announced FP4 network processor, and a data center fabric solution.’
Id.; *see also* United IPR, *NOKIA & XIAOMI: Sign Landmark Patent Licensing Agreement*, MONDAQ (Aug. 8, 2017), <http://www.mondaq.com/india/x/617484/Patent/NOKIA+XIAOMI+Sign+Landmark+Patent+Licensing+Agreement>.

113. *See* NOKIA & XIAOMI, *supra* note 112.

Company managers who negotiate “bundles” determine royalty payments within the context of business relationships.¹¹⁴

The patent holder has an interest in the technology adopter succeeding in the marketplace.¹¹⁵ For example, Suzanne Harrison and Patrick Sullivan consider how companies engage in strategic technology transfers involving both IP and a company’s non-IP intangibles.¹¹⁶ They refer to non-IP intangibles as “I-stuff,” which includes “tacit knowledge, know-how, relationships as well as the non-legally protected and codified knowledge of the firm.”¹¹⁷ Harrison and Sullivan quote Jeff Weedman, Vice President at Procter & Gamble:

Part of my unit’s I-stuff is found in the way we approach a business or licensing negotiation with an external organization. When we sit down to ‘negotiate,’ we don’t spend a lot of up-front time talking about the royalty rates or what should be the value to you and the value to me. The most productive thing we talk about is how we can marry our capability and yours to build the most value. We consciously focus the conversation on how we can make the pie bigger.¹¹⁸

Patent license agreements often arise at the intersection of invention and innovation.¹¹⁹ Technology providers supply inventions created through research and development (“R&D”). Technology adopters extend the inventions, apply the inventions to create innovations, and use the inventions to generate economic value.¹²⁰ Technology adopters absorb knowledge, design products, develop transaction methods, implement production techniques, and obtain complementary assets.¹²¹

The traditional view of patent license agreements is that licensing royalties exist only to compensate inventors for their costs of invention or for the contributions of their inventions to society.¹²² This backward-looking approach to royalties derives from the traditional characterization of patents as rewards for inventors who successfully conclude their R&D efforts.¹²³

Patents, however, generate dynamic efficiencies by providing incentives for invention, innovation, and technology adoption. Patents serve to protect the returns to *future* investments in developing the inventions, creating innovations that apply the invention, and using the inventions to generate economic value.¹²⁴ Patents have an important forward-looking role in protecting incentives for inventors to improve and commercialize their inventions.

114. See Spulber, *supra* note 77, at 694.

115. Spulber, *supra* note 58, at 291.

116. SUZANNE S. HARRISON & PATRICK H. SULLIVAN, *EINSTEIN IN THE BOARDROOM: MOVING BEYOND INTELLECTUAL CAPITAL TO I-STUFF 2* (Wiley ed. 2006).

117. *Id.*

118. *Id.* at 62.

119. Spulber, *supra* note 58, at 281.

120. See Spulber, *supra* note 8, at 16.

121. *Id.* at 48–49.

122. See Lee, *supra* note 4, at 7–8.

123. See Spulber, *supra* note 77, at 710.

124. See Spulber, *supra* note 58, at 274.

Patent holders commercialize their IP by contracting with technology adopters. Inventors provide their inventions to firms who can use the inventions and develop innovations based on the inventions. The market for inventions includes a variety of transactions including patent license contracts, cross-licensing agreements, patent transfers, and financing of invention and innovation.¹²⁵ As Scott Kieff observes:

This commercialization approach sees property rights in IP serving a role akin to beacons in the dark, drawing to themselves all of those potential complementary users of the IP-protected-asset to interact with the IP owner and each other. This helps them each explore through the bargaining process the possibility of striking contracts with each other.¹²⁶

Kieff points out that patents “facilitate investment in the complex, costly, and risky commercialization activities required to turn nascent inventions into new goods and services.”¹²⁷

Patents are the basis of what I have termed the “market for innovative control.”¹²⁸ The market for inventions is not simply a market for future returns but also a market for rights to control innovation that is based on the inventions. Through patent license agreements, a licensor delegates some innovative control to the licensee.¹²⁹ The licensee has decision-making authority to apply and extend the inventions subject to restrictions in the licensing contract.¹³⁰ The patent license contract grants to the licensee rights to practice the invention and develop innovations based on the invention.¹³¹ Licensing royalties not only reflect returns to inventors but also are based on the returns to managing the adoption and application of inventions.¹³²

The technology transfer addressed by a patent license agreement must add economic value. This means that the technology adopter’s usage of the technology generates economic value. The technology adopter creates value by applying the technology to produce goods and services, develop production processes, or implement business methods. For the technology transfer to create economic value, the technology adopter’s benefits from the technology transfer must be greater than the technology provider’s costs resulting from the transfer.

125. *Id.* at 273.

126. Scott Kieff, *Views of the Honorable F. Scott Kieff, Commissioner, United States International Trade Commission, on the United States Federal Trade Commission’s and the United States Department of Justice Antitrust Division’s Joint Guidelines for the Licensing of Intellectual Property*, U.S. INT’L TRADE COMMISSION (Sept. 23, 2016), https://www.ftc.gov/system/files/documents/public_comments/2016/09/00006-128911.pdf; see also F. Scott Kieff & Troy A. Paredes, *The Basics Matter: At the Periphery of Intellectual Property*, 73 GEO. WASH. L. REV. 174, 185–88 (2004).

127. F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 703 (2000); see also John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 439–40 (2004); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 265–90 (1977). But see Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473, 499–500 (2005).

128. Spulber, *supra* note 58, at 290–97.

129. *Id.* at 295.

130. *See id.*

131. *See id.* at 274.

132. *See id.* at 307.

C. *The Informed Contract*

The “informed contract” provides a guide for the finder of fact in determining reasonable royalty damages. The “informed contract” is based on the actions of the patent holder and the infringer during the period of infringement rather than the presumption of a willing licensor and a willing licensee. The “informed contract” builds on relevant information revealed during the period of infringement. This allows the court to base reasonable royalty damages on evidence from the patent case. The court constructs an “informed contract” on the basis of information observed after infringement began. This improves estimates of damages to the patent holder from infringement. The burden on the court is reduced because the patent case already gathers much of the relevant information.

Uncertainty is a key issue in the determination of reasonable royalty damages.¹³³ The “informed contract” bases reasonable royalty damages on information obtained after uncertainty is resolved. The court takes an objective approach based on *ex post* information rather than a subjective approach based on *ex ante* information. In contrast, the “hypothetical negotiation” requires the court to make assumptions about the knowledge, beliefs, and expectations of the parties before information was revealed.¹³⁴ The court’s task is impossible because parties’ knowledge, beliefs, and expectations are unobservable and intangible.

The “hypothetical negotiation” approach requires the court to ignore much of the relevant information. This approach is necessarily speculative because it must imagine an agreement that would have occurred prior to infringement.¹³⁵ The “hypothetical negotiation” approach thus provides an inaccurate picture of the patent holder’s damages. Reasonable royalty damages under the “hypothetical negotiation” approach are likely to be inconsistent with the evidence in the patent case.

The “informed contract” constructed by the court generally should not be the same as the contract that the two parties would have negotiated at the time the infringement occurred. Both the patent owner and the infringer have engaged in economic activities in the absence of a contract. These activities are likely to differ from the activities both parties would have undertaken if they had entered into a contract. This is because a contract provides incentives that affect the business decisions of the licensor and the licensee.¹³⁶

Contracts differ from immediate exchange such as the sale of products or assets.¹³⁷ Contracts involve incentives for performance over time.¹³⁸ The object of contract negotiation generally is to maximize the joint returns from exchange.¹³⁹ In the same way, a patent license agreement differs from an immediate

133. See Jarosz & Chapman, *supra* note 21, at 803; Yang, *supra* note 4, at 651.

134. See Jarosz & Chapman, *supra* note 21, at 783–84.

135. *Id.* at 799–800.

136. *Id.* at 785–88.

137. See *id.* at 799–807.

138. See Spulber, *supra* note 8, at 32.

139. *Id.* at 48.

exchange such as a patent transfer.¹⁴⁰ Rather, a patent license involves incentives for performance over time.¹⁴¹ The purpose of a patent license agreement is to induce efficient technology adoption by the potential licensee.¹⁴² Also, a patent license agreement should induce efficient invention, innovation, and other profit-maximizing actions by the licensee.¹⁴³

Negotiation of a patent license agreement thus involves much more than simply determining what a willing buyer will offer and a willing seller will receive. License royalties are more than transfer payments for instantaneous exchange. Rather, license royalties are structured to provide incentives for efficient performance over time.¹⁴⁴ Royalties reflect the efforts of the parties to maximize the returns from investment.

The license agreement specifies royalties within the context of other contract provisions.¹⁴⁵ This implies that to determine reasonable royalties, the patent case should construct an “informed contract.” The provisions of the “informed contract” should affect how the court estimates reasonable royalty damages.

The terms of the “informed contract” depend on the observed actions of the parties and the interpretation of the court. The “informed contract” lacks intent on the part of the patent owner because the patent owner did not agree to the infringement and related activities of the infringer. The “informed contract” also lacks intent on the part of the infringer whether or not the infringement was intentional. This implies that the “informed contract” can differ from what would have been negotiated by the parties at the time infringement began.

If the infringement was inadvertent, the infringing firm made economic decisions without recognizing the effects of using a patented technology. The infringing firm made technology adoption decisions without taking into account the cost of royalty payments and the benefits and costs of using the patented technology. The infringing firm may not have explored the costs and benefits of adopting and applying alternative technologies. The infringing firm chose products, production processes, and transaction methods without adjusting for royalty payments or contractual restrictions on using the patented technology. The “informed contract” must adjust for the actions of the infringing firm and their effects on the patent holder.

If the infringement was intentional, the infringing firm’s actions are likely to differ substantially from those actions if there had been a contract with the patent owner. The infringer did not intend to negotiate a contract and need not have chosen the particular terms of the forgone contract. Intentional infringement includes the possibility that the infringer engaged in licensing negotiations without intending to reach an agreement or engaged in hold-out to delay or prevent

140. *See id.* at 12.

141. *See id.* at 17.

142. *See id.* at 49.

143. *See id.* at 52.

144. *Cf. id.* at 18.

145. *Id.* at 47.

an agreement. Again, the court must adjust the provisions of the “informed contract” to address the actions of the infringing firm and their effects on the patent holder.

The court constructs an “informed contract” to remedy the failure to contract. Infringement represents a failure to contract whether the infringer’s action was inadvertent or intentional. Infringement may be inadvertent because the infringer was unaware of the patented technology. Alternatively, the infringer may have avoided searching for patented technology, neglected to obtain licenses from patent owners, refused to negotiate a licensing agreement, or copied the technology deliberately. Deliberate infringement, however, can be difficult to prove and, as noted previously, may only trigger enhanced penalties with egregious behavior.¹⁴⁶

The parties can fail to contract even after a patent suit is filed. The parties have the option of resolving the dispute through a contract either before or during the patent case.¹⁴⁷ In practice, the advantages of negotiation and the costs of the legal system provide incentives for the parties to resolve patent disputes outside the courtroom. Only a small share of patent suits reaches the end of trial. Jean Lanjouw and Mark Schankerman find that once patent suits are filed, about 95% are settled before the end of trial and most are settled before trial begins.¹⁴⁸

Constructing an “informed contract” can involve considerable difficulties. It is widely acknowledged that the courts have difficulty enforcing observable contracts.¹⁴⁹ Transaction costs limit the efficiency of negotiated contracts, including the design of contingent contracts.¹⁵⁰ Even negotiated contracts are subject to mistakes by the parties.¹⁵¹ The parties negotiating a patent license agreement face various types of uncertainty. There is uncertainty regarding whether or not the patents are valid and whether or not the patents are included in technology standards. There is also market uncertainty that may affect the returns to the technology implementer and the opportunity costs of the patent owner.

The contract approach to patent infringement offered here suggests an alternative interpretation of the *Georgia-Pacific* factors. *Georgia-Pacific* is not controlling law in the Federal Circuit or in the Supreme Court. The widely-cited *Georgia-Pacific* case provides a “comprehensive list of evidentiary facts relevant, in general, to the determination of the amount of a reasonable royalty for a patent license.”¹⁵² The *Georgia-Pacific* factors are very useful because they describe the negotiation of royalties in the context of patent license contract provisions, rather than simply the division of rents from exchange.¹⁵³ *Georgia-Pacific*, however, is flawed because it requires turning back the clock before infringement

146. See *Panduit Corp. v. Stahl Bros. Fibre Works*, 575 F.2d 1152, 1158–59 (6th Cir. 1978).

147. See Lanjouw & Schankerman, *supra* note 99, at 48.

148. *Id.* at 56

149. See Eric Rasmusen & Ian Ayres, *Mutual and Unilateral Mistake in Contract Law*, 22 J. LEGAL STUD. 309, 312 (1993).

150. Spulber, *supra* note 8, at 21.

151. See generally Rasmusen & Ayers, *supra* note 149.

152. *Ga.-Pac. Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970).

153. See *id.*

and maintains the fiction of a willing licensor and a willing licensee.¹⁵⁴ This can be remedied by using the *Georgia-Pacific* factors in the context of an “informed contract.”

Basing the “informed contract” on the facts of the case means that the patent case takes into account information revealed after infringement. In *Panduit*, Judge Howard Markey emphasizes that determining reasonable royalties depends on the facts of the case.¹⁵⁵ This requires a modification of the “hypothetical” negotiation at least where infringement is deliberate.

On the date a patent issues, a competitor which made no investment in research and development of the invention, has four options: (1) it can make and sell a non-infringing substitute product, and refrain from making, using, or selling a product incorporating the patented invention; (2) it can make and sell the patented product, if the patent owner be willing, negotiating a license and paying a reasonable (negotiated) royalty; (3) it can simply take the invention, running the risk that litigation will ensue and that the patent will be found valid and infringed, or (4) it can take a license under option (2) and thereafter repudiate its contract, challenging the validity of the patent. Determination of a reasonable royalty, after election of option (3), cannot, without injustice, be treated as though the infringer had elected option (2) in the first place.¹⁵⁶

Judge Markey points out that the speculative nature of the “hypothetical negotiation”:

Determination of a “reasonable royalty” after infringement, like many devices in the law, rests on a legal fiction. Created in an effort to “compensate” when profits are not provable, the “reasonable royalty” device conjures a “willing” licensor and licensee, who like Ghosts of Christmas Past, are dimly seen as “negotiating” a “license.” There is, of course, no actual willingness on either side, and no license to do anything, the infringer being normally enjoined, as is Stahlin, from further manufacture, use, or sale of the patented product.¹⁵⁷

The “informed contract” approach suggested here is consistent with some aspects of *In re Innovatio* and *LaserDynamics*.¹⁵⁸ Judge James F. Holderman in

154. *Id.* (“The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement . . .”).

155. *Panduit Corp. v. Stahlin Bros. Fibre Works, Inc.* 575 F.2d 1152, 1159 (6th Cir. 1978).

The amount of a reasonable royalty after infringement turns on the facts of each case, as best they may be determined. Among the relevant facts are: “what plaintiff’s property was, to what extent defendant has taken it, its usefulness and commercial value as shown by its advantages over other things and by the extent of its use[.]”

Id. (citations omitted).

156. *Id.* at 1158–59.

157. *Id.* at 1159.

158. In *LaserDynamics*, Judge Reyna states “[i]n considering the fifteen *Georgia-Pacific* factors, it is presumed that the parties had full knowledge of the facts and circumstances surrounding the infringement at that time.” *LaserDynamics, Inc. v. Quanta Comput., Inc.*, 694 F.3d 51, 76 (Fed. Cir. 2012).

In re Innovatio approaches the “hypothetical negotiation” from an *ex-post* perspective, taking into account information revealed since infringement.¹⁵⁹ Judge Holderman points out that “[a]t the time of the hypothetical negotiation, the parties in actuality would not have known whether a given patent is valid or infringed, and the alleged infringer would have had the option of contesting these issues in court.”¹⁶⁰ Judge Holderman further observes “[s]tated another way, the hypothetical negotiator could no longer leave the negotiating table to contest liability in court, and could no longer demand the benefit of uncertainty about a court’s rulings.”¹⁶¹

Judge Holderman cites *Lucent Technologies*, “the hypothetical negotiation also assumes that the asserted patent claims are valid and infringed,” explaining that this is “because no hypothetical negotiation would have taken place if it were otherwise. The patent infringer gets no discount on its licensing fee because of uncertainty about its liability that has since been cleared up by litigation.”¹⁶² This differs from the *ex-ante* negotiation in the absence of infringement that is envisaged in *Lucent Technologies*.¹⁶³

The “informed contract” approach provides a context for the reasonable royalties damage remedy. Total compensatory damages should adjust for imperfections in enforcement and risks associated with the legal process. This is necessary to avoid incentives to infringe and to mitigate incentives for hold-out in patent license negotiations. Compensation should not exceed damages to avoid incentives for excessive use of the legal system. The court can grant injunctions if necessary to fully compensate the patent holder and to prevent future infringement.¹⁶⁴ In addition to compensatory damages, the court can award legal costs to the patent owner.¹⁶⁵ If compensatory damages are not sufficient to address injuries, the courts can provide enhanced damages when there is egregious behavior by an infringer.¹⁶⁶

D. Comparison to the Property Approach to Patent Infringement

To understand the contribution of the contract approach offered here, it is useful to review the property approach to licensing and infringement. Property-based damages for patent infringement are similar to remedies for breach of a

159. *In re Innovatio IP Ventures, LLC*, No. 11-C-9308, 2013 WL 5593609, at *7 (N.D. Ill. Oct. 3, 2013).

160. *Id.*

161. *Id.*

162. *Id.*; see *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1325 (Fed. Cir. 2009).

163. *Lucent Techs.*, 580 F.3d at 1325 (“The hypothetical negotiation tries, as best as possible, to recreate the *ex ante* licensing negotiation scenario and to describe the resulting agreement. In other words, if infringement had not occurred, willing parties would have executed a license agreement specifying a certain royalty payment scheme.”).

164. Jones, *supra* note 24, at 240 n.75.

165. See *Halo Elecs., Inc. v. Pulse Elecs., Inc.*, 136 S. Ct. 1923, 1929 (2016).

166. See *id.* at 18 (“Consistent with nearly two centuries of enhanced damages under patent law, however, such punishment should generally be reserved for egregious cases typified by willful misconduct.”).

patent license contract: an injunction, compensatory damages, and attorney fees.¹⁶⁷

This suggests that reasonable royalty damages for infringement should include expectation damages for breach of the “informed contract.”¹⁶⁸ The patent owner should also receive injunctive relief and attorney’s fees where necessary to compensate for infringement.

Property rules for technology offer the many advantages of the power to exclude.¹⁶⁹ If effectively enforced, property rules provide incentives for market transactions such as patent licensing and patent transfers. Competitive markets serve to promote economically efficient licensing royalties and prices for patent sales.¹⁷⁰

By protecting IP, patents support what I have called “the market for innovative control.”¹⁷¹ Patent ownership not only generates economic returns but also provides control over how inventions are used.¹⁷² This means that markets for licensing and transferring patents not only allocate rents from invention but also allocate control over innovation based on invention.¹⁷³ Patents provide a highly effective system of IP rights that includes exclusion, transferability, disclosure, certification, standardization, and divisibility.¹⁷⁴ These features generate transaction efficiencies by improving the allocation of IP and inducing investment in invention and innovation.

With protections for IP rights, payments for using patented technologies are market determined, reflecting competition among IP owners to supply technology and competition among IP adopters to obtain technology.¹⁷⁵ Market pricing of technology reflects the knowledge of many market participants, which is inevitably superior to the knowledge of courts or government regulators. Market allocation of technology offers efficiencies in specialization and division of creative and productive labor, allocation of technology to the highest-value users, and dynamic efficiencies in promoting R&D.¹⁷⁶

167. Jones, *supra* note 24, at 240 n.75 (“In fact, a licensor may be able to obtain the same range of remedies in state court for the breach of a license agreement that the licensor would be able to obtain in federal court for patent infringement under 35 U.S.C. §§ 283–285 (i.e., an injunction, compensatory damages, and attorney fees).”).

168. Although Cotter does not examine patent license contracts, he refers to reasonable royalties as “expectation damages,” which he defines as “the value of the license that the patentee would have negotiated with the defendant, absent the infringement.” Thomas F. Cotter, *Four Principles for Calculating Reasonable Royalties in Patent Infringement Litigation*, 27 SANTA CLARA COMPUT. & HIGH TECH. L.J. 725, 737–38 (2010); *Id.* at 727 (“[T]he baseline damages recovery for prevailing patent owners should be the amount that restores them to the position they would have enjoyed but for the infringement.”).

169. Spulber, *supra* note 58, at 274.

170. *Id.* at 275.

171. *Id.* at 272.

172. *Id.* at 303.

173. *Id.* at 274.

174. *Id.* at 276.

175. *Id.* at 280.

176. *Id.* at 295.

Property protections are sufficient for economic efficiency when there is knowledge of prior art, detection of infringement, and effective enforcement.¹⁷⁷ With IP rights, injunctions and penalties help reduce hold-out in patent license negotiations and deter patent infringement.¹⁷⁸ Problems arise, however, when there are imperfections in knowledge of prior art, detection, and enforcement. Courts must still determine damages when infringement occurs.¹⁷⁹ Viewing either royalties or damages as payment for the use of property generally does not fully reflect the role of licensing agreements in creating inventions, developing innovations based on inventions, and promoting technology adoption.

The contract approach to infringement is complementary to enforcement of IP rights. Injunctive relief for infringement provides incentives for firms to enter into licensing contracts with patent holders. If patent holders make patent license offers to technology adopters, patent holders run the risk that adopters will engage in hold-out, that is, they may seek to delay negotiation as a means of reducing royalty payments. The possibility of injunctions provides incentives for adopters to negotiate with patent holders rather than engaging in hold-out. Damages for infringement and compensation for legal costs also provide incentives for infringers to avoid engaging in hold-out. Conversely, limitations on infringement damages, injunctive relief, or compensation for legal costs provide incentives for hold-out and infringement.

E. Comparison to the Tort Approach to Patent Infringement

An advantage of the contract approach over the tort approach is that the contract approach identifies the harm from infringement as a failure to contract. This allows a determination of reasonable royalty damages on the basis of an “informed contract.” The failure to contract also implies that courts should consider injunctive relief, which can differ from tort approaches. The contract approach is consistent with the tort approach in that it provides compensation for harm to the patent owner caused by infringement.

Tort liability rules are problematic because they often *prevent* the patent holder from excluding access to technology.¹⁸⁰ This contrasts sharply with IP rules, which give patent owners the rights to exclude others from using, making, or selling the invention.¹⁸¹ Tort liability rules prevent exclusion because infringers can obtain access to the technology simply by paying its market value if liability is established.¹⁸² Richard Epstein observes that in general, property rules

177. Harold Demsetz, *The Exchange and Enforcement of Property Rights*, 7 J.L. & ECON. 11, 17 (1964) (“The enforcement of the accompanying property rights has an important impact on the ability of prices to measure benefits.”).

178. Spulber, *supra* note 58, at 280.

179. *Id.* at 288.

180. Richard A. Epstein, *The Clear View of the Cathedral: The Dominance of Property Rules*, 106 YALE L.J. 2091, 2091 (1997).

181. *Id.*

182. *Id.* (“[A] liability rule denies the holder of the asset the power to exclude others or, indeed, to keep the asset for himself. Rather, under the standard definition he is helpless to resist the efforts by some other individual to take that thing upon payment of its fair value, as objectively determined by some neutral party.”).

dominate liability rules when the objective is “to preserve the stability of possession and social expectations that are necessary for the growth of any complex social order.”¹⁸³

The tort approach applies liability rules to infringement.¹⁸⁴ Liability rules are useful when there is imperfect enforcement of property rights because they compensate patent owners for damages and damage payments may reduce infringement.¹⁸⁵ With liability rules, however, courts seeking to determine damages for infringement face the usual constraints on information and expertise. Courts may not accurately estimate lost profits and reasonable royalty damages in comparison to royalties and transfer prices established by efficient markets. Without the possibility of injunctions, the parties may not have sufficient incentive to enter into settlement negotiations. Remedies for patent infringement should provide incentives for efficient contracts between licensors and licensees.¹⁸⁶

The tort approach and liability rules are increasingly prominent because courts have placed greater emphasis on damages for infringement and stricter limits on injunctions.¹⁸⁷ In *eBay*, the Supreme Court emphasizes that permanent injunctive relief in patent cases requires satisfying the four-factor test, and in particular, showing that damage remedies are inadequate compensation for infringement.¹⁸⁸

The main purpose of damages is to compensate the patent owner for infringement rather than deterring infringement or punishing the infringer.¹⁸⁹ Over the last half century, damages for infringement have been based on the forgone royalties or the lost profits of the patent owner.¹⁹⁰ 35 U.S.C. § 284 states “[u]pon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.”¹⁹¹

183. *Id.* at 2120.

184. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092 (1972).

An entitlement is protected by a property rule to the extent that someone who wishes to remove the entitlement from its holder must buy it from him in a voluntary transaction in which the value of the entitlement is agreed upon by the seller Whenever someone may destroy the initial entitlement if he is willing to pay an objectively determined value for it, an entitlement is protected by a liability rule. This value may be what it is thought the original holder of the entitlement would have sold it for.

Id.

185. *Id.* at 1119.

186. Paul J. Heald, *Optimal Remedies for Patent Infringement: A Transactional Model*, 45 Hous. L. Rev. 1165, 1176 (2008) (“The goal of remedies for patent infringement should be to provide incentives for efficient transactions to occur while accounting for the cost of transacting.”); see John M. Golden, *Principles for Patent Remedies*, 88 TEX. L. REV. 505, 554 (2010).

187. Heald, *supra* note 186, at 1185.

188. *eBay Inc. v. MercExchange, L. L. C.* 547 U.S. 388, 393–94 (2006).

189. For an overview of these issues, see Hylton, *supra* note 22, at 417–18.

190. *Aro Mfg. Co. v. Convertible Replacement Tops*, 377 U.S. 476, 505 (1964); Hylton, *supra* note 22, at 430–31.

191. 35 U.S.C. § 284 (2018).

Reasonable royalty damages are based on harm to the patent owner.¹⁹² Reasonable royalty damages consider the gains of the infringer only as a means of estimating harm to the patent owner.¹⁹³ Prior to *Aro*, however, “judges, lawyers, and academics took for granted that a patentee could recover the infringer’s profits.”¹⁹⁴ Gain-based remedies refer to restitution damages and disgorgement damages.¹⁹⁵ Under the restitution remedy, the infringer’s gain from using the invention would provide a form of relief to the patent owner.¹⁹⁶ Interestingly, some commentators refer to restitution as an implied contract or a quasi-contract.¹⁹⁷

III. THE PATENT LICENSE CONTRACT AND THE PATENT CASE

The contract approach contributes to an understanding of reasonable royalty damages for patent infringement. Contract negotiation addresses economic factors that increase or decrease reasonable royalty damages. Reasonable royalty damages should be based on the terms of the “informed contract.” The economic benefits and costs of the “informed contract” provide an economic foundation

192. Mohamed Yusuf M. Mohamed, *Unjust Enrichment for Patent Infringement: A Novel Idea?*, 4 J. INTELL. PROP. L. 123, 125 (1996).

193. *Id.* at 125–26.

194. *Id.* at 155.

What is unacceptable is how courts have managed to read the 1946 amendment of the patent code as eliminating the traditional remedy of an accounting for the infringer’s profits. Such a reading is without basis.

In fact, Congress appears to have intended to preserve the option of a restitutionary recovery. *Id.* at 159; see also LORD GOFF OF CHIEVELEY & GARETH JONES, *THE LAW OF RESTITUTION* 12 n.63 (Gareth Jones ed., 4th ed. 1993).

195. See JAMES EDELMAN, *GAIN-BASED DAMAGES: CONTRACT, TORT, EQUITY AND INTELLECTUAL PROPERTY* 1 (2002) (“Restitutionary damages are a reverse which operates to restore wrongful transfers of value from a claimant to a defendant. Disgorgement damages operate to strip a defendant of profit made by wrongful conduct.”); see also Ross Grantham & Charles Rickett, *A Normative Account of Defenses to Restitutionary Liability*, 67 CAMBRIDGE L.J. 92, 101 (2008); R. B. Grantham & C. E. F. Rickett, *Disgorgement for Unjust Enrichment?*, 62 CAMBRIDGE L.J. 159, 159 (2003) (“Restitution is the giving back of wealth received by a defendant from a claimant, which must be given back or restored because it amounts to an unjust enrichment at the claimant’s expense.”); R.B. Grantham & C. E. F. Rickett, *Property Rights as a Legally Significant Event*, 62 CAMBRIDGE L.J. 717, 738 (2003).

196. Her Majesty’s Attorney General v. Blake [2000] (HL) (appeal taken from U.K.).

Be that as it may, in these types of case equity considered that the appropriate response to the violation of the plaintiff’s right was that the defendant should surrender all his gains, and that he should do so irrespective of whether the violation had caused the plaintiff any financially measurable loss. Gains were to be disgorged even though they could not be shown to correspond with any disadvantage suffered by the other party. This lack of correspondence was openly acknowledged. In *Lever v. Goodwin* (1887) 36 Ch. D. 1, 7, Cotton L.J. stated it was ‘well known’ that in trade mark and patent cases the plaintiff was entitled, if he succeeded in getting an injunction, to take either of two forms of relief: he might claim from the defendant either the damage he had sustained from the defendant’s wrongful act or the profit made by the defendant from the defendant’s wrongful act.

Id.

197. See generally ANDREW BURROWS, *THE LAW OF RESTITUTION* 2 (3rd ed. 2011). See also PETER BIRKS, *AN INTRODUCTION TO THE LAW OF RESTITUTION* 2 (rev. ed. 1989); Andrew Kull, *Rationalizing Restitution*, 83 CALIF. L. REV. 1191, 1201 (1995) (“Where the law imposes an obligation to pay for benefits conferred in the absence of contract, the ordinary measure of recovery is therefore defendant’s gain, not plaintiff’s cost.”). Restitution for patent infringement would be subject to a defense of innocence by the infringer. See EDELMAN, *supra* note 195, at 242.

for determining compensatory damages. The contract approach is consistent with the combination of an injunction, damages, and attorney's costs.

A. *The Framework of a Patent License Contract*

To better understand the patent case, it is useful to consider a list of patent license contract provisions.¹⁹⁸ The elements of a patent license contract affect the benefits of the agreement for the licensor and the licensee.¹⁹⁹ The provisions of a patent license contract also affect the compensation arrangements chosen by the parties.²⁰⁰ In a similar manner, the provisions of the “informed contract” will help determine reasonable royalty damages for infringement.

Although patent license contracts typically are confidential, it is nonetheless feasible to observe many license agreements.²⁰¹ The EDGAR database of the U.S. Securities and Exchange Commission (“SEC”) includes many patent license agreements, although confidential portions of these agreements are redacted.²⁰² The International Trade Commission (“ITC”) also includes patent license contract filings, although confidential portions of these agreements are redacted.²⁰³

The framework of a patent license agreement includes the following six critical elements. The list does not describe in detail provisions such as treatment of confidential information, representations and warranties, disclaimers and limitations of liability, conflict resolution, contract termination and renewal, and enforceability.²⁰⁴

198. For a guide to license agreements, see, e.g., Donald M. Cameron & Rowena Borenstein, *Key Aspects of IP License Agreements*, OGIIVY RENAULT (2003), <http://www.jurisdiction.com/lic101.pdf>; Donna Bobrowicz, *A Checklist for Negotiating License Agreements*, CONCEPT FOUNDATION (2007), <http://www.iphandbook.org/handbook/ch11/p11/>; see also U.N. Indus. Dev. Org., *Guidelines for Evaluation of Transfer of Technology Agreements*, 12 Development and Transfer of Technology Series 3 (1979); U.N. Indus. Dev. Org., UNIDO Manual on Technology Transfer Negotiation, modules 6, 16 (1996); World Intellectual Prop. Org. [WIPO], *Licensing Guide for Developing Countries*, no. 620 (1977). Gene Quinn, *Drafting a Licensing Agreement, A Patentee Perspective*, IPWATCHDOG (Apr. 30, 2016), <http://www.ipwatchdog.com/2016/04/30/drafting-licensing-agreement/id=68723>; Kristen Leute, *Anatomy of a License Agreement*, in 4 AUTM TECHNOLOGY PRACTICE MANUAL (3d. ed. 2010), https://www.autm.net/AUTMMain/media/ThirdEditionPDFs/V4/TTP_V4_AnatomyLicense.pdf.

199. See Cameron & Borenstein, *supra* note 198, at 6–9.

200. *Id.* at 8.

201. For standard licensing contracts, see, e.g., Gemalto's license agreement. *Standard Patent License Agreement*, GEMALTO, https://www.gemalto.com/companyinfo-site/about-site/merger-site/download-site/Documents/patent_licence.pdf (last visited Dec. 29, 2018).

202. See EDGAR | *Company Filings*, SEC, <https://www.sec.gov/edgar/searchedgar/companysearch.html> (last visited Dec. 29, 2018).

203. See *United States International Trade Commission*, USITC, <https://www.usitc.gov> (last visited Dec. 29, 2018).

204. See Cameron & Borenstein, *supra* note 198, at 6.

1. *Identification of the Parties, Description of Their Businesses, and Their Business Relationship with Each Other*

Patent license contracts reflect the characteristics of the particular licensor and licensee.²⁰⁵ Each patent license agreement includes rights and obligations specific to the combination of the licensor and licensee.²⁰⁶ This explains why there generally is no standard patent license contract.²⁰⁷ The terms of the contract depend on the properties of the technology that is being transferred.²⁰⁸ The terms of the contract also depend on the applications of the technology by the licensee.²⁰⁹ The license agreement includes “recitals” that detail developments leading up to the contract such as whether the contract was a settlement of an infringement dispute.²¹⁰

The contract terms including royalties will be tailored to the particular characteristics of the licensor and licensee and will reflect their business relationship. The licensor and the licensee may have other business relationships that are connected to or extend beyond the licensing agreement. These include complementary knowledge transfers from the licensor to the licensee that enhance the value of the patented technology to the licensee resulting in higher royalties for the licensed technology. The licensor may supply products to the licensee so that the licensing terms may adjust depending on the value of the business relationship to the licensor and the licensee. For example, Qualcomm supplies modem chips such as Snapdragon for mobile phones to phone manufacturers such as Apple, Asus, LG, Samsung, and Sony.²¹¹ Qualcomm also licenses its patents to those manufacturers or to their suppliers as a condition for the purchase of its chips.²¹²

2. *Start Date, Duration of the Agreement, and Period of Coverage*

The start date and duration of the agreement are important for determining performance and the basis for compensation. The duration of the agreement and period of coverage limit the grant of rights to the licensee. The duration of the agreement and period of coverage provide an indication of the activities of the

205. *Id.* at 6–9, 26.

206. *Id.* at 1–2, 33.

207. Raymond C. Nordhaus, *Patent License Agreements*, 21 *BUS. LAW.* 643, 643 (1966)

Because of the infinite variety of rights and obligations that may be established between a patent licensor and his licensee, there is no “standard” form of license agreement that may be used in all situations. Each license agreement must be carefully tailored to the specific circumstances of the particular case.

Id.

208. Cameron & Borenstein, *supra* note 198, at 1, 11.

209. *Id.*

210. *Id.* at 7.

211. Mark Sullivan, *In Its War With Apple, Qualcomm Tries To Save Its Business Model*, *FAST COMPANY* (July 20, 2017), <https://www.fastcompany.com/40442789/apple-qualcomm-war-existential-threat>.

212. Press Release, FTC, *FTC Charges Qualcomm With Monopolizing Key Semiconductor Device Used in Cell Phones* (Jan. 17, 2017), <https://www.ftc.gov/news-events/press-releases/2017/01/ftc-charges-qualcomm-monopolizing-key-semiconductor-device-used>.

licensee in terms of application of the technology by the licensee. During the time period specified by the contract, the licensee may develop products, production processes or transaction methods that apply the technology.²¹³

The duration of the agreement also provides information about the time period during which the licensee produces output or makes sales that are the basis for royalties to be paid to the licensor.²¹⁴ The license contract may also specify how the parties may terminate the agreement. Additionally, the license contract specifies a period of coverage of the patented technology that may differ from the duration of the agreement.²¹⁵ Coverage can include compensation for infringement that occurred prior to the start of the licensing agreement.²¹⁶ The agreement may also include compensation for use of the patented technology that may extend beyond the term of the licensing agreement.

3. *Definition of the IP*

Perhaps the most important aspect of the patent license contract is identification of the IP covered by the agreement. This part of the agreement specifies what patents are covered by the license and may identify particular claims within patents. Contracts also cover patent portfolios consisting of many individual patents.²¹⁷ Because technological change occurs during the contract, the agreement may include new patents that will be added to those portfolios. The contract may include patent families across countries including the United States, the European Union, China, Japan, and Korea.²¹⁸ The agreement may also specify other types of IP that are covered by the agreement, including patent applications, trademarks, copyrights, trade secrets, and know-how. In cross-licensing contracts, the contract specifies all of the IP that is covered by the agreement.²¹⁹

4. *Grant of Rights (IP Limits, Field of Use, Territory, Degree of Exclusivity, Improvements to the Technology)*

The Code of Federal Regulations states “the licensing of a patent transfers a bundle of rights which is less than the entire ownership interest, e.g., rights that may be limited as to time, geographical area, or field of use.”²²⁰ The grant of rights imposes limitations that affect the benefits of the transaction for both the licensor and the licensee. The grant of rights may place limitations on both parties in cross-licensing contracts.²²¹

213. See Cameron & Borenstein, *supra* note 198, at 11, 32.

214. *Id.* at 32.

215. See *id.*

216. See *id.* at 12, 37.

217. See, e.g., Nordhaus, *supra* note 207, at 644; Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, TEMPLE U., <http://www.temple.edu/lawschool/dpost/ptw/parchomovsky.pdf> (last visited Dec. 29, 2018).

218. See Cameron & Borenstein, *supra* note 198, at 1.

219. *Id.* at 1, 17.

220. 301 Ownership/Assignability of Patents and Applications, MPEP (9th ed., rev. July 2015).

221. U.S. DEP'T OF JUST. & FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 59 (2007).

For convenience and to mitigate transaction costs, patent licenses may include the entire patent portfolio of the licensor.²²² Alternatively, the patent license may be limited to specific patents and even to specific claims within the patents covered by the agreement.²²³ The license agreement may place “field-of-use” restrictions on the licensee’s ability to make, use, or sell products using the patented technology.²²⁴ Also, the license agreement may limit the geographic area in which the licensee may use the patented technology.²²⁵

The license agreement also specifies the degree of exclusivity.²²⁶ The license may be exclusive to the licensee and the licensor may not practice the invention or grant licenses to others.²²⁷ A sole license allows the licensor and the licensee to practice the patent.²²⁸ A nonexclusive license allows the licensor to practice the patent and to license the patent to others.²²⁹ The degree of exclusivity may affect product market competition between the licensor and the licensee and among licensees. The grant of rights also may include a release if the license is part of a settlement of an infringement dispute.²³⁰

The licensing contract addresses the effects of inventive activities that improve the features of the technology.²³¹ Either the licensor or the licensee may make improvements in the technology. If the licensor makes improvements in the technology, the licensing contract can specify whether the licensee will be able to use those improvements.²³² The licensee would benefit from these additional improvements, which may be reflected in higher royalties.²³³ The license contract determines whether or not to grant the licensee a right to modify the

222. *Id.* at 57.

223. Nordhaus, *supra* note 207, at 643–44.

224. *Id.* at 644–45, 657.

225. See Cameron & Borenstein, *supra* note 198, at 18.

226. See *id.* at 9, 18.

227. See 37 C.F.R. § 3.1 (2018).

An exclusive license may be granted by the patent owner to a licensee. The exclusive license prevents the patent owner (or any other party to whom the patent owner might wish to sell a license) from competing with the exclusive licensee, as to the geographic region, the length of time, and/or the field of use, set forth in the license agreement. A license is not an assignment of the patent. Even if the license is an exclusive license, it is not an assignment of patent rights in the patent or application.

Ownership/Assignability of Patents and Applications, 2015 Dec. Comm’r Pat. 301, <https://www.uspto.gov/web/offices/pac/mpep/s301.html#d0e17687>.

228. Cameron & Borenstein, *supra* note 198, at 9.

229. *Id.*

230. *Id.* at 12.

231. *Id.* at 21 (“There is no widely accepted definition for ‘improvement’ in the context of intellectual property licenses, but it is usually used to mean a development within the field of the licensed technology that enhances the usability, functionality, efficiency, performance or other characteristic of the original technology.”).

232. *Id.*

233. *Id.* at 21.

At the end of it all, the royalty fee should account for the bargain struck, and a higher royalty may be justified to the extent the licensee is entitled to the benefit of subsequent licensor improvements. It may also be dealt with through an extension of the term of the Agreement (and a corresponding extension of the length of time during which a licensee must pay royalties), particularly if the improvements are patentable.

Id.

invention and specifies who owns the IP resulting from the modification.²³⁴ Cameron and Borenstein point out that “[l]icensee improvements may be a far more contentious matter to negotiate than licensor improvements. If the licensee intends to actually modify the technology in order to create improvements, the license grant must provide that right.”²³⁵ Cameron and Borenstein also point out that the licensing agreement may require the licensee to disclose improvements.²³⁶ If the licensee benefits from ownership of improvements, this may be reflected in higher royalties for the licensed technology.

5. *Compensation*

Royalty payments and other contract terms are jointly determined by the contracting parties. The licensor and the licensee choose royalty payments in the context of other aspects of their business relationship. The royalty payments in the contract are jointly determined with the other provisions of the contract. For example, when the parties are engaged in cross licensing, there is an adjustment of net payments to reflect the net benefits of the parties.²³⁷ When infringement occurs, however, the infringer is not granting cross licenses to the patent holder. This means that all other things being equal, the “informed contract” would have greater royalties than a licensing contract with cross licensing.

To illustrate how compensation is determined within the context of the contract provisions, consider for example, a patent license agreement between a patent holder Interdigital Technology Corporation (“ITC”) and an adopter Samsung Electronics Co., Ltd. (“SEC Group”).²³⁸ The contract identifies the parties and describes their businesses.²³⁹ The contract specifies the license grant: “a non-exclusive, worldwide, royalty bearing, perpetual license for the life of and under the Licensed Patents . . . to make, have made, use, sell, lease or otherwise dispose of” various time-division multiple access (“TDMA”) technologies.²⁴⁰ The con-

234. *Id.* at 22.

235. *Id.* at 21.

At the end of it all, the royalty fee should account for the bargain struck, and a higher royalty may be justified to the extent the licensee is entitled to the benefit of subsequent licensor improvements. It may also be dealt with through an extension of the term of the Agreement (and a corresponding extension of the length of time during which a licensee must pay royalties), particularly if the improvements are patentable.

Id.

236. *Id.*

237. See Patent Cross License Agreement Between Advanced Micro Devices, Inc. and Intel Corporation, SEC ARCHIVES, §§ 2–3 (Nov. 11, 2009), <https://www.sec.gov/Archives/edgar/data/2488/000119312509236705/dex102.htm>.

238. The articles of the contract are as follows: 1. Definitions, 2. License Grant, 3. Warranties, 4. Additional Covered Standards, 5. Term; Termination, 6. Payment of License Fees, 7. Wireless Local Loop Subscriber Units, 8. Adjustments to Royalties, 9. Payments, 10. Cross Licenses, 11. Advance Payment, 12. Miscellaneous. See TDMA Patent License Agreement Between Interdigital Tech. Corp. & Samsung Elec. Co., SEC ARCHIVES, <https://www.sec.gov/Archives/edgar/data/354913/000119312506230371/dex1085.htm>. (last visited Dec. 29, 2018).

239. See *id.*

240. *Id.* at art. 2.

tract specifies running royalty payments per unit of products, in this case subscriber units or infrastructure units.²⁴¹ The contract refers to the calculation of royalties based on the manufacture, sale, lease, and/or use of the units of products.²⁴² The contract provides for advance payments of royalties.²⁴³ The contract has a “no stacking” provision for the two types of products sold by the adopter.²⁴⁴ The contract also provides for cross licensing of patents from SEC Group to ITC.²⁴⁵

B. *Patent Pools and the Patent License Contract*

The basic framework of a patent license agreement applies even to licensing contracts offered by patent pools. This is important because patent pool contracts are the exception that proves the rule. Patent pool royalty rates generally are “posted prices” that are publicly announced and the contract itself also is posted and applied to all technology users.²⁴⁶ These contracts are not negotiated with licensees, which serves to reduce the transaction costs of widespread adoption and application of the technology.²⁴⁷ Standardized royalties and contract terms, however, reflect internally negotiated agreements among members of the patent pool rather than negotiation between patent owners and technology adopters.²⁴⁸

Even with standardization of royalties and contract terms, patent pool license agreements have complex provisions.²⁴⁹ Patent pool royalties should be viewed in the context of the overall licensing agreement. With suitable adjustments for differences in contract provisions, patent pool contracts can provide comparable license contracts.

Because the agreement is a patent pool license it typically does not address complementary knowledge transfers.²⁵⁰ The antitrust guidelines toward IP, however, state concerns that:

a pooling arrangement that requires members to grant licenses to each other for current and future technology at minimal cost may reduce the incentives of its members to engage in research and development because members of the pool have to share their successful research and development and

241. *Id.* at § 11.1.

242. *Id.* at § 6.3.

243. *Id.* at § 11.1.

244. *Id.* at § 6.4.

245. *Id.* at § 7.2.

246. See LARRY M. GOLDSTEIN & BRIAN N. KEARSEY, TECHNOLOGY PATENT LICENSING AN INTERNATIONAL REFERENCE ON 21ST CENTURY PATENT LICENSING, PATENT POOLS AND PATENT PLATFORMS 70 (2004).

247. See *id.*; TDMA Patent License Agreement Between Interdigital Tech. Corp. & Samsung Elec. Co., SEC ARCHIVES, <https://www.sec.gov/Archives/edgar/data/354913/000119312506230371/dex1085.htm>.

248. See GOLDSTEIN & KEARSEY, *supra* note 246, at 68.

249. For other patent license agreements, see SISVEL, *SISVEL LTE Patent Pool Portfolio License Agreement*, <http://sisvel.com/images/media/2016/LTE-Portfolio-License-Agreement.pdf>; SISVEL, *SISVEL WLAN Program License Agreement*, http://www.sisvel.com/Wi-Fi/License_Agreement.pdf.

250. See GOLDSTEIN & KEARSEY, *supra* note 246, at 70.

each of the members can free ride on the accomplishments of other pool members.²⁵¹

Consider for example, MPEG LA's MPEG-2 Patent Portfolio License (hereafter "MPEG-2 contract").²⁵² The license contract offered by the pool covers SEPs and has helped to establish a technology standard.²⁵³ According to the patent pool MPEG LA, "[w]ide acceptance of the MPEG-2 Patent Portfolio License has helped produce the most widely employed standard in consumer electronics history."²⁵⁴

1. *Identification of the Parties, Description of Their Businesses, and Their Business Relationship with Each Other*

The MPEG-2 contract begins with identification of the parties.²⁵⁵ Because the agreement is standardized, it does not specify the business relationship between the parties. The contract identifies the licensors, for example, "Alcatel Lucent, a corporation of France, having a principal place of business in Paris, France."²⁵⁶ The agreement also limits the business relationships: "Nothing in this Agreement shall be construed to create a principal-agent relationship, partnership or joint venture between the parties, or give rise to any fiduciary duty from one party to the other party."²⁵⁷

2. *Start Date, Duration of the Agreement, and Period of Coverage*

Section 6 of the MPEG-2 Patent Portfolio License specifies the term and termination: "[t]his agreement shall expire on termination of all MPEG-2 Patent Portfolio Patents."²⁵⁸ The contract provides for termination for material breach by the licensee.²⁵⁹

251. Antitrust Guidelines for the Licensing of Intellectual Property, F.T.C § 5.5, at 31 (U.S. Dep't Just. Jan. 12, 2017); *see also* Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition, F.T.C, Ch. 3 (U.S. Dep't Just. Apr., 2017).

252. *MPEG-2 License Agreement*, MPEGLA, <http://www.mpegla.com/main/programs/M2/Pages/License.aspx> (last visited Dec. 29, 2018).

253. *See MPEG-2 Introduction*, MPEGLA, <http://www.mpegla.com/main/programs/m2/pages/intro.aspx> (last visited Dec. 29, 2018).

254. *Id.* For a summary of the Agreement, see MPEGLA, *supra* note 252.

255. *See* MPEGLA, *supra* note 252.

256. The licensors of the MPEG-2 Patent Portfolio License include the following: Alcatel Lucent, ARRIS Technology, Inc. (formerly General Instrument Corporation), British Telecommunications plc, Canon Inc., CIF Licensing, LLC, Cisco Technology, Inc., Fujitsu Limited, GE Technology Development, Inc., Hewlett Packard Enterprise Company, Hitachi, Ltd., JVC KENWOOD Corporation, KDDI Corporation, Koninklijke Philips N.V., LG Electronics Inc., Mitsubishi Electric Corporation, Multimedia Patent Trust, Nippon Telegraph and Telephone Corporation, Orange SA, Panasonic Corporation, Robert Bosch GmbH, Samsung Electronics Co. Ltd., SANYO Electric Co. Ltd., Sharp Corporation, Sony Corporation, The Trustees of Columbia University in the City of New York, Thomson Licensing, and Toshiba Corporation. *See id.*; *see also* MPEGLA, *MPEG-2 Licensors*, <http://www.mpegla.com/main/programs/M2/Pages/Licensors.aspx> (last visited Dec. 29, 2018).

257. MPEGLA, *supra* note 252, at § 7.9.

258. *Id.* at § 6.1.

259. *Id.* at § 6.2.

3. *Definition of the IP*

The MPEG-2 Patent Portfolio License “provides access to patents that are essential to the MPEG-2 Video and Systems coding standards used in set-top boxes, DVD players and recorders, TVs, personal computers, game machines, cameras, DVD Video Discs and other products.”²⁶⁰ The first “whereas” statement identifies the relevant technology standard, “SO/IEC JTC 1 and The International Telecommunications Union have jointly adopted an international standard relating to video data compression and data transport, formally known as ISO/IEC 13818-1 and 13818-2, and referred to in this Agreement as the ‘MPEG-2 Standard.’”²⁶¹

4. *Grant of Rights (IP Limits, Field of Use, Territory, Degree of Exclusivity, Improvements to the Technology)*

The MPEG-2 contract spells out the grant of rights.²⁶² Section 2 of the contract sets forth the licensing administrator grant.²⁶³ For example, for MPEG-2 Decoding Products, the contract reads:

The Licensing Administrator hereby grants to Licensee a royalty bearing worldwide, nonexclusive, nontransferable sublicense under all MPEG-2 Patent Portfolio Patents to make, have made, use, and Sell or offer for Sale MPEG-2 Decoding Products (i) that bear the brand name that Licensee owns or otherwise has the right to use at Licensee’s discretion or (ii) Sold without a brand name if the decision to do so is at the discretion of Licensee.²⁶⁴

The “whereas” clauses also state the following with regard to the grant of rights:

WHEREAS, each Licensor hereby commits on behalf of itself and its Affiliates to make available licenses and/or sublicenses under any and all MPEG-2 Essential Patents licensable or sublicensable by the Licensor and its Affiliates to any individual, company or other entity desiring such a license and/or sublicense on fair, reasonable and nondiscriminatory terms and conditions;

WHEREAS, each Licensor has granted the Licensing Administrator a worldwide, nonexclusive license and/or sublicense under all MPEG-2 Essential Patents licensable or sublicensable by the Licensor to allow the Licensing Administrator to grant worldwide, non-exclusive sublicenses under all such MPEG-2 Essential Patent(s) under the terms hereof;

WHEREAS, the Licensors desire to make available through the Licensing Administrator license rights under their and their Affiliates’ respective MPEG-2 Essential Patents in a single sublicense for the convenience of any

260. MPEGLA, *supra* note 253.

261. MPEGLA, *supra* note 252.

262. *See id.*

263. *Id.* at § 2.

264. *Id.*

individual, company or other entity desirous of acquiring such rights, thereby avoiding the need of such individual, company or other entity to obtain a separate license from each of the Licensors under its MPEG-2 Essential Patent(s);

WHEREAS, the Licensing Administrator desires to grant MPEG-2 Patent Portfolio Licenses to all individuals, companies and other entities desiring such a license under the terms and conditions set forth herein;

WHEREAS, nothing in this Agreement precludes the respective Licensors from licensing or sublicensing rights under individual MPEG-2 Essential Patent(s) to make, use, sell, or offer to sell products or processes including but not limited to the rights licensed in the MPEG-2 Patent Portfolio License²⁶⁵

The agreement states the following:

Licensee shall promptly identify to the Licensing Administrator each Patent(s), except for MPEG-2 Patent Portfolio Patents of the Licensors, licensable or sublicensable by Licensee or its Affiliate(s), if any, which Licensee believes in good faith to be an MPEG-2 Essential Patent(s) within fourteen (14) Days of execution of this Agreement.²⁶⁶

5. *Compensation*

Section 3 of the MPEG-2 contract covers royalty and payments.²⁶⁷ The contract specifies the royalty base and the level of payments in terms of number of units sold.²⁶⁸ For example, Section 3.1.1 addresses the MPEG-2 Decoding Product.²⁶⁹

Upon the Sale of each MPEG-2 Decoding Product Manufactured or Sold in a country in which one or more MPEG-2 Patent Portfolio Patent(s) is in force, the royalty for the sublicense granted pursuant to Section 2.1 shall be four United States Dollars (U.S. \$4.00) per MPEG-2 Decoding Product Sold prior to January 1, 2002; two and one half United States Dollars (U.S. \$2.50) per MPEG-2 Decoding Product Sold between January 1, 2002 and the later of December 31, 2009 or the execution date of this Agreement (in which case as provided below, the applicable royalty is Two United States Dollars (\$2.00) per MPEG-2 Decoding Product as of the later of such dates) but not later than December 31, 2015; two United States Dollars (\$2.00) per MPEG-2 Decoding Product Sold between the later of January 1, 2010 and the execution date of this Agreement (failing which the applicable royalty continues to be two and one half United States Dollars (U.S. \$2.50) per MPEG-2 Decoding Product through such execution date) but not later than December 31, 2015; and \$0.50 per MPEG-2 Decoding Product Sold after December 31, 2015 with right of voluntary termination on thirty (30) Days' written notice unless and until an election is made to the

265. *Id.*

266. *Id.*

267. *Id.*

268. *Id.*

269. *Id.*

Licensing Administrator in writing for a royalty of \$0.35 per MPEG-2 Decoding Product, MPEG-2 Encoding Product (pursuant to Section 3.1.2 below) or Consumer Product (pursuant to Section 3.1.3 below) Sold after December 31, 2015 in which case a right of voluntary termination shall not be available until on or after January 1, 2018 on thirty (30) Days' written notice.²⁷⁰

C. *The Framework of the Patent Case*

The patent case proceeds through a number of standard phases: the early case, preliminary injunction, discovery, claim construction, summary judgment, pretrial, the trial, and the post-trial.²⁷¹ At each stage, the patent case collects and records information about the parties. The patent case also gathers information about the technology. Patent cases may involve many patents and large numbers of patent claims.²⁷² The courts engage in claim construction to interpret the meaning of patent claims and evaluate validity and infringement.²⁷³

The patent case also constructs an “informed contract” when there are SEPs. In *Microsoft v. Motorola*, United States District Judge James L. Robart outlines the case as follows:

The court’s analysis proceeds in six parts. First, the court introduces the parties and their relation to one another. Second, the court provides background on standards, SSOs, and the RAND commitment. Third, the court develops a framework for assessing RAND terms. Specifically, the court adopts a modified version of the Georgia-Pacific factors to recreate a “hypothetical negotiation” between the parties. See *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970). Importantly, the court determines that the parties in a “hypothetical negotiation” would set RAND royalty rates by looking at the importance of the SEPs to the standard and the importance of the standard and the SEPs to the products at issue. These considerations are central to the court’s analysis. Fourth, after establishing a framework for assessing RAND terms, the court introduces the H.264 Standard and Motorola’s H.264 SEPs, analyzing each patent in turn and setting out the portfolio’s relative importance to the H.264 Standard and to Microsoft’s standard-using products. Fifth, the court introduces the 802.11 Standard and Motorola’s 802.11 SEPs and analyzes each 802.11 Patent using the same framework.

Sixth, the court uses all of the foregoing information, along with comparables suggested by the parties, to determine an appropriate RAND royalty rate for Motorola’s SEPs.²⁷⁴

270. *Id.*

271. The chapters describe these phases. See MENELL ET AL., *supra* note 5, at §§ 2-1–9-3.

272. *See id.* at 5–8.

273. See J. Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 NW. U.L. REV. 1, 3–4 (2014).

274. *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, 2013 WL 2111217, at *3 (W.D. Wash. Apr. 25, 2013).

The components of a patent case roughly correspond to the elements of an “informed contract.” The patent case thus collects information that describes various aspects of the “informed contract.” Many of the terms of the “informed contract” are set in stone because infringement already has occurred. By the time of the patent case, the actions of the infringer and the patent owner have filled in much of the patent license contract. The court discovers and interprets many of the elements of the “informed contract” in the course of resolving the infringement dispute. The court determines royalties in the context of the overall patent case, so that the court determines royalties in the context of an “informed contract.”

The patent case can be compared to the basic elements of an “informed contract” identified in the previous sections. The evidence gathered by the patent case provides information that constructs the provisions of a patent license contract.

1. *Identification of the Parties, Description of Their Businesses, and Their Business Relationship with Each Other*

The patent case specifies the parties to the “informed contract” and their business relationship. The patent case describes the identities and characteristics of the licensor and licensee. We can observe the industries in which the licensor and licensee operate. We know whether or not the licensor practices the patent and we may be able to observe whether or not the patent owner makes use of the patented technology. We also know whether or not the licensor has licensed the patent to others.²⁷⁵

2. *Start Date, Duration of the Agreement, and Period of Coverage*

The patent case determines the starting date and the duration of the “informed contract.” The date that infringement began determines the starting date of the forgone license contract.²⁷⁶ The duration of the infringement specifies the duration of the forgone license contract.

3. *Definition of the IP*

The infringement litigation determines the IP that is being transferred by the “informed contract.” This is because the litigation determines the IP that is infringed, including particular patents, trade secrets, and other technology. Determining the patents at issue and the specific claims within patents are of critical

275. Infringement generally does not involve complementary knowledge transfers because the patent holder and the infringer are not already involved in a business relationship. However, complementary knowledge transfers may arise when the infringement suit stems from a business dispute between the parties such as a breach of contract.

276. See MENNELL ET AL, *supra* note 5, at E-93 (reproducing Federal Circuit Bar Association Model Patent Jury Instruction).

importance in infringement disputes.²⁷⁷ Litigants and the courts devote effort to selecting what patents and specific claims within those patents will be part of the infringement case. Menell et al. identify many legal strategies for claim winnowing and claim construction.²⁷⁸ They point out, “[c]onstruing patent claim terms has long been a key aspect of patent litigation and arises in almost every patent case.”²⁷⁹ The district judge has responsibility for claim construction.²⁸⁰

4. *Grant of Rights (IP Limits, Field of Use, Territory, Degree of Exclusivity, Improvements to the Technology)*

The actions of the infringer and the patent owner during the period of infringement determine the rights granted by the “informed contract.” The rights granted by a patent license agreement are the main purpose of the contract.²⁸¹ The infringer may have made, used, sold, or imported products or production processes based on the patented invention. In this way, the actions of the infringer determine some of the rights granted by the forgone license contract.

The actions of the patent owner determine the type of the “informed contract.” If the patent owner does not use or license the technology, the “informed contract” is exclusive. If the patent owner licenses the technology to others, the “informed contract” is nonexclusive. If the patent owner uses the technology but does not license it to others, the “informed contract” is a sole license.

The infringer’s actions during the period of infringement determine various restrictions in the “informed contract.” These restrictions include the industry and territory in which the technology adopter will operate. The descriptions of the business activities of the infringer indicate the restrictions in the “informed contract.” Also, the infringer’s relationships with customers and suppliers may indicate whether or not the infringer has shared the technology with third parties, including sub-licensing. This determines whether the forgone license contract granted sub-licensing rights to the licensee.

5. *Compensation*

The business activities of the infringer during the period of infringement determine some critical aspects of consideration in the “informed contract.” In particular, it is possible to observe the infringer’s number of units sold, prices

277. *Id.* at § 2-9 (“Patent claims play a central role in patent cases, as they establish and delineate the intellectual property.”).

278. *Id.* at §§ 2-9–2-26.

279. *Id.* at § 2-13.

280. *Id.*

The Supreme Court’s seminal decision in *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 391 (1996), took claim construction out of the jury’s hands and put the responsibility squarely on the district judge to construe patent claim terms. More recently, *Teva Pharmaceuticals USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831 (2015), not only confirmed that district courts were authorized to resolve subsidiary factual issues underlying claim construction, but held that such findings of fact should be upheld unless they are clearly erroneous.

Id.

281. See LEUTE, *supra* note 198, at 5.

received, sales revenues, costs, and profits. These provide a basis for determining some aspects of royalty payments in the “informed contract.” Royalty payments may be defined in terms of the units sold or sales revenue of the technology adopter. Although the patent case generally focuses on specific patents or patent claims, the IP being infringed often is part of a portfolio. Compensation should reflect the fact that patent licensing often involves entire portfolios rather than individual patents or specific claims.

D. Contrast with Hypothetical Negotiation

The “informed contract” approach proposed here modifies the “hypothetical negotiation” approach by recognizing what actually occurred during the period of infringement. In contrast, the Federal Circuit Bar Association Model Patent Jury Instructions emphasize expectations of the patent holder and infringer for calculating damages:

A reasonable royalty is the amount of royalty payment that a patent holder and the alleged infringer would have agreed to in a hypothetical negotiation taking place at a time prior to when the infringement first began. In considering this hypothetical negotiation, you should focus on what the expectations of the patent holder and the alleged infringer would have been had they entered into an agreement at that time, and had they acted reasonably in their negotiations.²⁸²

However, these jury instructions then depart from expectations by recognizing that the patent is valid and infringed; something that may not have been known at the time infringement began.

In determining this, you must assume that both parties believed the patent was valid and infringed and that both parties were willing to enter into an agreement. The reasonable royalty you determine must be a royalty that would have resulted from the hypothetical negotiation, and not simply a royalty either party would have preferred. Evidence of things that happened after the infringement first began can be considered in evaluating the reasonable royalty only to the extent that the evidence aids in assessing what royalty would have resulted from a hypothetical negotiation. Although evidence of the actual profits an alleged infringer made may be used to determine the anticipated profits at the time of the hypothetical negotiation, the

282. MENELL ET AL., *supra* note 5, at E-93 (citing the following authorities for model instructions: “*Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292 (Fed. Cir. 2011) (25% “rule of thumb” inadmissible); *ResQNet.com, Inc. v. Lansa, Inc.*, 594 F.3d 860 (Fed. Cir. 2010) (per curiam) (licenses must be related to patent at issue to be relevant to a reasonable royalty); *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1340 (Fed. Cir. 2009) *cert. denied*, 130 S. Ct. 3324 (2010) (vacating and rewarding jury award as excessive); *Golight, Inc. v. Wal-Mart Stores, Inc.*, 355 F.3d 1327, 1338 (Fed. Cir. 2004); *Maxwell v. J. Baker, Inc.*, 86 F.3d 1098, 1108-10 (Fed. Cir. 1996); *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1579-81 (Fed. Cir. 1996); *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1554 (Fed. Cir. 1995) (en banc); *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970); *Interactive Pictures Corp. v. Infinite Pictures, Inc.*, 274 F.3d 1371 (Fed. Cir. 2001); *Trans-World Mfg. Corp. v. Al Nyman & Sons, Inc.*, 750 F.2d 1552 (Fed. Cir. 1984).

royalty may not be limited or increased based on the actual profits the alleged infringer made.²⁸³

Consistency requires that the estimation of damages also should recognize the infringer's actual profits after infringement began. This provides a consistent basis for estimating reasonable royalty damages when there is insufficient evidence about lost profits and lost licensing opportunities.

Using the information obtained from the patent case, including the infringer's actual profits, vastly improves the estimate of damages. This better fulfills the purpose of the damage estimate, which is used to compensate the patent holder. The profits of the infringer during the period of infringement are readily obtained and provide the best foundation for calculating damages when the patent holder's lost profits and opportunity costs from technology transfer are not available.

The infringer's profits and other events during the period of infringement provide a better guide than the court's conjectures regarding the expectations of the patent holder and the infringer. What is already an impossible task becomes even more unrealistic when the court asks the jury to imagine what the expectations of the patent holder and the infringer were some years in the past. This requires the jury to forget what actually happened and to form beliefs about how the patent holder and the infringer might have seen the future. It is difficult enough for an individual to understand his own current expectations about the future, let alone his past expectations. By eliminating this philosophical problem, the "informed contract" greatly simplifies the problem of estimating damages.

IV. REASONABLE ROYALTY DAMAGES

Based on the contract approach outlined here, this Part introduces a "market value method" for calculating reasonable royalty damages. The "market value method" does not require information about comparable licensing contracts. Conversely, when information on comparable licensing contracts is available, the contract approach provides guidance on selecting comparable licensing contracts and inferring reasonable royalty damages from those contracts.

A. The Market Value Method

Courts in patent cases may face the difficult task of determining reasonable royalty damages when there are no comparable patent license contracts. Even if there are comparable license contracts, the royalties on those contracts may be confidential. Then, the court must estimate reasonable royalty damages using other information. The market value of a patent or patent portfolio provides information that is useful for determining reasonable royalty damages. An advantage of using market prices of patents is that they embody expectations about earnings without having to make arbitrary estimates of expected royalties.

283. *Id.*

1. *Calculating Reasonable Royalty Damages*

The “market value method” offered here determines reasonable royalty damages using the estimated market price of a patent. The market price of a patent generally is the best indicator of the economic value of the patent.²⁸⁴ This approach is consistent with Judge Richard Posner’s decision in *Apple v. Motorola*, “[f]or example, a party may use the royalty rate from sufficiently comparable licenses, value the infringed features based upon comparable features in the marketplace, or estimate the value of the benefit provided by the infringed features by a comparing the accused product to non-infringing alternatives.”²⁸⁵

The purchase price of a patent provides valuable information. As Gregory Leonard and Stephen Rusek observe:

The purchase of a patent is just another type of market transaction. As such, the purchase of a patent should also be accorded substantial consideration in a damages analysis. Of course, as with any potentially comparable market transaction (including an existing license), it may be necessary to make adjustments to account for any significant dissimilarities in the underlying economic conditions between the market transaction and the hypothetical transaction.²⁸⁶

Bruce Burton and Scott Weingust note that:

With some frequency, attorneys, businesspeople and damages experts have attempted to meaningfully compare the purchase price of a patent to the damages being sought by the plaintiff associated with the same patent in patent infringement litigation (“litigation damages value”). Courts have also been asked to consider whether the purchase price of an allegedly infringed patent should somehow limit the amount of patent damages that can be sought as a result of the infringement of that same patent.²⁸⁷

Among a number of cases, they cite the example of *Spectralytics*: “In this suit, the defendants argued that the relatively low purchase price for the allegedly infringed patent should preclude plaintiffs from asking for a 5 percent royalty, which, when applied to the relevant royalty base, caused damages to greatly exceed the prior purchase price of the patent.”²⁸⁸

If there is no observable market price for a patent, it may be possible to estimate the price of the patent based on the market prices of comparable patents. The market prices of comparable patents yield information about the effects of

284. Gregory K. Leonard & Stephen P. Rusek, *Patent Purchase Price is Useful in Damages Analysis*, LAW360 (Sept. 8, 2014), <https://www.law360.com/articles/573442/patent-purchase-price-is-useful-in-damages-analysis>.

285. *Apple Inc. v. Motorola Inc.*, 757 F.3d 1286, 1315 (Fed. Cir. 2014).

286. Leonard & Rusek, *supra* note 284.

287. Bruce W. Burton & Scott Weingust, *Misuse of Patent Purchase Price in Damages Analysis: Part 1*, LAW360 (Aug. 11, 2014), <https://www.law360.com/articles/562178/misuse-of-patent-purchase-price-in-damages-analysis-part-1> [hereinafter Burton & Weingust, *Part 1*]; see also Bruce W. Burton & Scott Weingust, *Misuse of Patent Purchase Price in Damages Analysis: Part 2*, LAW360 (Aug. 12, 2014), <https://www.law360.com/articles/562184?scroll=1>.

288. Burton & Weingust, *Part 1*, *supra* note 287; see *Spectralytics, Inc. v. Cordis Corp.*, 649 F.3d 1336, 1345 (Fed. Cir. 2011).

patent characteristics on market value, including the type of technology, the age of the patent, and whether the patent reads on a standard.

The market value of a patent equals the total expected discounted stream of returns from owning the patent. This follows from standard economic analysis of the market value of durable assets.²⁸⁹ The stream of returns from patent ownership should be discounted at the risk-adjusted interest rate.

The market value of a patent is based on the patent holder's benefits from residual returns and innovative control.²⁹⁰ The patent holder's benefits include the returns to own use and the returns to licensing the patent to others over the life of the patent. The returns to own use include the returns obtained by practicing the patent and excluding others from making, using, selling, or importing the invention.²⁹¹ The returns to licensing include royalties and other compensation from entering into patent license contracts net of transaction costs and administrative costs.

The "market value method" does not require information about comparable licenses. This method applies in the absence of licensing of the patent at issue. If the patent owner intended to practice the patent without licensing, the market value method also takes into account the effect of infringement on benefits from own use. If the patent owner has lost profits from competition, these may be evaluated separately from reasonable royalties.

The "market value method" extends readily to a group of patents because the market prices of the patents can be added to each other. Also, the market value method extends to patent portfolios when there are market prices for the portfolios.

Suppose that the benefits of patent ownership are from licensing royalties. Royalties from a patent license contract equal the expected discounted stream of royalty payments. Then, the market price of a patent equals total licensing royalties across patent licenses over the lifetime of the patent. The market price of a patent equals the total of the expected discounted streams of royalty payments. This implies that we can infer the total expected discounted streams of royalty payments by observing the market price of the patent.

The greater the demand for the patent, including demand for licensing the patent, the greater is the market value of the patent. Because technology has public good features, there can be multiple users of the same technology.²⁹² Increases in the number of potential users for a patented technology can increase the market value of the patent.²⁹³ For example, the development of the Internet of Things ("IoT") increases the market value of various patents by increasing the number of users and applications of the patented technologies.²⁹⁴

289. Spulber, *supra* note 58, at 291, 303, 311.

290. *Id.* at 274.

291. *Id.* at 290.

292. *Id.* at 308.

293. *Id.* at 291.

294. See EUROPEAN PATENT OFFICE, PATENTS AND THE FOURTH INDUSTRIAL REVOLUTION: THE INVENTIONS BEHIND DIGITAL TRANSFORMATION 14 (2017) ("[T]echnologies are increasingly being integrated

For purposes of illustration, suppose that the patent holder does not practice the patent and enters into patent license contracts. Let R denote the total market equilibrium royalties for a particular patent license contract and suppose that contracts continue for the remaining lifetime of the patent. Let V denote the estimated market price of the patent and let T denote licensing and legal costs. Suppose that patent license contracts are symmetric and let N denote the market equilibrium number of licensees. Suppose also that the number of licensees remains constant over the remaining life of the patent. Then, the market value of the patent equals the number of licensees multiplied by market equilibrium royalties net of licensing and legal costs, $V = N \cdot R - T$. This means that the market equilibrium royalty equals the market value of the patent plus licensing and legal costs divided by the number of licensees, $R = (V + T) \div N$. So, we can infer the market equilibrium royalty from the market price of the patent and the number of licensees.

The market value method calculates reasonable royalty damages as the estimated market price of the patent plus licensing and legal costs allocated among infringers. When infringement is symmetric and there are N infringers, reasonable royalty damages are given by $R = (V + T) \div N$. This method of calculating reasonable royalty damages compensates the patent holder for infringement. Infringement deprives the patent holder of the expected returns from patent ownership, including own use and licensing royalties.

For example, if two firms infringe a patent valued at \$3 million and licensing and legal costs are \$1 million, reasonable royalty damages would be \$2 million per firm. If say four firms infringed a patent portfolio valued at \$60 million, with licensing and legal costs of \$12 million, then reasonable royalty damages would be \$18 million per firm.

If the patent holder is not practicing the patent and has not licensed the patent, compensation should equal the estimated market value of the patent plus licensing and legal costs divided by the number of infringers. Recovering damages from each infringer will recover no more than the market value of the patent plus licensing and legal costs.

If there is only one infringer and the patent owner is not licensing the patent, then the estimated market value of the patent plus licensing and legal costs provides a measure of reasonable royalty damages. A patent transfer is analogous to an exclusive license agreement for the life of the patent. Infringement by a sole infringer then corresponds to a patent transfer or an exclusive license contract. Infringement deprives the patent holder of the sale of the patent or the returns from an exclusive license contract. So, reasonable royalty damages should equal the market value of the patent plus licensing and legal costs, $R = (V + T)$.

The patent holder's returns can differ across patent license contracts depending on the characteristics of the licensee and the provisions of the patent license contracts. For purposes of illustration, suppose that the patent license

contracts are for the remaining life of the patent. If the patent holder practices the patent, the patent holder's benefits can be represented by a stream of royalty payments. Consider N licensing agreements with royalties R_i indexed by i . Then, the market value of the patent equals the sum of royalties net of licensing and legal costs, $V = \sum_{i=1}^N R_i - T$. Then, each royalty can be expressed as a share of the market value of the patent plus licensing and legal costs, $R_i = s_i(V + T)$, where the shares sum to one, $\sum_{i=1}^N s_i = 1$.

When there are multiple infringers, their shares of the market value of the patent may differ. Then, reasonable royalty damages equals the estimated market price of the patent plus licensing and legal costs multiplied by the infringer's share, $R_i = s_i(V + T)$. The shares can be calculated on the basis of the provisions of the informed contracts for the various infringers. For example, if there are two infringers, one of which has infringed on the patent for twice as long as the other, all other things equal, reasonable royalty damages for that infringer would be two-thirds of the market value of the patent plus licensing and legal costs. If there are two infringers and one produces twice as much final output as the other, then all other things equal, reasonable royalty damages for that infringer would again be two-thirds of the market value of the patent plus licensing and legal costs.

If the patent holder practices the patent, a similar approach can be used to assign shares of the market value of the patent plus licensing and legal costs to the patent holder and the infringers. Then, reasonable royalty damages again equal an infringer's share of the market price of the patent plus licensing and legal costs. Suppose that the patent holder practices the patent and there is one infringer, then if the patent holder and the infringer are comparable firms, reasonable royalty damages might be half of the market price of the patent plus licensing and legal costs.

2. *Adjusting Estimates of Market Value*

The contract approach emphasizes the importance of taking into account new information in calculating reasonable royalty damages. The market value of the patent changes to reflect various economic developments that affect the value of own use and license royalties.

Market prices vary over time depending on changes in supply and demand. Market prices tend to reflect information available to market participants. The market prices of patents vary continually over time just as do prices of financial assets.²⁹⁵ The book value of a patent need not provide an accurate estimate of its market value. In other words, the market value of a patent is the current price not the past purchase price.²⁹⁶ It is necessary to adjust the purchase price of a patent or the prices of comparable patents to reflect new information.

A number of events are likely to raise the market value of a patent. First, the market value of a patent is likely to increase when a patent is found to be

295. Burton & Weingust, *Part 1*, *supra* note 287.

296. *Id.*

valid and infringed.²⁹⁷ The market value of the patent could increase in comparison to the original purchase price, often by a substantial amount. Calculating reasonable royalty damages would require an adjustment of the purchase price to reflect this information. If the patent price reflected a likelihood of 50% that the patent was valid, a finding that the patent was valid could double the patent price. The contract approach suggests that estimates of the market price of the infringed patents should use prices of comparable patents that also are found to be valid and infringed.

Second, the price of a patent will contain a premium if it is an SEP. This requires an upward adjustment in the purchase price of a patent if it becomes an SEP. The court should use the market prices of comparable SEPs when determining reasonable royalty damages for infringement of SEPs. When comparing the price of an SEP to a patent that is not an SEP, it is necessary for the court to make an upward adjustment to the price of the benchmark patent. Just as patents that are found to be valid and infringed command a premium, so too should SEPs command a premium. This is because a patent that is an SEP is likely to be more valuable than a patent that is not an SEP, all other things equal.²⁹⁸ The premium is due to the value of the technology represented by an SEP. The premium does not result from the SEP being incorporated into a standard or because the SEP has an SSO seal of approval.

SEPs tend to be more valuable than other patents because SSOs have incentives to choose valuable technologies as the basis for standards.²⁹⁹ SEPs are often more valuable because they provide benefits to the industry and allow the industry to achieve the best standard.³⁰⁰ The market prices of SEPs take into account the patents' contribution to the industry technology and ultimate customer benefits.³⁰¹ Not all patents declared to be SEPs are actually essential and not all technologies need be adopted to satisfy the standard.³⁰² The market price of the SEP provides an indication of the contribution of the patented invention to industry technology and customer benefits.

Third, the market price of a patent will increase when demand for the technology increases. There may be new developments in products that use the patented technology. There may be changes in expectations about future technological change. The development of complementary technologies may also raise

297. For a discussion on the discounting of royalties in contract negotiations to reflect the probability that a patent is found to be valid and infringed, see Joseph Farrell & Carl Shapiro, *How Strong Are Weak Patents?*, 98 AM. ECON. REV. 1347, 1348 (2008); see also Burton & Weingust *Part 1*, *supra* note 287.

298. Masoud Vakili, *Patent Portfolio Valuations—Importance of IP and Patents*, IPWATCHDOG (July 12, 2017), <http://www.ipwatchdog.com/2017/07/12/patent-portfolio-valuations/id=85409/> [hereinafter Vakili]. Rainer K. Kuhnen, *Huawei v. ZTE—ECJ Sets Framework for Injunctive Relief Regarding SEPs*, IAM (Apr. 11, 2016), <https://www.iam-media.com/huawei-v-zte-ecj-sets-framework-injunctive-relief-regarding-seps>.

299. See Daniel F. Spulber, *Standard Setting Organisations and Standard Essential Patents: Voting and Markets*, ECON. J. (forthcoming).

300. See *id.* at 2–3.

301. *Id.* at 5.

302. Stitzing et al., *supra* note 108, at 1.

the demand for the patent technology at issue. Demand increases require an upward adjustment in the past purchase price of the patent or upward adjustments in the prices of comparable patents.

Fourth, the market price of a patent will decrease when the technology becomes obsolete, particularly when inventors develop substitute technologies. This requires a downward adjustment in the purchase price of the patent to reflect current market value. Alternatively, it is necessary to take into account technological change and obsolescence when considering comparable patents.

Fifth, the market price of the patent depends on various other factors such as the age of the patent.³⁰³ The patent price may be low due to restrictions on licensing or cross licensing as part of the sales contract.³⁰⁴

The market value of a patent is affected by competition among buyers and among sellers.³⁰⁵ Even if there was limited competition in buying or selling a particular patent, the patent transfer price still results from an agreement between a willing buyer and a willing seller. The purchase price will not exceed the buyer's net benefits and will be greater than the seller's opportunity costs. Patent ownership is not concentrated because there are many patent owners. Also, patent adoption is not concentrated because there are many potential purchasers of patents.

The market value of the patent may be affected by the number of infringers. More infringers can reduce the value of the patent by increasing competition in the product market and dissipating returns to the invention.³⁰⁶ Alternatively, more infringers can increase the value of the patent by employing the technology in production, selling products that use the patented technology, and combining the patented invention with complementary assets.³⁰⁷

3. *Estimating the Market Value of a Patent*

Estimates of the market value of a patent should be based on economic considerations. The main economic approaches to estimating the market prices of patents are (1) prices in patent transfers, (2) the intangible asset value of the patent to the firm, and (3) the patent holder's renewal decisions.³⁰⁸

The market price of a transfer provides the most accurate indication of the market value of a patent.³⁰⁹ The market for patents yields information on the

303. Shyam Sreekumaran Nair, Mary Mathew & Dipanjan Nag, *Dynamics Between Patent Latent Variables and Patent Price*, 31 *TECHNOVATION* 648, 650 (2011).

304. Burton & Weingust, *Part 1*, *supra* note 287 (expressing concerns about the efficiency of the market for patents).

305. Burton and Weingust, *Part 2*, *supra* note 287.

306. Stephen Yelderman, *Do Patent Challenges Increase Competition?*, 83 *U. CHI. L. REV.* 1943, 1953 (2016).

307. *Id.* at 1959–60.

308. See Chizoba Morah, *Patents Are Assets—Learn How to Value Them*, *INVESTOPEDIA* (Apr. 23, 2018, 7:03 PM), <https://www.investopedia.com/articles/fundamental-analysis/09/valuing-patent.asp>.

309. Kelvin King, *The Value of Intellectual Property, Intangible Assets and Goodwill*, *WORLD INTELL. PROP. ORG.*, http://www.wipo.int/sme/en/documents/value_ip_intangible_assets_fulltext.html (last visited Dec. 29, 2018).

characteristics of patent that are bought and sold. The characteristics of patents affect the likelihood that those patents will be transferred, including the age of the patent, the size of the buyer's patent portfolio, and the technological fit of the patent in the buyer's portfolio.³¹⁰ There are market prices for some patent portfolio transactions. For example, Google obtained a portfolio of LTE patents from Motorola Mobility for \$5.5 billion.³¹¹

If the market price of a patent or patent portfolio is not available, the price can be inferred from observed prices of comparable patents. This requires adjustment of the prices of comparable patents to reflect differences between the patents at issue and comparable patents. For example, patents should have a price premium if they are found to be valid and infringed. Patents that are SEPs should command a premium in comparison to patents that are not SEPs. Other factors that potentially affect market value include the age of the patent, forward and backward citations, patent families, and the type of technology.

There are various indicators of patent value that can be used to estimate patent value. This would require a regression analysis to explain variations in the market value of the patent. The regression analysis takes the market value of the patent as the dependent variable and various indicators of patent value as the independent variables.³¹²

A number of empirical studies examine the determinants of market prices observed in auctions conducted by the Ocean Tomo company.³¹³ Timo Fischer and Jan Leidinger consider how the market value of patents depends on forward citations, size of the patent family, and the number of distinct IPC classes to which the patent is assigned.³¹⁴ Cristina Odasso et al. also use Ocean Tomo data and examine the effects on patent value of the number of claims, forward and backward citations, the size of the patent family, and the technological congruence of the lot being auctioned.³¹⁵ Katherine Sneed and Daniel Johnson also look at the market value of patents and examine the effects of such factors as patent scope, family size, forward and backward citations, number of claims, public or

310. Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents*, 41 RAND J. ECON. 686, 698 (2010).

In summary, we find that active patents with a higher number of patent citations received and generality, as well as previously traded patents (especially the recently traded), are more likely to be traded and renewed.

The data also reveal that the probability that an active patent will be traded decreases with age, with one exception, which is the year immediately after a renewal date. Finally, we also show that the probability of an active patent being allowed to expire increases with age.

Id. Alberto Galasso et al., *Trading and Enforcing Patent Rights*, 44 RAND J. ECON. 275, 306 (2013) (“[T]he impact of trade is related to transaction characteristics—specifically, the size of the buyer's patent portfolio and the technological fit of the patent in that portfolio.”).

311. Vakili, *supra* note 298.

312. This can be represented by a general function that describes how market value is related to factors that affect patent value, $V = F$ (patent value indicators).

313. *See generally* OCEAN TOMO, <http://www.oceantomo.com/featured-engagements/> (last visited Dec. 29, 2018).

314. Timo Fischer & Jan Leidinger, *Testing Patent Value Indicators on Directly Observed Patent Value—An Empirical Analysis of Ocean Tomo Patent Auctions*, 43 RES. POL'Y 519, 520 (2014).

315. Cristina Odasso et al., *Selling Patents at Auction: An Empirical Analysis of Patent Value*, 24 INDUS. & CORP. CHANGE 417, 417 (2014).

private ownership, and the number of inventors.³¹⁶ Shyam Nair et al. use USPTO information about the patents as predictor variables including age, generality, originality, forward and backward citations, and technology field.³¹⁷

The main issue is obtaining prices of patents. This is becoming more feasible with the expansion of the market for patent transfers. The United States Patent and Trademark Office has a database that records over 7.2 million patent assignments involving over 12.2 million patents.³¹⁸ This database can be used to obtain information about what patents are transferred.³¹⁹ The SEC provides information about reported patent sales and acquisitions.³²⁰ The global market for patents is expanding as well.³²¹

There are various private sources of information about patent transfers. According to a report by Richardson et al. “[w]e are currently tracking \$11 billion of patent packages, across over 3,500 packages with more than 86,000 assets. Through assignment data, we see that \$2.3 billion of that market has sold. However, this number likely underestimates the total sales because not all assignments are recorded.”³²² AST launched IP3 2017 (Industry Patent Purchase Program), “a fixed price, fixed term, collaborative patent buying program.”³²³ IAM Magazine established IAM Market that brings together patent buyers and

316. Katherine A. Sneed & Daniel K. N. Johnson, *Selling Ideas: The Determinants of Patent Value in an Auction Environment*, 39 R&D MGMT. 87, 91 (2009).

317. Nair et al., *supra* note 303, at 650.

318. *Patent Assignment Dataset*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-assignment-dataset> (last visited Dec. 29, 2018).

The USPTO allows parties to record assignments of patents and patent applications to, as much as possible, maintain a complete history of claimed interests in a patent. The USPTO also permits recording of other documents that affect title (such as certificates of name change and mergers of businesses) or are relevant to patent ownership (such as licensing agreements, security interests, mortgages, and liens). The 2016 update to the Patent Assignment Dataset contains detailed information on 7.2 million patent assignments and other transactions recorded at the USPTO since 1970 and involving roughly 12.2 million patents and patent applications. It is derived from the recording of patent transfers by parties with the USPTO.

Id.

319. See generally Stuart J.H. Graham et al., *Monetizing Marks: Insights from the USPTO Trademark Assignment Dataset*, J. ECON. & MGMT. STRATEGY, Apr. 2015.

320. See Thomas R. Varner, *Technology Royalty Rates in SEC Filings*, 45 Les Nouvelles 120, 120 (2010).

321. See Antonio De Marco et al., *Global Markets for Technology: Evidence from Patent Transactions*, 46 RES. POL'Y 1644, 1648 (2017) (“The highest incidence of transactions is recorded for US priority patents (6.37%), and this is followed by EPC priority patents (5.51%). China, Japan and Korea show a lower percentage incidence of traded patents (3.07%, 1.47% and 1.36%, respectively).”).

322. Kent Richardson et al., *2016 Patent Market Report: Overview*, IPWATCHDOG (Apr. 10, 2017), <http://www.ipwatchdog.com/2017/04/10/2016-patent-market-report-overview/id=81689/>.

323. *Announcing AST's IP3 2017 – A Fixed Price, Fixed Term Collaborative Patent Buying Program*, ALLIED SECURITY TRUST (May 1, 2017), http://ast.com/news_article/announcing-asts-ip3-2017-fixed-price-fixed-term-collaborative-patent-buying-program/.

sellers.³²⁴ ICAP Patent Brokerage, which refers to itself as the “world’s largest neutral patent intermediary”, operates patent auctions.³²⁵

Some patent transfers involve entire patent portfolios. For example, a consortium consisting of Apple, EMC, Ericsson, Microsoft, Sony, and Research In Motion bought a portfolio of patents in 2011 from the bankrupt Nortel Networks for \$4.5 billion.³²⁶ The Nortel Networks portfolio consisted of 6,000 patents and patent applications.³²⁷ In 2012, Kodak sold its digital imaging patent portfolio to a consortium of twelve companies for \$525 million.³²⁸ Some firms specialize in purchasing patents and patent portfolios. For example, Intellectual Ventures has acquired 95,000 patents and patent applications.³²⁹

Corporations report the value of their intangible assets including patents in their balance sheets. For example, IBM reports its patents and trademarks as an intangible asset class, and specifies the gross carrying amount, accumulated amortization, and net carrying amount.³³⁰ The company further reports the acquisitions of intangible assets including patents, which provides some information about its market transactions and indicates the market value of patents involved in those transactions.³³¹ IBM earned 8,088 patents in 2016, becoming the first company to earn more than 8,000 patents in one year, and has earned 97,040 total patents since 1993.³³² IBM reports its royalty-based, custom development income, and sales and other transfers of intellectual property.³³³ IBM states in its annual report “[s]ome of IBM’s technological breakthroughs are used exclusively in IBM products, while others are licensed and may be used in IBM products and/or the products of the licensee.”³³⁴

Various economic studies estimate the value of the firm’s group of patents by considering the contribution of the firm’s intangible IP assets to the value of

324. *About IAM Market*, IAM MARKET, <https://www.iam-market.com/node/4> (last visited Dec. 29, 2018). IAM Market aims to simplify the IP transactions market, as well as making it more transparent. It allows IP owners to profile their licensing, sales operations and technology transfer programmes, as well as provide details of specific rights that they are interested in transacting. It allows IP buyers to search IP assets based on industry, technology and transaction type, and it facilitates requests for intellectual property and technology. IAM has no stake in or knowledge of the deals.

Id.

325. *Valuation*, ICAP PAT. BROKERAGE, <https://icappatentbrokerage.com/valuation> (last visited Dec. 29, 2018).

326. Charles Arthur, *Nortel Patents Sold for \$4.5bn*, THE GUARDIAN (July 1, 2011, 3:08 PM), <https://www.theguardian.com/technology/2011/jul/01/nortel-patents-sold-apple-sony-microsoft>.

327. *Id.*

328. Natasha Lomas, *Kodak Agrees to Sell Digital Imaging Patent Portfolio for \$525M to Consortium of 12 Licensees, Including Apple, Google, Facebook*, TECHCRUNCH (Dec. 19, 2012), <https://techcrunch.com/2012/12/19/kodak-to-sell-digital-imaging-patent-portfolio-for-525m/>.

329. *Our Patent Portfolio*, INTELL. VENTURES, <http://www.intellectualventures.com/inventions-patents/patent-portfolio/> (last visited Dec. 29, 2018).

330. *2016 IBM Annual Report*, IBM, at 119, <https://www.ibm.com/annualreport/2016/images/downloads/IBM-Annual-Report-2016.pdf> (last visited Dec. 29, 2018).

331. *See id.*

332. *Id.* at 21.

333. *Id.* at 94.

334. *Id.* at 35.

the firm.³³⁵ Firms report the value of their intangible assets including patents, as in the IBM example. Also, the market value of a firm's patents can be inferred from the market value of the firm by subtracting the value of the firm's tangible assets and non-patent intangible assets. For example, James Besen obtains upper-bound estimates of the expected discounted value of the firm's future patent returns using regressions on Tobin's Q, which is the ratio of the firm's market value to the replacement costs of its assets.³³⁶ Akcigit et al. look at the firm's market value in relation to the characteristics of its patent portfolio including a measure of technological distance of the patent portfolio and the firm.³³⁷

A similar approach to estimating patent value as an intangible asset infers patent value from the effects of patent announcements on the market value of the firm. Leonid Kogan et al. estimate the market value of patents from the increase in the market value of a company following the announcement of new patents owned by that company.³³⁸ They find the median value of a patent to be \$3.2 million, which they note is comparable to estimates from survey data.³³⁹

Many studies estimate the market value of patents using information on patent renewals. The appeal of renewal data is that it provides a lower bound for patent value because patent holders will not renew unless they expect the value of the patent to cover the costs of renewal.³⁴⁰ Empirical analysis shows that there is a concentration of high value patents in the upper tail of the distribution.³⁴¹ Nicolas Van Zeebroeck considers the market potential of a patent.³⁴² Estimates based on patent renewals, however, do not accurately indicate the extent

335. Bronwyn Hall studies how the ratio of the firm's market value to the book value of its tangible assets is related to the ratio of the firm's stock of R&D assets to the book value of the firm's tangible assets and the ratio of the firm's stock of patents to the stock of R&D assets. See Bronwyn H. Hall, *Exploring the Patent Explosion*, 30 J. TECH. TRANSFER 35, 42 (2005); see also Bronwyn H. Hall et al., *Market Value and Patent Citations*, 36 RAND J. ECON. 16, 17–23 (2005).

336. See generally James Bessen, *Estimates of Patent Rents from Firm Market Value*, 38 RES. POL'Y 1604 (2009).

337. See Ufuk Akcigit et al., *Buy, Keep, or Sell: Economic Growth and the Market for Ideas*, 84 ECONOMETRICA 943, 944 (2016).

338. Leonid Kogan et al., *Technological Innovation, Resource Allocation, and Growth*, 132 Q.J. Econ. 665, 666 (2017).

339. *Id.* at 682; see Paola Giuri et al., *Inventors and Invention Processes in Europe: Results from the PatVal-EU Survey*, 36 RES. POL'Y 1107, 1121 (2007); see also Dietmar Harhoff et al., *Citations, Family Size, Opposition and the Value of Patent Rights*, 32 RES. POL'Y 1343, 1349 (2003).

340. James Bessen, *The Value of U.S. Patents by Owner and Patent Characteristics*, 37 RES. POL'Y 932, 932 (2008); Yi Deng, *Private Value of European Patents*, 51 EUR. ECON. REV. 1785, 1801 (2007); Charlotta Grönqvist, *The Private Value of Patents by Patent Characteristics: Evidence from Finland*, 34 J. TECH. TRANSFER 159, 160 (2007); Ariel Pakes, *Patents as Options: Some Estimates of the Value of Holding European Patent Stocks*, 54 ECONOMETRICA 755, 755 (1986); Mark Schankerman, *How Valuable is Patent Protection? Estimates by Technology Field*, 29 RAND J. ECON. 77, 78 (1998); see also Mark Schankerman & Ariel Pakes, *Estimates of the Value of Patent Rights in European Countries During the Post-1950 Period*, 96 ECON. J. 1052, 1059 (1986).

341. Dietmar Harhoff et al., *Exploring the Tail of Patented Invention Value Distributions*, in *ECONOMICS, LAW AND INTELLECTUAL PROPERTY* 279, 280 (O. Grandstrand ed., 2003) (“[P]atent renewal studies reveal a highly rightward-skewed distribution of individual patent values . . .”).

342. Nicolas van Zeebroeck, *The Puzzle of Patent Value Indicators*, 20 ECON. INNOVATION & NEW TECH. 33, 33 (2011).

to which the value of patents exceeds the costs of renewal. For purposes of determining reasonable royalty damages, analysis of renewal data can provide some useful guidance on the lower bound of patent valuation. Such estimates miss the critical upper tail of patent value that may be significant in patent cases involving important patents.

Some studies use survey data based on the evaluation of patent value by patent holders or by experts. Informal reports may be significantly different from market value.³⁴³ Large-scale surveys provide insights into how patent holders subjectively view the value of their patents and what factors influence value, but have limited application for determining the value of specific patents or patent portfolios.³⁴⁴ Alfonso Gambardella et al. examine survey data to determine the value of patents as measured by the price at which patent owners are willing to transfer the patent to others.³⁴⁵ This is an indicator of the market value of the patent, which could involve both use of the patent by the firm that owns the patent and licensing revenues. They find that that country, technology, and patent class fixed effects explain less than 12% of the variation in patent value.³⁴⁶ Gambardella et al. refer to this result as a “measure of our ignorance” about the determinants of patent value.³⁴⁷

There are various other approaches to estimating the market value of patents.³⁴⁸ Estimates of the market value of patents based on the discounted cash flow of returns to patent ownership may be useful because companies report their licensing revenues. The firm’s set of patents, however, is subject to change so it may be difficult to associate returns from licensing to particular groups of patents. Also, the cash flow may reflect the firm’s investment in complementary assets and sales efforts.³⁴⁹ Estimates of the market value of a patent should not be based on arbitrary rules of thumb because such estimates will not reflect economic evidence. In addition, valuation methods based on the costs of R&D are not useful because the market value of any type of good or asset need not be related to the costs incurred to produce it.

Additional study of the determinants of the market value of patents is needed. A better understanding of the determinants of the market value of patents

343. On surveys of patent holders, see Alfonso Gambardella, et al., *The Market for Patents in Europe*, 36 RES. POL’Y 1163, 1177 (2007); Dietmar Harhoff et al., *Citation Frequency and the Value of Patented Inventions*, 81 REV. ECON. & STAT. 511, 511 (1999); Markus Reitzig, *What Determines Patent Value?: Insights from the Semiconductor Industry*, 32 RES. POL’Y 13, 17 (2003) (discussing surveys evaluated by technical experts); Dietmar Harhoff et al., *Exploring the Tail of Patented Invention Value Distributions* (WZB Berlin Soc. Sci. Ctr., Working Paper No. FS IV 97-27, 1997).

344. See, e.g., Alfonso Gambardella et al., *The Value of European Patents*, 5 EUR. MGMT. REV. 69, 69 (2008); Jun Suzuki, *Structural Modeling of the Value of Patent*, 40 RES. POL’Y 986, 988 (2011); Alfonso Gambardella et al., *THE VALUE OF EUROPEAN PATENTS EVIDENCE FROM A SURVEY OF EUROPEAN INVENTORS 3* (2005), http://ec.europa.eu/invest-in-research/pdf/download_en/patval_mainreportandannexes.pdf.

345. See generally Gambardella et al., *The Value of European Patents*, *supra* note 344.

346. *Id.* at 80.

347. *Id.* at 82–83.

348. See John Lerner & Anne Layne-Farrar, *Valuing Patents for Licensing: A Practical Survey of the Literature 7* (Mar. 2006) (unpublished manuscript).

349. *Id.* at 10.

should be useful in estimating the market value of patents and patent portfolios that have not been traded. This would be helpful in applying the proposed market value method because it would help identify comparable patents and patent portfolios and also adjust the observed prices of those patents to obtain estimates of the value of the infringed patents.

B. Comparable Patent License Contracts

The contract approach helps the court estimate the patent holder's economic costs due to infringement. The costs of infringement include lost profits resulting from competition with the infringer. The costs of infringement also include the costs of foregone licensing opportunities and other damages to the patent holder. Estimating royalties for the "informed contract" should begin with identifying comparable license contracts. Reasonable royalty damages equal royalties in comparable contracts with adjustments for differences in contract terms and technology.

1. Calculating Reasonable Royalty Damages from Comparable Licenses

The patent case determines reasonable royalty damages on the basis of evidence. The best way to measure the patent holder's economic costs of infringement is to consider royalties on comparable patent licenses when such information is available. This important principle is reaffirmed in *Ericsson*, "the fact that a license is not perfectly analogous generally goes to the weight of the evidence, not its admissibility."³⁵⁰

The best measure of economic value of a good is its market price.³⁵¹ The market price of a good reflects both the demand and supply of the good.³⁵² With negotiation between a buyer and seller, the exchange price reflects the buyer's benefits and the seller's costs from the exchange and accounts for market alternatives available to the buyer and seller. Prices resulting from bilateral negotiation are market prices.

The imputation of economic value when market prices are not available is a classic economic problem.³⁵³ A solution to this problem is to infer market prices for a good from the market prices of related goods. It may be possible to infer the price of a good from a substitute good by estimating the economic value to consumers of differences in the features of the two goods. The additional expenditures associated with product differences are referred to as *compensating*

350. *Ericsson, Inc. v. D-Link Systems, Inc.*, 773 F.3d 1201, 1227 (Fed. Cir. 2014).

351. Daniel F. Spulber, *Access to Networks: Economic and Constitutional Connections*, 88 CORNELL L. REV. 885, 899 (2003).

352. In a competitive market, at the price that equates demand and supply, the value of the good to the marginal buyer equals the cost of the good to the marginal seller. *Id.* at 895.

353. *Id.* at 900–01.

variation.³⁵⁴ For example, a particular good may have different prices at two locations. It may be possible to estimate the price of the good at one location from the price of the good at the other location. When the good is mobile and transportation costs are known, the possibility of arbitrage implies that the price difference must be less than transportation costs.³⁵⁵ For goods that are not mobile, differences in the costs of inputs may be useful in inferring a relationship between prices at two locations. When inputs are mobile, this will limit differences in the prices of the goods at the two locations.³⁵⁶

If comparable patent license contracts exist, the royalties in those contracts can be used to estimate reasonable royalty damages. Royalties on comparable patent license contracts provide the best indicators of the market prices of the technology. The court can determine reasonable royalty damages by adding other costs from infringement to market royalties on comparable contracts.

Comparable patent licenses can involve patents other than the infringed patents. The licenses, however, should be for similar technology if not the technology itself. The court in *LaserDynamics* faults an expert witness for not relying on licenses for the patent itself.³⁵⁷

The contract approach helps in the search for comparable patent license contracts. A patent license contract differs from the exchange of an asset where the buyer's benefit and the seller's cost are fixed at a certain level. In the exchange of an asset, the negotiation between the buyer and the seller are only about the price.³⁵⁸ In contrast, the provisions of a license contract affect the adopter's willingness to pay and the provider's willingness to accept. Royalties and the other terms of the contract are part of a contract negotiation.³⁵⁹ This means that royalties and the other terms of the contract are jointly determined; royalties are not the cause of other contract terms nor are other contract terms the cause of particular values of royalties.

The parties to a patent license contract choose contract provisions and engage in economic activities to maximize the economic value of the contract.³⁶⁰ Negotiation generates an efficient outcome when transaction costs are low, as Ronald Coase emphasized in his discussion of bargaining when there are social

354. JOHN R. HICKS, *VALUE AND CAPITAL: AN INQUIRY INTO SOME FUNDAMENTAL PRINCIPLES OF ECONOMIC THEORY* 40–41 (1939).

355. Shubha Ghosh, *An Economic Analysis of the Common Control Exception to Gray Market Exclusion*, 15 U. PA. J. INT'L BUS. L. 373, 410–12 (1994).

356. See Robert A. Mundell, *International Trade and Factor Mobility*, 47 AM. ECON. REV. 321, 330, 326–30 (1957).

357. *LaserDynamics, Inc. v. Quant Computer, Inc.* 694 F.3d 51, 56 (Fed. Cir. 2012); see also *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1325–26 (Fed. Cir. 2009).

358. See Harold Demsetz, *The Exchange and Enforcement of Property Rights*, 7 J.L. & ECON. 11, 14 (1964); see also Lerner & Layne-Farrar, *supra* note 348.

359. Zelin Yang, *Damaging Royalties: An Overview of Reasonable Royalty Damages*, 29 BERKELEY TECH. L.J. 647, 651–52 (2014).

360. For a discussion of bargaining in the context of patent licensing and also references to the economics literature on bargaining, see generally Spulber, *supra* note 77.

and private costs.³⁶¹ The parties adjust the terms of the contract to account for benefits, costs, and legal constraints.

The “informed contract,” however, reflects decisions made by the patent holder and infringer in the absence of negotiation. It follows that the “informed contract” is likely to differ from an efficient contract. Reasonable royalty damages are thus likely to differ from a “hypothetical negotiation.” So, the provisions of comparable contractual agreements are likely to differ from the terms of the “informed contract.” The patent holder’s damages may be greater than or equal to the royalties in a comparable contract.

It generally will be necessary to modify the royalties on comparable licenses to estimate reasonable royalty damages. The court should consider compensating variation in royalties to account for the effects of contract provisions on the economic costs to the patent holder. It is necessary to adjust market royalties for contract features such as the royalty base, the duration of the agreement, additional knowledge transfers, investment by the licensee, and degree of exclusivity.

As already noted, the contract approach suggests the need to use information revealed during the period of infringement. The actions of the parties determine many of the provisions of the hypothetical patent license contract. The provisions of the hypothetical patent license contract affect the calculation of reasonable royalty damages. For example, royalties should be greater for exclusive contracts than they would be for nonexclusive contracts.

Patent license contracts present additional complications because they are often the subject of bilateral negotiation and royalties depend on the unique characteristics of the licensor-licensee pair and the provisions of the contract.³⁶² The patent case constructs many of the contract terms so that comparable licenses should approximate those provisions. Comparable contracts should be those with provisions similar to those of the “informed contract.” It may be necessary to adjust royalties from comparable licenses that differ from the “informed contract.” Some contractual provisions benefit the licensor and others benefit the licensee and may systematically increase or decrease license royalties.

The “informed contract” approach presented here suggests that the best comparable contracts are those in which the parties agree that the patent is valid and the licensee is making use of the patented technology. This implies that the court should adjust the royalties on benchmark patent licenses that have not been found to be valid and infringed.

Jonathan Masur argues that when using comparable patents that have not been found valid and infringed, the court should make an upward adjustment in royalties.³⁶³ Alternatively, he suggests that courts should use comparable licenses that accurately reflect the finding that a patent was valid and infringed or

361. See generally Coase, *supra* note 59.

362. See Spulber, *supra* note 77, at 695.

363. Masur, *supra* note 14, at 145 (“The dollar value of a license (roughly) represents the underlying value of the patent discounted by the probability that the patent will be found invalid or not infringed at trial.”).

modify comparable licenses accordingly.³⁶⁴ When using a comparable patent license that has not been found to be valid or infringed, the court should multiply royalties from comparable contracts by $1/z$, where z is a probability that represents the parties' expectations that a patent would be found to be valid and infringed. Thus, if the parties to a comparable license contract negotiated royalties expecting that a patent will be found to be valid and infringed with a probability of say 25%, the court should multiply those royalties by a factor of four. This adjusts for expectations of the parties in a "hypothetical negotiation" prior to the determination that the particular patent is valid and infringed.³⁶⁵

It is not necessary, however, for the court to make the full adjustment for the probability that a patent is found valid and infringed. Litigation costs help to deter infringement and induce adopters to license patents. This increases negotiated royalties and offsets some of the effects of uncertainty about whether a patent will be found to be valid and infringed. Thus, if negotiated royalties equal damages multiplied by the likelihood the patent is found valid and infringed plus legal costs L , it follows that $R = zD + L$. For example, if anticipated damages are 100 and legal costs are forty, then when z equals 25%, the corresponding royalty would equal sixty-five. So, damages would involve an adjustment to the benchmark royalty of $100/65$.

Litigation costs are substantial. An AIPLA survey compares average litigation costs to the amount in controversy.³⁶⁶ For an amount in controversy less than \$1 million, legal costs through trial are \$873,000.³⁶⁷ For an amount in controversy between \$1 million and \$10 million, legal costs through trial are \$2.2 million.³⁶⁸ For an amount in controversy between \$10 million and \$25 million, legal costs through trial are \$3.5 million.³⁶⁹ Finally, for an amount in controversy greater than \$25 million, legal costs through trial are \$6.3 million.³⁷⁰ This suggests that adjustments of benchmark royalties to take into account the determination that a patent is valid and infringed need not reflect the full effects of uncertainty.

364. As Masur notes, this runs contrary to *LaserDynamics v. Quanta Computer*, 694 F.3d 51 (Fed. Cir. 2012). *Id.* at 127 ("I wish to suggest that the Federal Circuit had it exactly backwards: the BenQ license, and not the other twenty-eight licenses, was the most accurate indication of the 'true' value of the patent.")

365. *Id.* at 133 (expressing concerns that a problem would arise because parties would anticipate this adjustment in future litigation, and that this would increase negotiated royalties, leading to an upward spiral as a patent holder increases demands on each consecutive licensee).

366. INTELLECTUAL PROP. INS. SERVS. CORP., AIPLA 2015 REPORT OF THE ECONOMIC SURVEY (2015), <http://www.patentinsuranceonline.com/wp-content/uploads/2016/02/AIPLA-2015-Report-of-the-Economic-Survey.pdf> (citing AIPLA, REPORT OF THE ECONOMIC SURVEY (2015), https://www.accmeetings.com/AM16/faculty/files/Article_482_7928_LitSpend__AIPLA_2015_Report.pdf).

367. *Id.*

368. *Id.*

369. *Id.*

370. *Id.*

Some commentators recommend that “naked licenses” should be used as comparable licenses in calculating reasonable royalty damages.³⁷¹ This recommendation is based on the erroneous idea that removing contractual provisions would help to estimate royalties. This is inconsistent with the contract approach because infringement is not a “naked license.” Rather, infringement generates harm to the technology provider and benefits to the technology adopter that differs from a “naked license.” The economic benefits and costs of infringement are comparable to a more complex licensing arrangement that is consistent with the patent case.

The term “naked license” indicates a basic or simple license that allows usage of the technology with no transfers of additional IP.³⁷² Even the most basic license, however, is likely to have contract terms beyond royalties.³⁷³ Additional contract terms are necessary to spell out the details of the business relationship over time and to address various contingencies.

The patent owner has an interest in managing how the IP is used in the marketplace, making a “naked license” unlikely for patent agreements. In trademark licensing, a “naked license” refers to an absence of formal quality controls by the licensor over the licensee.³⁷⁴ Even if the licensor trusts the licensee to maintain product quality and the licensee does provide product quality, the courts view a “naked license” as abandonment of a trademark, resulting in the loss of a trademark.³⁷⁵ In the same way, the courts should reject the notion of a “naked license” as the basis for royalties in patent disputes.

The contract approach presented here addresses important legal issues regarding expert testimony and the rules of evidence. After *Lucent Technologies* and *ResQNet*, experts must place royalties in comparable contracts in some context.³⁷⁶ The provisions of patent license contracts provide the context for royalties. The provisions of comparable patent license contracts should be compared to the provisions of the “informed contract” examined by the court.

2. *Comparable Licenses with Technology Standards and SEPs*

Technology standards affect the use of comparable license contracts for the determination of reasonable royalty damages. If the patents at issue are SEPs, it is useful to consider royalties for license contracts that also involve SEPs. If the

371. See, e.g., Merritt J. Hasbrouck, *Protecting the Gates of Reasonable Royalty: A Damages Framework for Patent Infringement Cases*, 11 J. MARSHALL REV. INTELL. PROP. L. 192 (2011); Jarosz & Chapman, *supra* note 21.

372. Masur, *supra* note 14, at 142 n.108.

373. *Id.* at 142.

374. *FreecycleSunnyvale v. Freecycle Network*, 626 F.3d 509, 515 (9th Cir. 2010) (quoting *Barcamerica International USA Trust v. Tyfield Importers, Inc.*, 289 F.3d 589, 596 (9th Cir. 2002)).

375. *Id.* at 515–26 (quoting *Barcamerica*, 289 F.3d 598).

376. Bo Zeng, *Lucent v. Gateway: Putting the Reasonable Back into Reasonable Royalties*, 26 BERKELEY TECH. L.J. 329, 352 (2011) (“The Federal Circuit remanded these cases, in part, because damage experts must present a specific methodology. The court will not accept mere recitations of large royalty rates based on unreliable evidence that may mislead the jury.”).

patents at issue are SEPs, the royalties on comparable license contracts for patents that are not SEPs should be adjusted upward to account for the additional economic value generated by SEPs. Finding comparable license contracts should take into account differences in SEPs and possible over-declaration of SEPs.³⁷⁷

The standard does not make the technology; it is the technology that makes the standard. Technology standards create value for industries by allowing companies to coordinate their inventive and innovative efforts.³⁷⁸ SSOs provide mechanisms for reducing coordination costs and also facilitate the exchange of information among industry members.³⁷⁹ As noted previously, SSOs choose SEPs because of the contribution of the patented inventions to the value of the technology.³⁸⁰ The economic value of the technologies underlying the standard are what drive the market value of standardized products.³⁸¹

FRAND commitments for SEPs raise fundamental issues with regard to comparable license contracts. Addressing these issues depends on whether the legal interpretation of FRAND commitments should rely on property, tort, or contracts.

One view of FRAND commitments is based on contract law because there is an agreement between the SEP holder and the SSO. Gregory Sidak characterizes FRAND commitments as contracts.³⁸² He observes that the SEP holder satisfies the FRAND obligation by making a FRAND offer to a potential licensee.³⁸³ Sidak concludes that “[t]here is no intellectually rigorous basis for creating the legal presumption that an SEP holder’s request for an injunction either breaches its FRAND commitment or violates antitrust law.”³⁸⁴

Another view of FRAND commitments is based on property and tort law. Jay Kesan and Carol Hayes argue for property and tort approaches to FRAND commitments and against contract principles because they are concerned that contractual obligations may not accompany patent transfers.³⁸⁵ They oppose injunctions for SEPs on that basis: “Through application of theoretical insights concerning property rules and liability rules, we established why a FRAND commitment should be understood as a waiver of the right to seek an injunction for infringement of an SEP.”³⁸⁶

377. Stitzing et al., *supra* note 108, at 2.

378. Spulber, *supra* note 58, at 277.

379. Spulber, *supra* note 299, at 2.

380. *Id.* at 22.

381. *Id.* at 2.

382. Gregory Sidak, *The Meaning of FRAND, Part II: Injunctions*, 11 J. COMPETITION L. & ECON. 201, 206 (2015) (“By entering into a FRAND contract, an SEP holder gives up its right to exclude from the use of the SEPs any implementer willing to pay FRAND compensation.”).

383. *Id.*

384. *Id.* at 268.

385. Jay P. Kesan & Carol M. Hayes, *FRAND’s Forever: Standards, Patent Transfers, and Licensing Commitments*, 89 IND. L.J. 231, 233 (2014) (“The conceptual framework we propose characterizes FRAND commitments as creating a property interest, instead of merely creating a contract or a condition that affects a competitive relation.”).

386. *Id.* at 313.

The contract approach to reasonable royalty damages introduced here supports a contract view of FRAND obligations. The patent holder makes a contractual commitment to the SSO regarding negotiation of royalties for SEPs. The patent holder's FRAND obligations are satisfied by the choice of compensation provisions in patent license contracts.

FRAND obligations are consistent with injunctions. The question of whether or not injunctions are justified in a particular patent case depends on the negotiation of patent license contracts. Judge Posner in *Apple v. Motorola* points out that FRAND commitments do not preclude the use of injunctions, "an injunction may be justified where an infringer unilaterally refuses a FRAND royalty or unreasonably delays negotiations to the same effect."³⁸⁷ The Court of Justice of the European Union in *Huawei v. ZTE* emphasizes that the actions of both the patent owner and the infringer determine the availability of injunctive relief.³⁸⁸ Holders of SEPs must alert infringers and make license offers to infringers willing to enter into a patent license contract on FRAND terms.³⁸⁹

Patent license contracts play an important role in *Huawei v. ZTE*.³⁹⁰ Holders of SEPs that make contract offers to license the SEPs on FRAND terms may pursue an injunction without violating competition law.³⁹¹ According to Sir Robin Jacobs and Alexander Milner, "[b]roadly the position is that competition law merely bolsters existing FRAND commitments (to grant licences on Fair Reasonable and Non-Discriminatory terms) and compels owners of SEPs to offer to grant licences on such terms."³⁹²

Injunctions may not be necessary when comparable license agreements allow the determination of reasonable royalty damages. Judge Posner in *Apple v. Motorola* observes "Motorola's FRAND commitments, which have yielded many license agreements encompassing the '898 patent, strongly suggest that money damages are adequate to fully compensate Motorola for any infringement."³⁹³

To apply comparable contracts in determining reasonable royalty damages, it is necessary to determine whether or not the patent holder in those contracts has made FRAND commitments. Then, it is necessary to determine whether or not the patent holder in the patent case has SEPs that are subject to FRAND

387. *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1332 (Fed. Cir. 2014).

388. Case C-170/13, *Huawei Technologies Co. Ltd. v ZTE Corp.*, 2014 E.C.J. 2391, ¶ 103; *see also* Kuhnen, *supra* note 298.

389. *See* Kuhnen, *supra* note 298.

390. ROBIN JACOB & ALEXANDER MILNER, LESSONS FROM HUAWEI V. ZTE 1 (2016), http://www.4ipcouncil.com/application/files/6314/7928/6022/Lessons_from_Huawei_v_ZTE_-_RJacob_-_24-10-16.pdf.

391. *Id.* at 2.

The judgment of the European Court of Justice (CJEU) in *Huawei v. ZTE* has provided valuable guidance on the circumstances when a holder of a Standard Essential Patent (SEP) which has given a commitment to license the SEP on FRAND terms is entitled to seek an injunction against an implementer without acting in breach of competition law.

Id. at 1.

392. *Id.* at 2.

393. *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1332 (Fed. Cir. 2014).

commitments. The royalties for the comparable contract may need to be adjusted accordingly if the patents differ in terms of FRAND commitments.

Patent license contracts play an important role in patent disputes involving SEPs. A patent license contract may insulate patent owners from disputes regarding whether license terms meet a FRAND commitment. In *Unwired Planet*, Justice Colin Birss states “[i]f parties agree license terms then their rights and obligations under the ETSI FRAND undertaking will be discharged and replaced by their contractual rights under the license.”³⁹⁴

Unwired Planet finds that FRAND commitments apply to royalties that are agreed to under patent license contracts rather than to royalty offers by either technology providers or technology adopters.³⁹⁵ Justice Birss writes:

Therefore it makes much more sense to interpret the ETSI FRAND obligation as applicable primarily to the finally agreed terms rather than to the offers. In other words, it is an obligation to enter into FRAND licenses. The same logic also applies to implementers: an obligation on implementers to make FRAND offers as opposed to enter into FRAND licenses would have them paying rates higher than the FRAND rate.³⁹⁶

Reasonable royalties for SEPs should consider comparable contracts for SEPs that were negotiated after the relevant standards were established. The Federal Trade Commission argues instead that reasonable royalty damages for SEPs should be based on royalties that would have been negotiated before the standard chosen.³⁹⁷ Critiquing the FTC report, Richard Epstein et al. argue in contrast that if the FTC’s bargain prices were always available to infringers through the courts—or worse yet, were used as a standard to accuse negotiated license terms retroactively of being ‘unreasonable’—the result would be the destruction of private bargains and the generation of government-sponsored hold-up that would substantially reduce the returns to innovators and adopters alike.³⁹⁸

3. *Adjusting for the Provisions of the Patent License Contract*

The *structure of royalty payments* refers to the various royalty provisions in the licensing contract. A particular level of total royalties is consistent with different combinations of running royalties and lump-sum fees.³⁹⁹ Also, a particular level of total royalties is consistent with different combinations of royalties

394. *Unwired Planet v. Huawei* [2017] EWHC (Pat) 711 [155] (Eng.).

395. *Id.* at 157.

396. *Id.* at 159.

397. FED. TRADE COMM’N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 22 (Mar. 2011), <https://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patentreport.pdf>.

398. Richard A. Epstein et al., *The FTC, IP, and SSOs: Government Hold-Up Replacing Private Coordination*, 8 J. COMPETITION L. & ECON. 1, 27 (2012).

399. FED. TRADE COMM’N, *supra* note 397, at 200.

and outputs or sales levels.⁴⁰⁰ Running royalties and lump-sum fees are building blocks that are used to construct total royalty payments.⁴⁰¹

The various provisions of the patent license contract affect the economic benefits of the technology adopter and the economic costs of the technology provider. These provisions affect how the parties allocate the economic value of the contract through royalties. Various economic factors affect the structure and level of royalty payments.

Patent license agreements often involve the entire patent portfolio for convenience and lowering transaction costs. Bundling also occurs for the usual reasons that firms bundle complements, or substitutes, or both, and also when there is asymmetric information about the technology being offered and the needs of the licensee.⁴⁰² Patent license contracts bundle patents even when the parties are aware that the licensee would only use some subset of the available technology.

A patent case, however, generally extracts particular patents or even specific claims from patents.⁴⁰³ This can affect the court's search for comparable licenses. This suggests that the court should use the full portfolio in the search for comparable license agreements if contracting parties typically do not extract particular patents or specific claims.

Reasonable royalty damages generally should be increased in comparison with contracts that bundle patent licenses with other products. This is because the infringing firm does not purchase the products that are bundled with the patent license. Varner observes:

A patent license also may specify that a royalty will be reduced if the licensed product is combined with another product. Combination product royalty reductions are a way to apportion a licensed patent's value in the event that a licensed product is later combined into a single saleable unit with another product that is not covered by the patented technology.⁴⁰⁴

In the absence of bundling, the royalty would be increased.

The technology adopter's economic benefits are equal to the value obtained by using the patented technology in combination with other technologies minus the net benefits of using the substitute technology in combination with other tech-

400. For example, a total royalty of $R = \$100$ is consistent with a fixed fee of \$60 and running royalties of 2% on sales of \$2,000, or a fixed fee of \$25 and running royalties of 1% on sales of \$7,500.

401. See Norman V. Siebrasse & Thomas F. Cotter, *A New Framework for Determining Reasonable Royalties in Patent Litigation*, 68 FLA. L. REV. 929, 97880 (2016) (discussing lump-sum versus running royalties).

402. STEVEN GIN, AN ANALYSIS OF CROSS-LICENSING WITH ASYMMETRIC PATENT PORTFOLIOS 16, 18 (2016).

403. See 2017 PATENT LITIGATION STUDY, *supra* note 10, at 3.

404. Thomas R. Varner, *An Economic Perspective on Patent Licensing Structure and Provisions*, 46 BUS. ECON. 229, 235 (2011).

Combination product royalty reductions can take a number of different forms, but the most common form observed in the data set is one in which the base royalty rate is multiplied by the ratio of the licensed product's stand-alone price . . . to the sum of the stand-alone prices of the licensed and unlicensed products

Other forms of combination product royalty reductions include ratios based on manufacturing or fully allocated costs, the number of active components, and the number of functions performed.

Id. at 235–36.

nologies. Let P represent the value of using the patented technology in combination with other technologies. This is the present value of the technology adopter's stream of profits during the period of infringement. Profits are the technology adopter's revenues minus any relevant costs, including production, marketing and sales, additional R&D, and transaction costs. Let A represent the adopter's opportunity cost. The adopter's opportunity costs are the returns to applying the best alternative technology available at the time infringement began. This is the best alternative technology that would have been available to the parties negotiating a licensing contract. By using the best alternative technology in combination with other technologies, the technology adopter would have obtained value P^A and paid royalties R^A for access to the alternative technology. Then, the adopter's opportunity costs are the net returns that the technology adopter would have obtained from using the best alternative technology, $A = P^A - R^A$.

Then, the adopter's economic benefits can be written as $B = P - A$. Alternatively, the technology adopter's economic benefits equal the incremental contribution of the invention plus royalties on the best alternative invention, $B = P - P^A + R^A$.

Let C represent the patent holder's opportunity costs. These costs of providing the technology are contingent on the terms of the patent licensing contract. These costs are the technology provider's willingness to accept payment for the technology. Total opportunity costs are the discounted stream of opportunity costs during the term of the contract. These costs include returns to licensing to other potential technology adopters that might have occurred. These costs also can include lost profits due to competition from the technology adopter.

The economic value of the contract equals the economic benefits of the technology adopter of using the technology minus the economic costs of the patent holder of providing the technology, $B - C$. A voluntary technology transaction could only occur only if the licensee's economic benefits are greater than the licensor's economic costs, $B > C$. Royalties allocate the economic value of the contract between the two parties. The technology adopter's economic benefits from using the patented invention B provide an upper limit to the range of reasonable royalty damages. The technology provider's economic costs of supplying the invention provide a lower limit to the range of reasonable royalty damages. If the informed contract has economic value, that is, if economic benefits exceed economic costs, this specifies a range for licensing royalties, $C \leq R \leq B$.

Reasonable royalty damages, however, may exceed the infringer's benefits. This is because the infringer obtained the technology without cost and thus made business decisions without taking into account the market value of the patented technology. Without taking into account running royalties, an infringer might have expanded output beyond the efficient level for those royalties. It is possible that the infringer's economic returns were not sufficient to cover the market value of the patented technology. Faced with paying the market value of the patented technology, the infringer would not have entered into a licensing contract.

Infringement may also impose various other costs on the patent holder such as legal costs and the costs of monitoring infringement.⁴⁰⁵

As already stated previously, royalties in patent license agreements are not just fixed payments for use of the inventions.⁴⁰⁶ Rather, they are combinations of payments consisting of running royalties, lump-sum license fees, and payments contingent on milestones attained by the licensee.⁴⁰⁷ There may also be maximum or minimum limits on payments as a share of profits, maintenance fees, and compensation in the form of equity in the licensee's firm. Running royalties typically are based on sales.⁴⁰⁸ If running royalties are *specific*, running royalties consist of a royalty r multiplied by the number of units sold Q . Total royalty payments with specific running royalties are $R = F + rQ$, where F is a lump-sum fee. If running royalty payments are *ad valorem*, they are a share s of the licensee's revenues PQ , where P is the sales price. Total royalties with *ad valorem* running royalties are $R = F + sPQ$.

The structure of the royalty payments often depends on the particular characteristics of the licensor and the licensee including in what industry the firms operate.⁴⁰⁹ The extent of competition and ease of entry in the downstream industry may affect the structure of royalty payments. If the downstream industry resembles the economics textbook description of "perfect competition," it may not be possible for licensees to pay fixed fees because competition and entry would drive down the profits of licensees.⁴¹⁰ Accordingly, licensors would rely on running royalties based either on revenues or on units sold.⁴¹¹ Conversely, if the downstream industry resembles a textbook "monopoly," the licensor can charge a lump-sum royalty either up-front or on an annual basis.⁴¹² Using a lump-sum royalty in licensing to a monopolist avoids the distortionary effects of double marginalization, which would occur because the monopolist would increase final product prices to reflect the higher per-unit costs that would result from a running royalty.

If the downstream industry, however, lies between the extremes of "perfect competition" and "monopoly" some combination of running royalties and lump-sum royalties may be feasible. I show elsewhere that when there is imperfect competition in the downstream industry, an inventor may rely on both running

405. See Shyamkrishna Balganesh, *Copyright Infringement Markets*, 113 COLUM. L. REV. 2277, 2295 (2013).

406. Deepak Hegde, *Tacit Knowledge and the Structure of License Contracts: Evidence From the Biomedical Industry*, 23 J. ECON. & MGMT. STRATEGY 568, 568–69 (2014).

407. *Id.*

408. Varner, *supra* note 404, at 234.

409. *Id.* at 229.

410. Spulber, *supra* note 77.

411. See generally Kenneth Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in NATIONAL BUREAU OF ECONOMIC RESEARCH, THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609 (Princeton Univ. Press 1962); Nancy T. Gallini & Ralph A. Winter, *Licensing in the Theory of Innovation*, 16 RAND J. ECON. 237 (1985); Michael L. Katz & Carl Shapiro, *How to License Intangible Property*, 101 Q.J. ECON. 567 (1986). See also Michael L. Katz & Carl Shapiro, *On the Licensing of Innovations*, 16 RAND J. ECON. 504, 511 (1985).

412. Arrow, *supra* note 411, at 619–22.

royalties and lump-sum royalties.⁴¹³ I also show that when there is imperfect competition in the downstream industry, and there is competition among inventors offering substitute inventions, the patent license may involve both running royalties and lump-sum royalties.⁴¹⁴ This is because competition limits profits in the downstream industry, which in turn limits lump-sum royalties so that the licensor uses a combination of running royalties and lump-sum royalties.

Eric Stasik surveys announcements of royalty rates by licensors and finds that royalties are shares of sales of the final product, in this case, mobile telephone handsets.⁴¹⁵ Stasik cautions that “[i]t is necessary at this point to clarify that an ‘announced’ royalty rate may be significantly different than the ‘actual’ royalty rate resulting from a bi-lateral negotiation.”⁴¹⁶ Even though these are likely to be opening bids in negotiations, the final outcome also appears to be royalties based on shares of sales revenues. Stasik cites a study by Kearsey and Goldstein showing that for 3G technology, “[i]ndividual patent owners usually charge between 0.5 and 4 percent on essential patents,” again in terms of shares of final sales revenues.⁴¹⁷

Thomas Varner finds that royalty rates for patent license contracts are among the lowest rates observed in IP license agreements.⁴¹⁸ Varner’s 2010 study examines royalty rates for a wide variety of IP license contracts, including “joint venture agreements, product bundling or re-branding agreements, distribution agreements, settlement agreements, manufacturing and supply agreements, employment agreements, and acquisition agreements.”⁴¹⁹ Varner in a 2011 study focuses on patent licensing royalties including fixed fees, running royalties, and equity.⁴²⁰ Varner considers both licensing of “patents-plus-know-how” and “bare patents” and finds that practically all contracts for “patents-plus-know-how” have running royalties and about 85% of contracts for “bare patents” have running royalties.⁴²¹ Varner finds that running royalties are based on sales revenue for about 90% of license contracts, with most of the rest of running royalties relying on units of output sold.⁴²²

413. See generally Daniel F. Spulber, *Competing Inventors and the Incentive to Invent*, 22 INDUS. & CORP. CHANGE 3 (2012) [hereinafter Spulber, *Competing Inventors*]; Daniel F. Spulber, *How Do Competitive Pressures Affect Incentives to Innovate When There Is a Market for Inventions?*, 121 J. POL. ECON. 1007 (2013) [hereinafter Spulber, *How Do Competitive Pressures*].

414. Spulber, *How Do Competitive Pressures*, *supra* note 413, at 1031–32.

415. See generally Eric Stasik, *Royalty Rates and Licensing Strategies for Essential Patents on LTE (4G) Telecommunications Standards*, 45 LES NOUVELLES 114 (2010).

416. *Id.* at 116–17.

417. *Id.* at 116 (citing BRIAN KEARSEY & LARRY M. GOLDSTEIN, TECHNOLOGY PATENT LICENSING: AN INTERNATIONAL REFERENCE ON 21ST CENTURY PATENT LICENSING, PATENT POOLS, AND PATENT PLATFORMS 53 (2004)).

418. Thomas R. Varner, *Technology Royalty Rates in SEC Filings*, 45 LES NOUVELLES 120, 120 (2010).

419. Varner, *supra* note 404, at 230.

420. *Id.* at 232.

421. *Id.* at 230, 233.

422. *Id.* at 233.

Mariko Sakakibara examines the structure of royalties in Japanese patent license contracts.⁴²³ The contracts involve both running royalties and lump-sum payments.⁴²⁴ She finds that royalties are affected by the profitability of underlying patents, the reservation price of licensors, and the relative bargaining power of licensors and licensee.⁴²⁵ Sakakibara conducts a regression analysis to examine how various determinants affect royalties in patent license contracts.⁴²⁶ The regressions consider the effects on licensing royalties of the following sets of factors: the attributes of licensors, the attributes of licensees, the attributes of licensor-licensee pairs, the attributes of contracts, and the attributes of traded patents.⁴²⁷

Sakakibara addresses the structure of royalty payments by considering both running royalties and lump-sum royalties, controlling for the effects of sales in examining the determinants of running royalties.⁴²⁸ Also, she controls for the length of the contract and whether or not the contract is exclusive.⁴²⁹ Sakakibara considers the attributes of licensors and licensees in terms of whether they are large or small firms and whether they are companies or research organizations.⁴³⁰ She finds that larger licensors tend to receive lower running royalties and larger licensees tend to have higher running royalties.⁴³¹ Royalties are decreasing in the age of patents being licensed, perhaps reflecting the effects of technological change on obsolescence of inventions.⁴³² Royalties are increasing in patent effectiveness, measured by survey analysis within industry categories.⁴³³

An empirical analysis of the market for technology by Pere Arqué-Castells and Daniel Spulber demonstrates that technology transactions take into account both the technology provider's lost profits from business stealing and the technology adopter's increased profits from business creation.⁴³⁴ Their study finds that market proximity and technological proximity can increase the likelihood of a match between a technology provider and a technology adopter.⁴³⁵ Market proximity and technological proximity increase the economic value of the contract.⁴³⁶ As a consequence, market proximity and technological proximity may

423. Mariko Sakakibara, *An Empirical Analysis of Pricing in Patent Licensing Contracts*, 19 *INDUS. & CORP. CHANGE* 927, 931 (2010). Sakakibara examines 661 patent licensing contracts between 1998 and 2003. *Id.*

424. *Id.* at 928.

425. *Id.*

426. *Id.* at 932.

427. *Id.*

428. *Id.* at 932–33.

429. *Id.* at 933.

430. *Id.*

431. *Id.* at 939.

432. *Id.* at 933.

433. *Id.* at 940.

434. Pere Arqué-Castells & Daniel F. Spulber, *The Market for Technology: Harnessing Creative Destruction* 1 (NW. UNIV. PRITZKER SCHOOL OF LAW & ECONS. SERIES NO. 18-14, 2018); see also Nicholas Bloom et al., *Identifying Technology Spillovers and Product Market Rivalry*, 81 *ECONOMETRICA* 1347, 1347 (2013). See generally Sakakibara, *supra* note 423.

435. Arqué-Castells & Spulber, *supra* note 434, at 40.

436. *Id.*

increase royalties in the forgone contract. This suggests that market proximity and technological proximity should increase reasonable royalty damages.

The structure of royalty payments is particularly significant because of their incentive effects. An important function of the royalty structure is to provide incentives for the licensee to invest efficiently in applying the invention and to share information about the profitability of using the invention.⁴³⁷ The royalty structure also may provide incentives for the licensor to provide know-how to the licensee. Economic studies have examined how asymmetric information and incentives affect the structure of royalties in patent license contracts.⁴³⁸ Deepak Hegde for example explores how tacit knowledge affects the structure of royalties in licensing contracts, including royalty rates, lump-sum fees, milestones, and minimum payments.⁴³⁹

4. *The Georgia-Pacific Factors*

The contract approach introduced here suggests that the *Georgia-Pacific* factors are useful only if they correspond to the information revealed by the patent case. In *Ericsson v. D-Link*, the court observes that “the district court included all 15 *Georgia-Pacific* factors in its damages instruction—over objection—without considering their relevance to the record created at trial.”⁴⁴⁰

Events such as technology standardization and FRAND obligations affect the applicability of the factors: “[i]n a case involving RAND-encumbered patents, many of the *Georgia-Pacific* factors simply are not relevant; many are even contrary to RAND principles.”⁴⁴¹

The “informed contract” approach provides guidance on using the *Georgia-Pacific* factors.⁴⁴² The *Georgia-Pacific* factors have been applied widely.⁴⁴³ Although these factors focus on the provision of evidence, they are significant because they characterize the economic basis for reasonable royalty damages in the context of a contract. The *Georgia-Pacific* factors suggest how comparable contracts can be used to estimate reasonable royalty damages.⁴⁴⁴

Georgia-Pacific quotes a Supreme Court decision:

In fixing damages on a royalty basis against an infringer, the sum allowed should be reasonable and that which would be accepted by a prudent licensee who wished to obtain a license but was not so compelled and a prudent patentee, who wished to grant a license but was not so compelled.⁴⁴⁵

437. Sakakibara, *supra* note 423, at 941.

438. *Id.* at 929.

439. Hegde, *supra* note 406, at 568; see also Daniel F. Spulber, *Tacit Knowledge with Innovative Entrepreneurship*, 30 INT’L J. INDUS. ORG. 641 (2012).

440. 773 F.3d 1201, 1230 (Fed. Cir. 2014).

441. *Id.*

442. *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970).

443. Joseph A. Alfred, *Licensing Standards Essential Patents*, 52 LES NOUVELLES 223, 224 (2017) (noting that ninety-six cases cite *Georgia Pacific* since 1995, of which thirty-five discuss the *Georgia Pacific* factors).

444. *Georgia-Pacific*, 318 F. Supp. at 1120.

445. *Id.* at 1121 (citing *Horvath v. McCord Radiator & Mfg. Co.*, 100 F.2d 326, 335 (6th Cir. 1938)).

Georgia-Pacific also cites *Faulkner v. Gibbs*, 199 F.2d 635, 639 (9th Cir. 1952): “The primary inquiry, often complicated by secondary ones, is what the parties would have agreed upon, if both were reasonably trying to reach an agreement.”⁴⁴⁶ *Georgia-Pacific* refers to this as the willing buyer and willing seller rule, but also as “a willing licensor and a willing licensee.”⁴⁴⁷

The *Georgia-Pacific* factors view royalties in the context of an overall contractual agreement. The first two factors take into account the market alternatives available to both parties.⁴⁴⁸ The first factor considers the royalties that the patent owner may have received from alternative licensees: “The royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty.”⁴⁴⁹ As already noted, this approach should be followed if there is information about the royalties that the patent owner would have received.⁴⁵⁰

The second factor considers market alternatives that may be available to the adopter or comparable royalty rates paid by the adopter: “The rates paid by the licensee for the use of other patents comparable to the patent in suit.”⁴⁵¹ As already noted, if this information is not available it may be possible to use the market value of comparable patents.⁴⁵²

The *Georgia-Pacific* factors three through seven explicitly identify the contractual provisions of the patent license contract: the nature and scope of the license, the licensor’s conditions on restrictions of licensing to others, the commercial relationship between the licensor and the licensee, the value of the invention in generating sales, and the duration of the license.⁴⁵³ These factors are important aspects of patent license contracts and are very likely to be specified in the patent case.⁴⁵⁴ These factors are important determinants of reasonable royalty damages for infringement.

Factor three refers to “[t]he nature and scope of the license, as exclusive or non-exclusive; or as restricted or non-restricted in terms of territory or with respect to whom the manufactured product may be sold.”⁴⁵⁵ Thus, royalties should be increased the greater is the scope of the “informed contract” and the greater is the territory covered by the infringer. Factor four refers to “[t]he licensor’s established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly.”⁴⁵⁶ Royalties should be increased to

446. *Id.*

447. *Id.* (“What a willing licensor and a willing licensee would have agreed upon in a supposititious negotiation for a reasonable royalty would entail consideration of the specific factors previously mentioned, to the extent of their relevance.”).

448. *Id.* at 1120.

449. *Id.*

450. *See supra* Part III.

451. *Georgia-Pacific*, 318 F. Supp. at 1120.

452. *See supra* Part IV.

453. *Georgia-Pacific*, 318 F. Supp. at 1120.

454. Seaman, *supra* note 4, at 1665–66.

455. *Georgia-Pacific*, 318 F. Supp. at 1120.

456. *Id.*

the extent that the patent owner would have chosen not to license to others or would have granted few licenses to others to preserve the patent holder's market power.

Factor five is “[t]he commercial relationship between the licensor and licensee, such as, whether they are competitors in the same territory in the same line of business; or whether they are inventor and promotor.”⁴⁵⁷ If the patent owner and the infringer are competitors, royalties in patent license contracts should be increased in comparison with the situation in which the patent owner and the infringer are inventor and promoter respectively. Factor six refers to “[t]he effect of selling the patented specialty in promoting sales of other products of the licensee; the existing value of the invention to the licensor as a generator of sales of his non-patented items; and the extent of such derivative or conveyed sales.”⁴⁵⁸ Factor seven specifies “the duration of the patent and the term of the license.”⁴⁵⁹

The next three factors take into account the market value of the patent holder's IP.⁴⁶⁰ These factors will affect the market price of the patent in patent transfers and royalties in patent license contracts.⁴⁶¹ These factors are as follows: “8. The established profitability of the product made under the patent; its commercial success; and its current popularity.”⁴⁶² “9. The utility and advantages of the patent property over the old modes or devices, if any, that had been used for working out similar results.”⁴⁶³ “10. The nature of the patented invention; the character of the commercial embodiment of it as owned and produced by the licensor; and the benefits to those who have used the invention.”⁴⁶⁴

The eleventh factor addresses the actions of the technology implementer: “The extent to which the infringer has made use of the invention; and any evidence probative of the value of that use.”⁴⁶⁵ The greater the usage of the invention, the higher should be reasonable royalty damages.

The twelfth factor concerns the markdown of the infringer's profit: “The portion of the profit or of the selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions.”⁴⁶⁶ This factor directly addresses the infringer's profit.⁴⁶⁷ The share should not be too high to allow the infringer's business to operate. It may be useful to consider customary profit shares in the particular industry if evidence permits without resorting to arbitrary rule of thumb.

457. *Id.*

458. *Id.*

459. *Id.*

460. *Id.*

461. Gregory K. Leonard & Mario A. Lopez, *Determining RAND Royalty Rates for Standard-Essential Patents*, 29 ANTITRUST L.J. 86, 87 (2014).

462. *Georgia-Pacific*, 318 F. Supp. at 1120.

463. *Id.*

464. *Id.*

465. *Id.*

466. *Id.*

467. *Id.*

The thirteenth factor also concerns the markdown of the infringer's profit: "The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer."⁴⁶⁸ This concerns the question of apportionment that will be addressed further. The fourteenth *Georgia-Pacific* factor refers to the testimony of qualified experts.⁴⁶⁹ The "informed contract" approach presented here suggests that courts modify the fifteenth and final *Georgia-Pacific* factor, which describes the "hypothetical negotiation."⁴⁷⁰

C. *The Infringer's Benefits: The "Bottom-Up" and "Top-Down" Approaches*

Up to this point, the discussion has focused on reasonable royalty damage calculations based on the patent's holder's economic costs. The market value method and the comparable license method provide estimates of the patent holder's opportunity costs. Now, the discussion shifts to consideration of damage calculations based on the infringer's benefits. Many patent cases apply some version of either the "bottom-up" or the "top-down" approaches, both of which base reasonable royalty damages on the benefits of the infringer.⁴⁷¹

1. *The Infringer's Benefits*

If reasonable royalty damages do not exceed the infringer's benefits, then reasonable royalty damages can be calculated on the basis of the infringer's benefits.⁴⁷² This approach tends to depart from economic and legal analysis. The main problem with basing reasonable royalty damages on the benefits of the infringer is that it may not account for the value of the patent holder's IP.⁴⁷³ The patent holder's damages from infringement may exceed the infringer's benefits so that calculating reasonable royalty damages as a share of the infringer's benefits may fail to provide full compensation for the patent holder.

In a patent license contract negotiation, recall that royalties are in a *range* between the opportunity costs of the patent holder and the economic benefits of the technology adopter, $C \leq R \leq B$.⁴⁷⁴ The opportunity costs C of the patent holder

468. *Id.*

469. *Id.*

470. *Id.*

15. The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee – who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.

Id.

471. See Leonard & Lopez, *supra* note 461, at 88–91; Jason R. Bartlett & Jorge L. Contreras, *Rationalizing FRAND Royalties: Can Interpleader Save the Internet of Things?*, 36 REV. LITIG. 285, 293 (2017).

472. Bartlett & Contreras, *supra* note 471, at 292; see also Jarosz & Chapman, *supra* note 21, at 795–96.

473. Jarosz & Chapman, *supra* note 21, at 795–98.

474. See *supra* Section IV.B.

are lost profits, lost licensing revenues, and other licensing costs.⁴⁷⁵ The economic benefits B of the technology adopter are the adopter's profits net of the returns to using alternative technologies.⁴⁷⁶ The patent holder's opportunity costs and the adopter's benefits depend on the provisions of the contract. Negotiated royalties also depend on the provisions of the contract.

Negotiated royalties are a *point* within this range. This means that negotiated royalties can be viewed in two equivalent ways: either as a markup of the patent holder's opportunity costs, $R = YC$, or as a markdown of the technology adopter's benefits, $R = XB$.⁴⁷⁷ For any given royalty, the markup would be equal to the markdown multiplied by the ratio of the adopter's benefits to the provider's opportunity costs, $Y = X(B/C)$.⁴⁷⁸

The question is whether reasonable royalty damages can be determined on the basis of the infringer's benefits. If reasonable royalty damages were the result of a "hypothetical negotiation," and the outcome of the negotiation could be determined with some precision, then expressing royalties based on the patent holder's opportunity costs or the infringer's benefits would be equivalent. The infringer's profits, however, are an imperfect measure of damages to the patent holder because there was no licensing agreement. The result resembles a disgorgement remedy rather than full compensation of the patent holder.

As our discussion has emphasized, characterizing the "hypothetical negotiation" is practically impossible. The court generally cannot be expected to determine the knowledge and expectations of the parties. The "hypothetical negotiation" presumes a willing licensor and a willing licensee, which may be inaccurate.⁴⁷⁹

The "bottom-up" or the "top-down" approaches fail to fully compensate the patent holder when the market value of the patent holder's IP exceeds the infringer's benefits.⁴⁸⁰ Also, markdowns of the infringer's benefits tend to be arbitrary and disconnected from market value.⁴⁸¹ Such markdowns may not accurately account for the market value of the patent holder's IP.⁴⁸²

Shares of the infringer's benefits tend to be arbitrary and usually are based on counting patents.⁴⁸³ This is often a problem with SEPs because many patents that are declared essential may not be necessary to meet technical standards.⁴⁸⁴

475. See *supra* Section IV.B.

476. See *supra* Section IV.B.

477. The markup of the technology provider's opportunity costs is greater than or equal to one and less than or equal to the ratio of the adopter's benefits to the provider's costs, $1 \leq Y \leq B/C$. The markdown of the adopter's benefits is less than or equal to one and greater than or equal to the ratio of the provider's opportunity costs to the adopter's benefits, $C/B \leq X \leq 1$.

478. See Leonard & Lopez, *supra* note 461, at 89.

479. See, e.g., *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1554 n.13 (Fed. Cir. 1995) (en banc) ("The hypothetical negotiation is often referred to as a 'willing licensor/willing licensee' negotiation. However, this is an inaccurate, and even absurd, characterization when, as here, the patentee does not wish to grant a license.").

480. See Leonard & Lopez, *supra* note 461, at 88–91.

481. See *id.* at 86; see also Seaman, *supra* note 4, at 1696.

482. See Leonard & Lopez, *supra* note 461, at 87; see also Seaman, *supra* note 4, at 1696.

483. See Bartlett & Contreras, *supra* note 471, at 300–01.

484. See *id.*

Calculating reasonable royalty damages based on counting patents waters down the contribution of technologically important patents, which can result in incomplete compensation for patent holders' IP.⁴⁸⁵ Judge Holderman cautions in *In re Innovatio*, "The court agrees that the profit margin on an accused product is not always dispositive for determining a RAND rate."⁴⁸⁶

2. The "Bottom-Up" Approach

The "bottom-up" approach calculates reasonable royalty damages as a share of the infringer's benefit.⁴⁸⁷ This means that reasonable royalty damages are a share of the adopter's incremental returns, which is profit minus the returns to using alternative technologies, $B = P - A$.⁴⁸⁸

The "bottom-up" approach appears in various court decisions including *Microsoft v. Motorola*.⁴⁸⁹ Jason Bartlett and Jorge Contreras refer to the "bottom-up" approach as a "recipe for inconsistency."⁴⁹⁰ Many advocate this approach because it takes into account the incremental contribution of the patented technology to the infringer.⁴⁹¹ When there are SEPs, the application of the "bottom-up" approach to a FRAND royalty "begins by identifying the set of alternatives that would have been available prior to standardization and then determining the incremental value, if any, of the SEPs relative to those alternatives."⁴⁹²

If the alternative A is a close substitute, the net returns are close to the infringer's profit from applying the patented invention P .⁴⁹³ If the alternative is not a close substitute, the net returns are much smaller than the profits from using the patented invention P .⁴⁹⁴ To implement this approach, the patent case must measure the benefits of the alternative technologies net of royalty costs of those alternatives, $A = P^A - R^A$.⁴⁹⁵

485. See *id.* at 297–300.

486. *In re Innovatio IP Ventures, LLC*, No. 11-C-9308, 2013 WL 5593609, at *39 (N.D. Ill. Oct. 3, 2013).

487. Leonard & Lopez, *supra* note 461, at 88–89.

488. *Id.* at 89; see *supra* Section IV.B.

489. See *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, 2013 WL 2111217 (W.D. Wash. Apr. 25, 2013); see also Bartlett & Contreras, *supra* note 471, at 293–94.

490. Bartlett & Contreras, *supra* note 471, at 293.

491. See, e.g., Daralyn J. Durie & Mark A. Lemley, *A Structured Approach to Calculating Reasonable Royalties*, 14 LEWIS & CLARK L. REV. 627, 637 (2010).

Not surprisingly, a reasonable royalty designed to mimic the results of a hypothetical license negotiation between patentee and infringer should be strongly influenced by the value that the patented technology actually contributes. The more the patented technology is worth, the more a willing buyer would be willing to pay, and the more a willing seller could reasonably demand.

Id.; see also Amy L. Landers, *Patent Claim Apportionment, Patentee Injury, and Sequential Invention*, 19 GEO. MASON L. REV. 471, 472 (2012) ("This Article starts with the fundamental premise that a patentee's harm cannot be greater than the patentee's contribution.")

492. Leonard and Lopez, *supra* note 461, at 88.

493. *Id.* at 87–89.

494. See Seaman, *supra* note 4, at 1718–19.

495. See *id.*; see also Section IV.B.

The problem with the “bottom-up” approach is that it requires information that is generally unobservable and difficult to estimate.⁴⁹⁶ The infringer’s profits P^A from the alternative technologies are difficult to estimate because the technological alternatives are not fully specified and the infringer’s profit from using those technologies are not observable.⁴⁹⁷ In addition, it may be difficult to determine royalties R^A on the relevant alternatives because the technologies are not specified and also there may not be observable royalties on these technologies.⁴⁹⁸ Judge Holderman in *In re Innovatio* points out that finding the net benefits from alternative technologies requires accounting for royalty costs of those alternatives: “patented alternatives are also able to command a royalty, because it is unlikely that the market would drive the price of all patented technology to zero.”⁴⁹⁹

This issue arose in *Panduit*.⁵⁰⁰ The presence of a substitute was not sufficient for the infringer to avoid paying reasonable royalty damages.⁵⁰¹ The court suggested that the technology adopter had ignored the substitute for years while selling the infringing product.⁵⁰² This suggested that the alternative was not a close substitute.⁵⁰³ As the court noted “[t]here are substitute products for virtually every patented product; the availability of railroads and box cameras should not of itself diminish royalties payable for infringement of the right to exclude others from making and selling the Wright airplane or the Polaroid camera.”⁵⁰⁴

In *Georgia Pacific*, the court arrived at a markdown of profit of 22.36% by subtracting the infringer’s usual profit as a share of the selling price equal to 9% from the infringer’s actual profit as a share of the selling price.⁵⁰⁵ This provided a way of estimating the incremental contribution of the patented technology to

496. Such calculations require information about comparable licenses and the costs of design arounds for the licensee, with particular consideration given to “the amount of evidence available for implementing each methodology, the quality of data available to support each methodology, and the economic circumstances of each case.” Jarosz & Chapman, *supra* note 21, at 828; *see also* Seaman, *supra* note 4, at 1727 (describing a similar approach).

Specifically, the cost to the infringer of adopting and implementing an acceptable noninfringing substitute, plus any incremental benefit provided by the patented technology vis-à-vis the substitute, represents the true economic value of the patent over the prior art. As a result, the cost of the noninfringing substitute represents the maximum amount a rational licensee would have agreed to pay in a hypothetical negotiation. Seaman, *supra* note 4, at 1727. This approach should be modified because a buyer’s willingness to pay for the new technology would equal its economic value, that is, the incremental benefit of the new technology plus the cost of the inferior substitute.

497. *See* Bartlett & Contreras, *supra* note 471, at 303.

498. *See id.*; *see also* Leonard & Lopez, *supra* note 461, at 86.

499. According to Judge Holderman:

In essence, the Bottom Up approach suggests determining the cost of implementing reasonable alternatives to the *Innovatio* patents that could have been adopted into the standard, and dividing that cost by the total number of infringing units to determine the maximum per unit royalty *Innovatio*’s patents would have merited in the 1997 hypothetical negotiation.

In re Innovatio IP Ventures, LLC, No. 11-C-9308, 2013 WL 5593609, at *37 (N.D. Ill. Oct. 3, 2013).

500. *See generally* *Panduit Corp. v. Stahlin Bros. Fibre Works*, 575 F.2d 1152 (6th Cir. 1978).

501. *Id.* at 1159–62.

502. *Id.*

503. *Id.*

504. *Id.* at 1162 n.9.

505. *See* Pincus, *supra* note 11, at 127.

the infringer's profit, thus giving an estimate of reasonable royalty damages.⁵⁰⁶ The estimate of the incremental contribution of the patented technology was based on a change in profits as a share of the selling price that was presumably due to infringement.⁵⁰⁷ Reasonable royalty damages then would be calculated by multiplying the change in the share of the selling price by the infringers' total revenues during the infringement period.⁵⁰⁸ *Georgia Pacific* effectively implemented the "bottom-up" approach by using the change in profits to indicate the incremental contribution of alternative technologies.⁵⁰⁹

With multiple inventions, further difficulties arise because the total of the incremental contributions of various technologies can be greater than or less than the total value produced by using those technologies.⁵¹⁰ This depends on whether the technologies are what I term "innovative complements" or "innovative substitutes."⁵¹¹ Then, mechanically attributing royalties to various technologies based on incremental contributions will result in total royalties that are greater than or less than their total benefit.⁵¹² Contract negotiation resolves these problems in the market place.⁵¹³

The problem of calculating the infringer's incremental benefits is exacerbated with technology standards. As Judge Robart observes in *Microsoft*, "In practice, approaches linking the value of a patent to its incremental contribution to a standard are hard to implement."⁵¹⁴ Generally, this means that it may not be feasible to observe the infringer's alternative returns, which requires obtaining information on profits without the infringed technology and royalties on alternative technologies.⁵¹⁵

3. *The "Top-Down" Approach*

Another method of determining reasonable royalty damages is the "top-down" approach.⁵¹⁶ The "top-down" approach appears in *In re Innovatio* and *TCL Communications v. Ericsson*.⁵¹⁷ According to this approach, the royalty is

506. *Id.*; *Georgia-Pac. Corp. v. U.S. Plywood-Champion Papers Inc.*, 446 F.2d 295, 299 (2d Cir. 1971).

507. *See Georgia Pacific*, 446 F.2d at 299.

508. *Id.* at 299–300, 300 n.3.

509. *See Bartlett & Contreras*, *supra* note 471, at 293–94, 294 n.39; *see also* Pincus, *supra* note 11, at 127.

510. *See Spulber*, *supra* note 77, at 693.

511. *See generally id.*

512. *See id.* at 694.

513. *See id.*

514. *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, 2013 WL 2111217, at *13 (W.D. Wash. Apr. 25, 2013).

515. *Id.*

516. *See Leonard & Lopez*, *supra* note 461, at 89–91.

517. *TCL Comm'n Tech. v. Telefonaktiebolaget LM Ericsson*, No. 15-cv-2370, 2017 WL 6611635, at *1 (C.D. Cal. Dec. 21, 2017); *In re Innovatio IP Ventures, LLC*, No. 11-C-9308, 2013 WL 5593609, at *37 (N.D. Ill. Oct. 3, 2013); *see* Jason Rantanen, *Guest Post by Prof. Jorge Contreras: TCL v. Ericsson: The First Major U.S. Top-Down FRAND Royalty Decision*, PATENTLYO BLOG (Dec. 27, 2017), <https://patentlyo.com/patent/2017/12/contreras-ericsson-decision.html>; Richard Vary, *Supersize this: Unwired Planet American style*, BIRD & BIRD (Dec. 28, 2017), <https://www.twobirds.com/en/news/articles/2017/global/supersize-this-unwired-planet-american-style>.

based on marking down the infringer's profit and apportioning that profit among multiple technologies.⁵¹⁸

The "top-down" approach requires estimating a markdown x of the infringer's profits during the period of infringement, $R = xP$.⁵¹⁹ This avoids calculating reasonable royalty damages as a markdown from the technology adopter's economic benefits B , which requires estimating the incremental contribution of alternative technologies.⁵²⁰ The "top-down" approach is preferable to the "bottom-up" because the incremental contribution of the technology is often difficult or impossible to determine.⁵²¹

The market value method introduced earlier gives an economic implementation of the "top-down" approach.⁵²² Setting aside licensing and legal costs, reasonable royalty damages are equal to the estimated market value of the patent divided by the number of infringers, $R = V/N$. Then, the profit share necessary to realize the same reasonable royalty damages would be equal to the market value of the patent divided by the number of infringers multiplied by one over the infringer's profit, $x = (V/N)(1/P)$. This approach can be applied if the market value per infringer is less than the infringer's profit.

We can compare the "bottom-up" and the "top-down" approaches. The profit share is necessarily greater than the share of benefits because profits are lower than benefits.⁵²³ The share x of the infringer's returns depends on how close a substitute is the best alternative technology.⁵²⁴ The greater is the value of using the best alternative technology and the lower is the royalty on the best alternative technology, the smaller is the plaintiff's share of the defendant's return.⁵²⁵

Suppose for example that the value generated by the best alternative technology net of royalties is 90% of the value generated by using patent owner's invention, $A = 0.90V$. Suppose also that reasonable royalty damages are 70% of the patent infringer's economic benefits. Then, reasonable royalty damages are given by a markdown $x = 7\%$ of the infringer's profit, $R = 0.70(P - A) = 0.70(0.10P) = 0.07P$. To take another example, suppose that the value generated by the best alternative technology net of royalties is 50% of the value generated by using patent owner's invention, $A = 0.50P$. Suppose also that reasonable royalty damages are 50% of the patent infringer's economic benefits. Then, reasonable royalty damages are given by a markdown $x = 25\%$ of the infringer's profit, $R = 0.50(0.50P) = 0.25P$.

518. *TCL Comm'n Tech.*, 2017 WL 6611635, at *8.

519. Leonard & Lopez, *supra*, note 461, 89–91.

520. Spulber, *supra* note 8, at 11.

521. *Id.*

522. *See supra* Section IV.A.

523. Notice that if we view royalties as a share of the infringer's benefits $R = XB = X(P - A)$, and x is the share of the infringer's profit, $R = xP$, then it follows that the share of profits can be written as $x = X(1 - A/P)$.

524. Epstein & Malherbe, *supra* note 4, at 29.

525. *Id.* at 28.

The share x of the infringer's profit depends on a number of factors. First, the share x depends on the characteristics of the patented technology.⁵²⁶ Second, the share x depends on the contribution of the patented technology to the infringer's profit.⁵²⁷ Third, the share x depends on the provisions of the patent license contract.⁵²⁸

The profit share x should depend on evidence rather than an arbitrary profit share. This is reflected in the debate over the well-known "25 percent rule."⁵²⁹ As noted in *Uniloc*:

This court now holds as a matter of Federal Circuit law that the 25 percent rule of thumb is a fundamentally flawed tool for determining a baseline royalty rate in a hypothetical negotiation. Evidence relying on the 25 percent rule of thumb is thus inadmissible under Daubert and the Federal Rules of Evidence, because it fails to tie a reasonable royalty base to the facts of the case at issue.⁵³⁰

Gregory Leonard and Lauren Stiroh observe that the 25 percent rule "takes no account of the importance of the patent to the profits of the product sold, the potential availability of close substitutes or equally noninfringing alternatives, or any of the other idiosyncrasies of the patent at issue that would have affected a real-world negotiation."⁵³¹

The problems encountered with applying the "top-down" rule can be illustrated by *In re Innovatio*.⁵³² The court began with the chipmaker's average profit from the sale of a Wi-Fi chip and calculated a markdown percentage.⁵³³ The markdown percentage was based on an estimate of the profit contribution of SEPs multiplied by the number of Innovatio's 802.11 standard-essential patents divided by the number of a subset of 802.11 standard-essential patents.⁵³⁴

The problem in *In re Innovatio* arises from the estimate of the profit contribution of SEPs.⁵³⁵ According to Leonard and Lopez:

This approach involves first determining the aggregate royalty burden that could be charged for all SEPs. The aggregate royalty burden is then divided among all SEPs, taking into account differences in the relative value of those SEPs. A RAND royalty for a particular set of SEPs is an apportionment of the aggregate royalty burden.⁵³⁶

526. *Id.* at 26.

527. *Id.*

528. *Id.*

529. *Id.* at 11–14.

530. *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1315 (Fed. Cir. 2011) (surveying the academic literature on the 20% profits rule).

531. *See id.* at 1313 (quoting Gregory K. Leonard & Lauren J. Stiroh, *Economic Approaches to Intellectual Property Policy, Litigation, and Management*, 949 PLI/Pat 425, 454–55 (Sept.–Nov. 2008)).

532. *See In re Innovatio IP Ventures, LLC*, No. 11-C-9308, 2013 WL 5593609, at *1, *37–38 (N. D. Ill. Oct. 3, 2013).

533. *Id.* at *38–39.

534. *Id.* at *38.

535. *See id.* at *35–38.

536. Leonard & Lopez, *supra* note 461, at 89.

Based on expert testimony, the court in *In re Innovatio* determined the contribution of SEPs to an infringer's profit based on an estimate of the relative value of patents in the electronics industry.⁵³⁷ The relative value of patents was based on a study using renewal fees by Schankerman who found that 10% of patents generated 84% of value in the electronics industry as compared to other patents.⁵³⁸ The court erroneously interpreted this to imply that the top 10% of patents contributed 84% of an infringer's profits.⁵³⁹ The court then multiplied by the ratio of the number of an infringer's profits to 10% of the relevant number of patents.⁵⁴⁰ This approach presumed that the patents that were infringed made the same contribution to an infringer's profits as the relative values of the top 10% of patent values in the electronics industry.⁵⁴¹

There are a number of economic and legal problems with this approach. Recall that patent values calculated from renewal fees understate the upper tail of the distribution, so the contribution of the highest-value patents is understated.⁵⁴² Even so, the contribution of a particular patent to an infringer's profit is different from the distribution of patent values in an industry.⁵⁴³ For example, an infringer may only use one patent and that patent may be unimportant to the industry but very important to the infringer. Also, the infringement may be very damaging to the patent holder.

In *TCL v. Ericsson*, Judge James V. Selna applied the "top-down method."⁵⁴⁴ The court first determined a total reasonable royalty rate for the relevant SEPs that apply to the technology standard.⁵⁴⁵ Then, the court apportioned the total royalty to the SEP holders, which gave a share of the infringer's profits.⁵⁴⁶ Finally, the court obtained reasonable royalty damages by multiplying the profit share by the infringer's profits.⁵⁴⁷

Judge Selna determined the total reasonable royalties citing a press release before the relevant technology standard was established:

Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens today reached a mutual understanding to introduce licensing arrangements whereby essential patents for W-CDMA are licensed at rates that are proportional to the number of essential patents owned by each company. The intention is to set a benchmark for all patent holders of the W-CDMA technology to achieve fair and reasonable royalty rates.⁵⁴⁸

537. *In re Innovatio*, 2013 WL 5593609, at *43.

538. *Id.* (citing Schankerman, *supra* note 340, at tbl.5 & n.12).

539. *Id.* at *43.

540. *Id.*

541. *See id.*

542. *See supra* Section IV.A.

543. Schankerman, *supra* note 340, at 77.

544. *TCL Comm'n Tech. v. Telefonaktiebolaget LM Ericsson*, No. 15-CV-2370, 2017 WL 6611635, at *1, *18 (C.D. Cal. Dec. 21, 2017).

545. *Id.* at *25–26.

546. *Id.* at *41–48.

547. *Id.*

548. *Id.* at *11.

Judge Selna cited a later announcement by the company: “Ericsson believes the market will drive all players to act in accordance with these principles and to a reasonable maximum aggregate royalty level of 6–8% for handsets.”⁵⁴⁹ Ericsson argued that applying announced royalty rates would be inaccurate because the prices of mobile phones had decreased.⁵⁵⁰ Judge Selna rejected this argument on the grounds that the company’s announcement was not explicitly contingent on any final output price.⁵⁵¹

Next, the court in *TCL v. Ericsson* apportioned the total royalty using the ratio of the number of the patent holder’s SEPs to the number of patents in the standard.⁵⁵² Judge Selna stated, “The Court adopts a simple patent counting system which treats every patent as possessing identical value.”⁵⁵³ The economic value of patents varies considerably, so this calculation may fail to compensate the patent holder for the quality of the IP.⁵⁵⁴ The numerical calculation also ignores the problems associated with declaration of SEPs that may not be essential.⁵⁵⁵

The general problems of the “top-down” approach are compounded by incorrect estimates of the infringer’s profits. For example, in *TCL v. Ericsson*, the court applied an international average royalty rate and then adjusted for regional markets rather than obtaining accurate measures of the infringer’s profits.⁵⁵⁶ Applications of the “top-down” approach that do not fully account for the infringer’s profits are more likely to provide incomplete compensation for the patent holder’s IP.⁵⁵⁷

D. *Resolving Controversies over Reasonable Royalty Damages*

This Section addresses some controversies in the calculation of reasonable royalty damages. The discussion considers the selection of the rate base for applying reasonable royalty damages. Then, the discussion examines policy concerns of royalty stacking, patent holdup and SEPs and shows that these concerns are unfounded and based on an incorrect analytical model that is nearly 200 years old. The discussion also considers problems associated with using bargaining power in examining reasonable royalty damages. Also, the discussion considers how reasonable royalty damages affect incentives for hold-out and infringement.

549. *Id.* at *12.

550. *Id.* at *14.

551. *Id.* (“It is also unclear why the drop in the price of phones matters, because Ericsson’s public statements were never conditioned on a particular dollar-per-unit return.”).

552. *Id.* at *8.

553. *Id.* at *9.

554. *Id.* at *23.

555. *Id.*

556. *Id.* at *10; Vary, *supra* note 517, at 5 (“The top-down exercise starts from the artificial assumption that all handsets, globally, have an aggregate royalty rate which is a set percentage of the selling price.”).

557. J. Gregory Sidak, *Apportionment, FRAND Royalties, and Comparable Licenses After Ericsson v. D-Link*, 2016 U. ILL. L. REV. 1809, 1825.

1. *The Royalty Base*

From an economics perspective, the choice of a royalty base is arbitrary because the problem is to determine the damages caused by infringement.⁵⁵⁸ What matters is the total value of reasonable royalty damages. Reasonable royalty damages then can be recovered as a proportion of any particular royalty base. In practice, however, this has proven to be a contentious issue.⁵⁵⁹

Differences in the royalty base in patent license contracts are due to considerations related to the effect on incentives for the investment and sales for the licensee.⁵⁶⁰ Also, the division of royalties between lump-sum and running royalties depends on market structure in the final product markets as already noted.⁵⁶¹ The royalty base in practice also depends on what types of sales and profit information can be monitored and verified by the licensor.⁵⁶²

In *Ericsson*, the U.S. Court of Appeals for the Federal Circuit found that “[w]hat is taken from the owner of a utility patent (for purposes of assessing damages under § 284) is only the patented technology, and so the value to be measured is only the value of the infringing features of an accused product.”⁵⁶³ The Court of Appeals implicitly recognized the arbitrary nature of the royalty base in its instructions for experts:

Logically, an economist could do this in various ways—by careful selection of the royalty base to reflect the value added by the patented feature, where that differentiation is possible; by adjustment of the royalty rate so as to discount the value of a product’s nonpatented features; or by a combination thereof. The essential requirement is that the ultimate reasonable royalty award must be based on the incremental value that the patented invention adds to the end product.⁵⁶⁴

The “market value method” or comparable license contracts provide indicators of the effects of infringement as noted earlier.⁵⁶⁵ These values can be assigned to various royalty bases.

The Entire Market Value Rule (“EMVR”) limits the use of the market value of final products in valuing the contribution of patented inventions.⁵⁶⁶ The typical argument against royalties using final product prices incorrectly maintains that

558. Cotter, *supra* note 168, at 733.

559. See, e.g., *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1339 (Fed. Cir. 2009) (“There is nothing inherently wrong with using the market value of the entire product, especially when there is no established market value for the infringing component or feature, so long as the multiplier accounts for the proportion of the base represented by the infringing component or feature.”).

560. J. Gregory Sidak, *The Proper Royalty Base for Patent Damages*, 10 J.L. & ECON. 989, 990 (2014) (“Royalty compensation for patent infringement must reward the patent holder not only for the individual value of its patented technology, but also for a share of the value arising from complementarity and network effects. Only patent damages that meet this requirement are likely to maintain optimal incentives for investment in innovation.”).

561. Varner, *supra* note 421, at 230.

562. *Id.*

563. *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1226 (Fed. Cir. 2014).

564. *Id.* at 1233.

565. See *supra* Section IV.A.

566. Yang, *supra* note 4, at 654.

this approach does not identify the contribution of an invention.⁵⁶⁷ For example, Brian Love argues that using market value “systematically overcompensates patentees who own patents covering only one component of a larger, complex device. As a result, the doctrine has become a means for patentees to capture value that they did not create, at the expense of innovative infringers, other patentees, and society at large.”⁵⁶⁸

For many comparable contracts, however, including patent pools, royalties are based on final product sales.⁵⁶⁹ This generally is an indication that downstream markets are competitive.⁵⁷⁰ Also, basing royalties on final product sales is convenient and tends to reduce transaction costs. It generally is feasible to monitor product sales, which provides a measure of the use of the patented invention.

In *VirnetX*, the U.S. Court of Appeals for the Federal Circuit pointed out that “[n]o matter what the form of the royalty, a patentee must take care to seek only those damages attributable to the infringing features.”⁵⁷¹ The principle of attributable damages can be traced to the Supreme Court case *Garretson v. Clark* in 1884.⁵⁷² In *VirnetX*, for example, the Appeals Court stated:

Indeed, the Supreme Court long ago observed that a patentee must in every case give evidence tending to separate or apportion the defendant’s profits and the patentee’s damages between the patented feature and the unpatented features, and such evidence must be reliable and tangible, and not conjectural or speculative; or he must show, by equally reliable and satisfactory evidence, that the profits and damages are to be calculated on the whole machine, for the reason that the entire value of the whole machine, as a marketable article, is properly and legally attributable to the patented feature.⁵⁷³

The notion that royalties should be based on the Smallest Salable Patent-Practicing Unit (“SSPPU”) arose in *Cornell University*.⁵⁷⁴ Judge Rador compared the relative sizes of the components of the final product:

[T]he claimed invention is a small part of the IRB [instruction reorder buffer], which is a part of a processor, which is part of a CPU [central processing unit] module, which is part of a “brick,” which is itself only part of the larger server. For some general context, this server is larger than even

567. *Id.* at 655.

568. Brian J. Love, *Patentee Overcompensation and the Entire Market Value Rule*, 60 STAN. L. REV. 263, 293 (2007).

569. Erik Hovenkamp & Herbert Hovenkamp, *Patent Pools and Related Technology Sharing* 1, 2 (Apr. 10, 2017) (unpublished manuscript), http://scholarship.law.upenn.edu/faculty_scholarship/1766.

570. See Pincus, *supra* note 11, at 98 (“If in all reasonable probability, the Patent Owner would have made the sales, which the Infringer had made, what the Patent Owner in reasonable probability would have netted from the sales denied to him is the measure of his loss, and the Infringer is liable for that.”) (quoting *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1065 (Fed. Cir. 1983)).

571. *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1326 (Fed. Cir. 2014).

572. *Garretson v. Clark*, 111 U.S. 120, 121 (1884).

573. *VirnetX*, 767 F.3d at 1326.

574. *Cornell Univ. v. Hewlett-Packard Co.*, 609 F. Supp. 2d 279, 283 (N.D.N.Y. 2009); see also *LaserDynamics, Inc. v. Quanta Comput., Inc.*, 694 F.3d 51, 67 (Fed. Cir. 2012).

very large home refrigerator units; the CPU “brick” is longer and thinner than the ordinary masonry brick; the IRB is a thin wafer device approximately two inches wide and three inches long.⁵⁷⁵

Of course the physical size of a product or a component has little if anything to do with the market value of that product or component. The market value of a patented invention and its contribution to the market value of final product generally cannot be inferred from physical descriptions of components.

According to the *Cornell University* decision, “the processor is the smallest salable patent-practicing unit.”⁵⁷⁶ The court in *Cornell University* benefits from the fact that the technology adopter Hewlett-Packard did sell some processors a la carte although it primarily sold servers and workstations.⁵⁷⁷ If there is a well-established market for a component containing the patented invention, then the market price of the component is useful for determining the value of the patented invention.

The modularity of the final product, however, should not be used as a mechanism for arbitrarily reducing reasonable royalty damages. The existence of components containing the invention without a well-established market for the components would not provide an accurate basis for estimating damages from infringement.⁵⁷⁸ The result would provide inadequate compensation for patent holders. Reducing damages from infringement based on modularity would create significant inefficiencies if it were to discourage modularity in product design.⁵⁷⁹ Modularity is an important source of market value because it allows specialization and division of labor in the production of parts and components.⁵⁸⁰

The royalty base should not be used to increase or decrease reasonable royalty damages. The royalty base is useful in deriving the corresponding level of total royalties in comparable license contracts. The royalty base, however, need not provide information about damages caused by infringement.

2. *Royalty Stacking, SEP Hold-up and the Cournot Effect*

The contract approach has important implications for reasonable royalty damages when there are multiple inventions. The problem of multiple inventions has generated antitrust policy concerns about the determination of royalties in

575. *Cornell Univ.*, 609 F. Supp. 2d at 283 (“Hewlett-Packard’s primary business did not include a la carte processor sales.”).

576. *Id.*

577. *Id.* (“Hewlett-Packard’s primary business did not include a la carte processor sales.”).

578. See Eric C. Surette, *Construction and Application of “Entire Market Value” Rule in Patent Infringement Actions*, 21 A.L.R. Fed. 3d Art. 4 (2017) (“To assess how much value each patented and nonpatented component individually contributes to the overall end product . . . can be an exceedingly difficult and error-prone task.”).

579. Ro et al., *Modularity as a Strategy for Supply Chain Coordination: The Case of U.S. Auto*, 54 IEEE TRANSACTIONS ON ENGINEERING MGMT. 172, 179 (2007).

580. *Id.*

patent license contracts.⁵⁸¹ Decisions in various patent cases reflect these concerns.⁵⁸² These concerns are based on a fundamental misconception about royalties. Negotiation of patent license contracts should eliminate concerns about royalties with multiple inventions.

These public policy concerns include royalty stacking, patent thickets, patent hold-up, the tragedy of the anti-commons, and SEPs. Although these public policy concerns appear to be very different, they have a common source in economic theory. That source is the Cournot complementary monopolies model, which predicts that multiple input monopolists will set input prices above what a monopolist would choose for a bundle of those inputs.⁵⁸³ This is a familiar theoretical prediction in economics known as the “Cournot Effect.”⁵⁸⁴

Elsewhere, I show that the “Cournot Effect” is based on the assumption that complementary input monopolists choose “posted prices.”⁵⁸⁵ This means that the input monopolists announce prices that they will charge to downstream producers.⁵⁸⁶ This conduct generates a “free rider problem” because each of the input monopolists fails to recognize the negative influence that raising their price has on the profits of the other input monopolists.⁵⁸⁷ The result is that total input prices are greater than what a bundled monopoly would offer to downstream producers.

The “Cournot Effect,” however, does not apply to patent license agreements because these are contracts that are negotiated by the licensor and the licensee.⁵⁸⁸ Negotiation between licensors and licensees rules out the “Cournot Effect.” As a result of negotiation, patent holders obtain shares in the profits of downstream producers.⁵⁸⁹ When patent holders choose the number of license contracts to offer producers, they recognize the effects of their offers on the profits of a producer and they have incentives to avoid raising royalties excessively.⁵⁹⁰ This eliminates the “free rider problem” and results in total royalties that do not exceed the bundled monopoly royalty.

This suggests that the courts should not be concerned about royalty stacking in practice because patent license contracts tend to be negotiated. Royalties determined in the marketplace through negotiation should not generate concerns about excessive royalties. The courts, however, still should verify that the court’s own apportionment of royalties is not excessive. Judge Robart in *Microsoft v. Motorola* expressed concern about royalty stacking:

Thus, the fee that results from a hypothetical RAND negotiation is necessarily informed by the court considering the entire world of known SEPs

581. Spulber, *supra* note 124, at 310.

582. *Id.* at 302.

583. See generally Daniel F. Spulber, *Complementary Monopolies and Bargaining*, 60 J.L. & ECON. 29 (2017).

584. *Id.*

585. See Spulber, *supra* note 77, at 706; see also Spulber, *supra* note 583, at 57.

586. Spulber, *supra* note 583, at 41.

587. *Id.* at 30.

588. Spulber, *supra* note 77, at 693.

589. *Id.* at 694.

590. *Id.* at 704.

relevant to a given standard. That ultimate sum must be the aggregate licensing fee of all essential patents calibrated against the principle that license fees should not be stacked in such a way that makes implementation of the standard prohibitively expensive.⁵⁹¹

Judge Robart used patent pool licenses as comparable license contracts.⁵⁹² To address RAND royalty issues, Judge Robart determined the upper bound for royalties for Motorola's H.264 SEP portfolio based on "the highest fee discussed during formation of the MPEG LA EL264 patent pool."⁵⁹³ The court further concluded that "the value to Motorola . . . would be not only royalties received, but also access to the intellectual property, which equals an amount of twice the royalties received."⁵⁹⁴ Judge Robart also found that despite its shortcomings, the Via Licensing 802.11 pool was an "indicator of a RAND royalty rate for Motorola's 802.11 SEP portfolio."⁵⁹⁵ He noted that "royalties in the Via Licensing 802.11 pool are shared among licensors according to a Worldwide Revenue Sharing Algorithm. The algorithm divides revenue between licensors based on the relative number of patents each has contributed, adjusted by a country-weight factor."⁵⁹⁶

Judge Selna argued in *TCL v. Ericsson* that royalties for SEPs should be those established before the adoption of the technology standard.⁵⁹⁷ He suggested that statements made by SEP owners before standards were established were designed "to induce people to adopt and invest in each standard when the risk of hold-up was low," thus "providing the SEP owners with incentive to be reasonable with their overall expectations and greatly reducing the risk of hold-up and royalty stacking."⁵⁹⁸

Policy concerns about hold-up and royalty stacking are founded on incorrect economic analyses of the market for patent licenses.⁵⁹⁹ Recognizing economic incentives and market institutions eliminates the "Cournot Effect." This removes justifications for relying on patent license royalties chosen before technology standards are established. Patent license royalties for SEPs should be increased to reflect the establishment of the relevant technology standards. Courts determining reasonable royalty damages for infringement should use royalty rates that reflect the market value of SEPs and the damages to patent holders.

591. *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, 2013 WL 2111217, at *1, *86 (W.D. Wash. Apr. 25, 2013).

592. *Id.* at 74.

593. *Id.* at 87.

594. *Id.*

595. *Id.* at 89.

596. *Id.* at 88.

597. *TCL Commc'n Tech. v. Telefonaktiebolaget LM Ericsson*, No. 15-CV-2370, 2017 WL 6611635, at *24 (C.D. Cal. Dec. 21, 2017).

598. *Id.* at 14.

599. Spulber, *supra* note 77, at 704.

3. *Relative Bargaining Power and Reasonable Royalty Damages*

It often is suggested that the relative bargaining power of the parties determines royalties.⁶⁰⁰ This runs the risk of circular reasoning; relative bargaining power determines the division of surplus and the division of the surplus indicates relative bargaining power. The two methods of calculating reasonable royalty damages, comparable license contracts and the market value method, avoid having to speculate on bargaining power.

It is helpful to understand bargaining power in the context of contract negotiation. One view is that bargaining power reflects the costs of not reaching an agreement.⁶⁰¹ The opportunity costs of the two parties summarize the costs of not reaching an agreement.⁶⁰² So, opportunity costs narrow the range of possible royalty payments. This does not explain fully, however, how to divide the economic value of the contract, which already reflects opportunity costs. As already noted, the opportunity costs of the infringer often are difficult if not impossible to observe.⁶⁰³ Also, if the patent holder's opportunity costs were observable, they would be used as the basis for estimating reasonable royalty damages rather than the infringer's profit.

Some commentators advocate using basic economic models of bargaining to obtain royalties for the forgone licensing contract.⁶⁰⁴ For example, Choi and Weinstein suggest using the Nash bargaining solution to calculate reasonable royalty damages.⁶⁰⁵ The Nash bargaining solution is an even split of the surplus from the contract that is derived based on a set of desirable characteristics of a bargaining solution.⁶⁰⁶ Then, royalties evenly divide the net benefits from exchange.⁶⁰⁷ It follows that royalties are given by the average of economic benefits of the licensee and economic costs of the licensor, $R = (B + C)/2$.⁶⁰⁸

600. *Id.* at 711.

601. NEIL W. CHAMBERLAIN & JAMES W. KUHN, COLLECTIVE BARGAINING 170 (2d ed. 1965); see also Jan Svejnar, *Bargaining Power, Fear of Disagreement, and Wage Settlements: Theory and Evidence from US Industry*, 54 *ECONOMETRICA* 1055, 1057 (1986).

602. Svejnar, *supra* note 601, at 1057.

603. See *supra* Part IV.

604. For discussions on using the Nash Bargaining Solution to calculate reasonable royalties, see Doug Kidder & Vince O'Brien, *The Nash Bargaining Solution*, 49 *LES NOUVELLES* 1, 1 (2014); Thomas Varner, *Nash Bargaining May Not Be Right for Patent Damages*, *LAW360* (April 18, 2014, 9:37 PM), <https://www.law360.com/articles/529437/nash-bargaining-may-not-be-right-for-patent-damages>; see also F. Russell Denton & Paul J. Heald, *Random Walks, Non-Cooperative Games, and the Complex Mathematics of Patent Pricing*, 55 *RUTGERS L. REV.* 1175, 1234–40 (2003).

605. William Choi & Roy Weinstein, *An Analytical Solution to Reasonable Royalty Rate Calculations*, 41 *J.L. & TECH.* 49, 51 (2001).

606. See Ken Binmore & Partha Dasgupta, *Nash Bargaining Theory I*, in *THE ECONOMICS OF BARGAINING* 27 (Ken Binmore & Partha Dasgupta, eds. 1987); ALVIN E. ROTH, *AXIOMATIC MODELS OF BARGAINING* 8 (1979); Binmore, *Nash Bargaining Theory I-III*, *supra* note 60; Ken Binmore et al., *The Nash Bargaining Solution in Economic Modelling*, 17 *RAND J. ECON.* 176, 176–88 (1986); John C. Harsanyi & Reinhard Selten, *A Generalized Nash Solution for Two-Person Bargaining Games with Incomplete Information*, 18 *MGMT. SCI.* 80, 80–106 (1972); John F. Nash, Jr., *The Bargaining Problem*, 18 *ECONOMETRICA* 155, 155 (1950); John F. Nash Jr., *Two-Person Cooperative Games*, 21 *ECONOMETRICA* 128, 129 (1953).

607. Choi & Weinstein, *supra* note 605, at 52.

608. This follows from $B - R = R - C = (B - C)/2$.

In *VirnetX*, however, the U.S. Court of Appeals for the Federal Circuit criticizes applications of the Nash bargaining solution that are not tied to evidence.⁶⁰⁹ The court stated, “the invocation of a 50/50 starting point based on the Nash Bargaining Solution is akin to the ‘25 percent rule of thumb’ that we rejected in *Uniloc* as being insufficiently grounded in the specific facts of the case.”⁶¹⁰ This model was rejected under the *Daubert* standard.⁶¹¹ Thus, it is not possible to use arbitrary bargaining solutions to specify reasonable royalty damages.

A related approach would be to include the transaction costs of bargaining, either in terms of the costs of making offers or the time involved in making offers because the parties discount the future returns to reaching an agreement. This also generates a particular division of the economic value of the contract that depends on the costs of negotiation.⁶¹² If the parties engage in alternative offers bargaining, the outcome depends on which party makes the first offer.⁶¹³ The division of the surplus occurs because the parties seek to avoid the costs of making additional offers. The party making the first offer can obtain a larger share of the surplus by making an offer such that the other party is indifferent between accepting that offer and continuing to bargain, which leads to a bargaining equilibrium in which just one offer is made. Again, in the context of determining damages, it is generally necessary to examine whether such a negotiation would apply to the facts of the case.

V. CONCLUSION

The contract approach to reasonable royalty damages presented here is firmly grounded in economic analysis. Improving the economic analysis and factual basis for reasonable royalty damages enhances efficiency in the enforcement of IP rights. This should improve incentives for invention and innovation. Better enforcement of IP rights should also improve incentives for patent holders and technology adopters to engage in efficient negotiation.

I argued that the patent case already constructs an “informed contract”. The provisions of the “informed contract” depend on the evidence presented in the patent case regarding the actions of the patent holder and the infringer. The “informed contract” also takes into account information revealed since infringement began. For example, the “informed contract” takes into account increases in the value of patents that are found to be valid and infringed.

The “informed contract” thus provides an evidence-based approach to finding reasonable royalty damages. The “informed contract” should replace the pop-

609. *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1332 (Fed. Cir. 2014).

610. *Id.* at 1331.

611. *Id.* at 1332.

612. Ariel Rubinstein, *Perfect Equilibrium in a Bargaining Model*, 50 *ECONOMETRICA* 97, 97 (1982).

613. *Id.* at 102.

ular but problematic “hypothetical negotiation” approach. The “informed contract” approach avoids the “willing licensor and licensee” Ghosts of Christmas Past that Judge Markey cautioned against in *Panduit*.⁶¹⁴

The proposed contract approach suggests two primary options for determining reasonable royalty damages depending on the nature of the evidence. The court should apply the “market value method” introduced here if there is insufficient evidence about comparable license contracts. The “market value method” assigns shares to each infringer of the market price of the patent plus licensing and legal costs. Alternatively, the court should determine royalties by considering comparable license contracts with adjustments based on the provisions of the “informed contract.” Both of these approaches are based on market prices and reflect the economic value of the “informed contract.” The court should add price premia to the market value of patents or to comparable royalties if the patent is found to be valid and infringed and if the patent is an SEP.

The analysis identified problems with the alternative “top-down” and “bottom-up” methods that are based on the profit shares of the infringer. These approaches are problematic if they involve ad hoc calculations of profit shares that are not based on market prices. When patents are SEPs, these calculations are subject to additional inaccuracies because they are sensitive to declarations of essentiality and incomplete evaluations of technology standards.

The contract approach addresses the debate over whether to apply property and liability rules to patent infringement. The contract approach is consistent with injunctive relief and provides additional information about reasonable royalty damages. The contract approach adjusts reasonable royalty damages based on the provisions of the “informed contract” and compensates the patent holder for infringement. The contract approach addresses issues related to SEPs and FRAND commitments by accounting for their effects on the market value of patents and the provisions of comparable license contracts. The contract approach to finding reasonable royalty damages helps resolve the patent law controversy.

614. *Panduit Corp. v. Stahlin Bros. Fibre Works, Inc.* 575 F.2d 1152, 1159 (6th Cir. 1978).