Innovation Factors for Reasonable Royalties

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Table of Contents

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Abstract. Patentees who are successful in litigation are entitled to no less than a "reasonable royalty" for the infringing use of the patent. Currently, reasonable royalties are assessed by the fact-finder using the cumbersome, difficult-to-apply fifteen-factor *Georgia Pacific* test. The *Georgia Pacific* test has been widely and roundly criticized, and there is general agreement that it too often hinders patent law's central goal: promoting technological innovation. To improve the reasonable royalty analysis, this article proposes adding innovation-centric factors to the *Georgia Pacific* test, including the total amount spent on research and development (R & D) and commercialization of the invention, taking into account opportunity costs and project-specific risk. Additionally, the article suggests emphasizing a slightly modified version of one existing innovation-centric, *Georgia Pacific* factor: the technological benefits offered by the invention when compared to alternative approaches. Like the "objective" factors used to make determinations of whether a patent is obvious, these innovation factors will help fact-finders to make more accurate and more consistent reasonable royalty determinations while more ably advancing patent law's goal of spurring innovation.

I. Introduction

In the 19th century, patent damages were far less complex.[1] In general, a patentee winning at suit was required to introduce evidence either showing lost profits due to forgone sales or a previously established royalty for the patent-in-suit; otherwise, the patentee would be subject to nominal damages.[2] In the early 20th century, via a series of judicial decisions and congressional amendments, patentees became entitled to no less than a "reasonable royalty," regardless of evidence of lost profits or established royalty rates.[3] Because so-called "non-practicing entities" (NPEs) cannot by definition show lost profits, they are required to seek such reasonable royalty damages.[4] The rapidly growing number of NPE suits—coupled with stringent standards for showing lost profits—has led reasonable royalty determinations to substantially overtake lost profits as the dominant form of patent damages. Over the past twenty-five years, reasonable royalty awards have grown from less than half of all awards to over eighty percent of awards.[5]

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1 *See infra* Part II.A. For a thorough treatment of the history of reasonable royalty awards in patent actions, see Michael Risch, *(Un)Reasonable Royalties* 5–21 (Villanova Sch. of Law Pub. Law & Legal Theory, Working Paper No. 2016-1036, 2016).

2 *See* Risch, *supra* note 1, at 7.

3 *See id*. at 17–21.

4 *See id*. at 2–3.

5 ARON LEVKO ET AL., PRICEWATERHOUSECOOPERS, A CLOSER LOOK—2008 PATENT LITIGATION STUDY: DAMAGES, AWARDS, SUCCESS RATES AND TIME-TO-TRIAL 7 (2008), https://www.pwc.com/us/en/forensic-services/assets/2008_patent_litigation_study.pdf (showing a rise in reasonable royalty cases from 45% in the 1990s to 56% in the 2000s); CHRIS BARRY ET AL., PRICEWATERHOUSECOOPERS, 2015 PATENT LITIGATION STUDY 8 (2015),

In contrast to the rapidly changing rate of reasonable royalty determinations, the dominant approach for determining royalties—the fifteen-factor *Georgia-Pacific* test—is nearly fifty years old and has undergone little essential change over the years.[6] Such inertia is not the result of *Georgia-Pacific* being without substantial flaws. Rather, numerous commentators, policymakers, and stakeholders have roundly criticized the test on numerous grounds.[7] Concerns range from substantial uncertainty in application of the test, over-compensation, under-compensation, circularity, inconsistency, and the creation of perverse incentives leading to abusive negotiation and litigation tactics.[8]

The problems with reasonable royalty determinations have become so prominent that Congress and President Obama have made a concerted effort to propose and implement reforms.[9] Unfortunately, these efforts have not resulted in sensible policy recommendations. For example, President Obama's Council of Economic Advisers, National Economic Council, and Office of Science and Technology Policy released a joint report concluding that "the best approach . . . is . . . to reduce the extent to which legal rules allow patent owners to capture a disproportionate share of returns to investment."[10] As this article explains below, although excessive awards are certainly a problem, so are insufficient awards.[11] Similarly unsatisfactory proposals have emanated from Congress, as well as the courts, mainly because these governmental entities have lacked a coherent theory regarding reasonable royalty damages.[12]

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http://www.pwc.com/us/en/forensic-services/publications/assets/2015-pwc-patent-litigation-study.pdf (showing that courts employed a reasonable royalty methodology in 81% of all cases in which the plaintiff was victorious and the court awarded damages).

6 *See* George W. Jordan III & James D. Woods, *The Economics of Reasonable Royalty Damages in Patent Litigation*, 2 LANDSLIDE 29, 29 (2010) (stating that "courts have, for 40 years, applied the flexible framework of the 15 *Georgia-Pacific* factors in order to determine a 'reasonable royalty'"); David O. Taylor, *Using Reasonable Royalties to Value Patented Technology*, 49 GA. L. REV. 79, 83–84 (2014) (stating that "all three branches of the federal government have studied ways to improve the law governing reasonable royalties" but "[d]espite all of this concern, debate, and study, the federal government, to date, has not implemented any major reform of the law governing reasonable royalties.").

7 *See infra* Part II.B.

8 *See id.*

9 *See* Patent Reform Act of 2007, H.R. 1908, 110th Cong. § 5(b)(1) (2007) (proposing that the "court shall identify the factors that are relevant to the determination of a reasonable royalty . . . [and] shall consider only those factors in making the determination"); Patent Reform Act of 2009, S. 610, 111th Cong. § 4(a) (2009) (proposing codification of the meaning of reasonable royalty as "the amount that the infringer would have agreed to pay and the claimant would have agreed to accept if the infringer and claimant had voluntarily negotiated a license for use of the invention at the time just prior to when the infringement began"); Taylor, *supra* note 6, at 83–84 (stating that "President Obama expanded a program designed to bring academic experts to the Patent and Trademark Office (USPTO) to conduct research, and the USPTO subsequently called for proposals addressing" improvements to the calculation of damages in patent cases).

10 PRESIDENT'S COUNCIL OF ECON. ADVISORS ET AL., EXEC. OFFICE OF THE PRESIDENT, PATENT ASSERTION AND U.S. INNOVATION 13 (2013).

11 *See infra* Part II.B.

12 Roger D. Blair & Thomas F. Cotter, *Rethinking Patent Damages*, 10 TEX. INTELL. PROP. L.J. 1, 2

As the saying goes, "it takes a theory to beat theory."[13] Fortunately, academics have made notable inroads on this front.[14] In this regard, there have been two promising ideas. One line argues that reasonable royalty amounts should focus on the *Georgia-Pacific* factor that examines the economic value of the patented invention relative to the next best technological alternative, rather than an amorphous set of remaining factors.[15] Another line of argument, including some of my own work, is similar in nature to the first line of argument but goes much further.[16] These scholars contend that we should ultimately discard the *Georgia-Pacific* test in favor of one that more directly calibrates damages with patent law's main goal—namely, promoting optimal levels of innovation.[17] As I explain, however, neither argument describes in sufficient detail how to operationalize these ideas in any wide-scale and feasible fashion.[18]

In this article, I propose additional "innovation" factors to the *Georgia-Pacific* test that, with sufficient judicial development, have the potential to operationalize these aims.[19] Rather than focusing on the incremental value to end-users or the incremental cost to the accused infringer of using the patented invention, these innovation factors concern the cost to *the patentee* of research, development, and commercialization of the invention, along with determining a sufficient return on these costs.[20] Because the point of patent law is to generate an appropriate return on in-

(2001) ("[T]he rules courts have developed for estimating patent damages have been . . . both complex and contradictory."); Amy L. Landers, *Let the Games Begin: Incentives to Innovation in the New Economy of Intellectual Property Law*, 46 SANTA CLARA L. REV. 307, 311 (2006) ("[T]he proposed Patent Act of 2005 . . . fails to resolve the central problem with the unworkable methods used by courts to calculate reasonable royalty damages."); Mark A. Lemley, *Distinguishing Lost Profits from Reasonable Royalties*, 51 WM. & MARY L. REV. 655, 668 (2009) ("[T]he House of Representatives is currently attempting to solve one of the problems [the author has] identified . . . while cementing into the statute an equally serious problem—the misapplication of the entire market value in rule in reasonable royalty cases.").

13 *See, e.g.*, Richard A. Epstein, *Common Law, Labor Law, and Reality: A Rejoinder to Professors Getman and Kohler*, 92 YALE L.J. 1435, 1435 (1983) (using the axiom to expose flaws in the arguments of the article's critics). For a summary of the axiom, its applications, and its variations, see Lawrence Solum, *Legal Theory Lexicon: It Takes a Theory to Beat a Theory*, LEGAL THEORY LEXICON: LEGAL THEORY BLOG (Oct. 21, 2012, 9:40 AM), http://lsolum.typepad.com/legaltheory/2012/10/introduction-it-takes-a-theory-to-beat-a-theory-this-is-surely-one-of-the-top-ten-all-time-comments-uttered-by-law-professo.html.

14 *See infra* Part II.B.

15 *See infra* Part III.

16 *See id.*

17 *See id.*

18 *See id.*

19 *See infra* Part IV.

20 *See id.* I described such an approach in basic terms in 2014. *See* Ted Sichelman, *Purging Patent Law of "Private Law" Remedies*, 92 TEX. L. REV. 517 (2014) [hereinafter, Sichelman, *Purging Patent Law*]. More recently, Hannah Brennan, Amy Kapczynski, Christine H. Monahan, and Zain Rizvi suggested a similar approach in the context of the appropriation of patented pharmaceuticals by the government under 28 U.S.C. § 1498, but they did not propose extending their approach to damages more generally. *See* Hannah Brennan, Amy Kapczynski, Christine H. Monahan & Zain Rizvi, *A Prescription for Excessive Drug Pricing: Leveraging Government Patent Use for Health*, 18 YALE J.L. & TECH. 275, 283 (2016) ("If appropriate evidence is supplied by the patentee, courts

vestment so as to incentivize innovation, using these costs to assess reasonable royalties best aligns with the aim of patent law.[21] In more general terms, such an approach suggests that reliance damages—the recovery of costs, including opportunity costs—rather than expectation damages—the full benefit of the patent bargain—would better promote the delicate balance of incentives patent law must construct.[22]

Such an approach is not without its difficulties, including the addition of costly accounting experts to patent cases, incentives for patentees to fabricate costs, and difficulties in apportioning costs of inventions that may merely be components or by-products of larger research efforts.[23] Moreover, determining opportunity costs as well as patent-specific commercialization costs could be daunting.[24] For this reason—as well as what I perceive as statutory limitations—I suggest that the innovation factors be used in the short-term as additional factors that assist in providing objective evidence to ground the determination of a reasonable royalty under the usual approach of *Georgia-Pacific*, which attempts to reconstruct the royalty rate the parties would have bargained for in the private market prior to any infringing activity.[25] As courts, juries, and parties become more accustomed to these innovation factors—diminishing difficulties in implementation—I propose a more sweeping use of the innovation factors.[26] In this vision, the hypothetical negotiation would generally be discarded in favor of a true "reliance damages" approach that focused on adequately compensating the patentee for its R & D and commercialization efforts.[27]

Part II of this Article briefly describes the *Georgia-Pacific* test by which reasonable royalties are determined today and why this test is fraught with uncertainty and circularity. It briefly recounts why existing proposals are insufficient to correct these defects. Part III explains why the attempt of patent damages to "remedy a personal wrong" and restore the *status quo ante* is not ideal for optimally incentivizing innovative activity, such as technological invention and commercialization. Part IV suggests that adding innovation factors to the existing reasonable royalty framework will increase predictability and coherence, as well as provide remedies more aligned with the central aim of the patent system. Part IV also briefly considers whether the existing Patent Act would need to be amended to add such factors, suggesting that it would, and proposes a short-term and long-term approach to using the innovation factors.

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would then adjust this compensation award upwards to account for the patentee's risk-adjusted R&D costs and to ensure a reasonable profit.").

21 *See infra* Part IV.

22 *See id.*

23 *See infra* Part IV.B.

24 *See id.*

25 *See id.*

26 *See id.*

27 *See id.*

II. The *Georgia-Pacific* Test and its Discontents

As noted earlier, the fifteen-factor *Georgia-Pacific* test—and its attempt to recreate what the infringer would have paid the patentee if both had been a willing licensor and licensee—has been roundly criticized by academics and practitioners as difficult to apply and unpredictable, inaccurate, and ultimately circular.[28] This Part first provides a concise review of the *Georgia-Pacific* test, followed by a summary of common criticisms of the test.[29] It concludes by briefly explaining why none of the existing proposed remedies is sufficient to cure the test's defects.[30]

A. A Concise Review of the Georgia-Pacific Test

A prevailing party in a patent infringement action is entitled to recover either lost profits (for patent owners who would have made sales absent the infringement) or reasonable royalties (as a default remedy) for past infringement.[31] Courts have adopted a strict standard to prove lost profits, and given that a large percentage of plaintiffs are non-practicing entities (NPEs), most successful patentees must resort to reasonable royalties in order to be compensated.[32]

The standard test for reasonable royalty determinations derives from a 1970s district court case, *Georgia-Pacific Corp. v. U.S. Plywood Corp.*[33] The fifteen-factor *Georgia-Pacific* test attempts to create a "hypothetical negotiation" between the parties for a license that would have occurred prior to the infringement.[34] As the Federal Circuit has stated, "In other words, if infringement had not occurred, willing parties would have executed a license agreement specifying a certain royalty payment scheme."[35]

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28 *See infra* Part II.B.

29 *See infra* Part II.A.

30 *See infra* Part II.B.4.

31 *See* Panduit Corp. v. Stahlin Bros. Fibre Works, Inc., 575 F.2d 1152, 1157 (6th Cir. 1978) ("When actual damages, e.g., lost profits, cannot be proved, the patent owner is entitled to a reasonable royalty."); 35 U.S.C. § 284 (2006) (mandating "damages adequate to compensate for the infringement, but in no event less than a reasonable royalty").

32 *See* Lemley, *supra* note 12, at 655. As noted earlier, recent data shows more than 80% of all damage awards are now reasonable royalties. *See supra* note 5.

33 Georgia-Pac. Corp. v. U.S. Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *modified sub nom.* Georgia-Pac. Corp. v. U.S. Plywood-Champion Papers, Inc., 446 F.2d 295 (2d Cir. 1971).

34 *See* Christopher B. Seaman, *Reconsidering the* Georgia-Pacific *Standard for Reasonable Royalty Patent Damages*, 2010 BYU L. REV. 1661, 1677 (2010) (stating that the "hypothetical negotiation" attempts to determine the royalty the parties would have agreed upon had they reached a licensing agreement prior to the infringement).

35 Lucent Techs., Inc., v. Gateway, Inc., 580 F.3d 1301, 1325 (Fed. Cir. 2009). To be certain, there is also a so-called analytical test to determining reasonable royalties, which uses a profit-sharing approach to calculate reasonable royalties. *See, e.g.*, TWM Mfg. Co. v. Dura Corp., 789 F.2d 895, 899–900 (Fed. Cir. 1986). However, such an approach has been little used, so I ignore it in the remaining discussion. *See* Seaman, *supra* note 34, at 1677 n.83.

Of the fifteen factors, two are not factors per se, but rather guides on how to structure the overall determination.[36] Specifically, factor fifteen specifies that reasonable royalty determinations attempt to award the amount that the parties would have reached in a hypothetical negotiation,[37] and factor fourteen allows expert opinion evidence to come to that determination.[38]

The remaining thirteen factors specify the types of specific evidence that may be helpful in coming to a determination of the rate that would have been agreed upon in a hypothetical negotiation.[39] Importantly, courts have not treated these factors as exhaustive.[40] The thirteen factors fall roughly into four categories, which are briefly explained in turn.[41]

The first category concerns "whether the patentee [or its exclusive licensee] in fact produces a product in the market."[42] As noted, patentees who sell goods or services and are in direct competition with the infringer may be entitled to lost-profit damages.[43] However, because proving lost profits can be difficult, these practicing patentees are often left with reasonable royalties.[44] The reasonable royalty determination nonetheless must then assume that these patentees would be forced to license their invention to any comer, and the assumption—which has been contested by some scholars—is that these patentees license at higher royalty rates than non-

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36 *See* Daralyn J. Durie & Mark A. Lemley, *A Structured Approach to Calculating Reasonable Royalties*, 14 LEWIS & CLARK L. REV. 627, 643 (2010) (stating that factors fourteen and fifteen "are not really factors to be weighed at all" because "[e]xpert testimony is a source of evidence, one that is likely to predominate in all of the other factors . . . [and] [f]actor fifteen . . . represents the ultimate question all of the other factors are trying to establish.").

37 *Georgia-Pac. Corp.*, 318 F. Supp. at 1120 ("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.").

38 *Georgia-Pac. Corp.*, 318 F. Supp. at 1120 ("14. The opinion testimony of qualified experts.").

39 *See* Seaman, *supra* note 34, at 1683–85 (stating that factor one "relate[s] to a so-called established royalty" while "[f]actors 2 through 13 address[] a wide variety of considerations at issue in the case, including the relationship of the licensing parties; the type of license they likely would agree upon; comparable licenses made by the licensee and in the relevant industry more generally; the nature, benefits, extent of use, and alternatives to the patented technology; and the value of features unrelated to the patent"); Durie & Lemley, *supra* note 36, at 636–44 (proposing that only the first thirteen factors fall into four categories that reveal "the relevant questions in calculating a reasonable royalty," while factors fourteen and fifteen "are not really factors to be weighed at all").

40 *See* Durie & Lemley, *supra* note 36, at 630 ("The factors the *Georgia-Pacific* court identified, then, were nonexclusive; these were simply the factors that were relevant to the case before it.").

41 *See id.* at 636 (providing four categories for thirteen of the *Georgia-Pacific* factors).

42 *Id.*

43 *See* Lemley, *supra* note 12, at 658; Thomas F. Cotter, *Four Principles for Calculating Reasonable Royalties in Patent Infringement Litigation*, 27 SANTA CLARA COMPUTER & HIGH TECH. L.J. 725, 728 (2011).

44 *See* Seaman, *supra* note 34, at 1675 (explaining lost profit claims becoming less common because "courts have insisted on strict standards of proof for entitlement to lost profits," leaving reasonable royalties as the backstop for damages).

practicing patentees.[45] Therefore, in basic terms, factors three, four, five, and six are designed to distinguish between practicing and non-practicing patentees, as well as between non-practicing patentees that widely license their patents with few to no restrictions and those that do not (the latter group being entitled to higher royalties).[46] Specifically, these four factors encompass:

3. The 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.
4. The 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.
5. The 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 promoter.
6. The 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 convoyed sales.[47]

The second category largely examines the incremental contribution of the patented technology compared to the next best alternative.[48] The "hypothetical negotiation" should be heavily influenced by the value the patented technology actually contributes, because the more the patented technology is worth, the more a buyer is willing to spend, and the more a seller can reasonably demand.[49] This notion is incorporated into factors eight, nine, ten, and eleven. Specifically, these factors examine:

8. The established profitability of the product made under the patent; its commercial success; and its current popularity.
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.
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.

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[45] Patentees that license their patents to exclusive licensees are considered for these purposes to be practicing patentees because, in essence, such patentees stand in the shoes of their licensees. *See* Lemley, *supra* note 12, at 673.

[46] *See* Durie & Lemley, *supra* note 36, at 636–37.

[47] *Georgia-Pac. Corp*., 318 F. Supp. at 1120.

[48] *See* Durie & Lemley, *supra* note 36, at 636–37. To be certain, some of these factors examine the incremental commercial benefit—rather than solely the technological benefit—of the invention. However, to the extent that patents also drive commercialization of invention, such an examination is arguably justified. *See infra* Part IV.A.

[49] *See* Durie & Lemley, *supra* note 36, at 637.

> 11. The extent to which the infringer has made use of the invention; and any evidence probative of the value of that use.[50]

Typically, this analysis focuses on "how valuable the patented technology is to the accused infringer and to the marketplace as a whole."[51] When the patent covers a single, undifferentiated product, this analysis is relatively straightforward.[52] However, when the patent covers a mere component of an overall product, as with most complex industries, the "apportionment" of damages required to calculate the precise value of the patented component becomes much more complicated.[53]

The third category focuses on non-patent factors that contribute to the overall value of the patented invention.[54] Indeed, it is often the infringer who contributes to the success of technology, and such contributions should concomitantly reduce royalty rates, all other factors equal.[55] This is expressed by factor thirteen of the *Georgia-Pacific* test, which provides:

> 13. 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.[56]

The final category identifies the relevance of the actual negotiations in determining the value of reasonable royalties.[57] Factors one, two, and twelve expressly point to this piece of evidence.[58] They provide:

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[50] *Georgia-Pac. Corp*., 318 F. Supp. at 1120. Factor seven, which provides "[t]he duration of the patent and the term of the license," *id.*, would nominally fit into this category. However, this is not particularly useful, because the patent damages award always covers the period of infringement to the date of judgment, plus, in the absence of an injunction, the period from the date of judgment to the end of the patent term. *See* Durie & Lemley, *supra* note 36, at 638 & n.53 ("It is not necessarily clear whether an accused infringer would be willing to pay a higher royalty for a license of longer duration (because it is more valuable to get rights for a longer period of time) or a license of shorter duration (because the total financial outlay would not be as great, since the royalty payments will end sooner).").

[51] *See* Durie & Lemley, *supra* note 36, at 638.

[52] *See id.* (stating that an inquiry a court makes "to determine how valuable the patented technology is to the accused infringer and to the marketplace" is "relatively straightforward where the patent covers the product as a whole, but is more complicated when . . . the patented invention is merely one of many contributors to the success of a product").

[53] *See id*.

[54] *See id*. at 636, 639.

[55] *See id.* at 639; Cotter, *supra* note 43, at 744 (explaining how evidence showing how other patents contribute to the overall end product should be taken into account during the "hypothetical negotiation," because these facts factor into how much the infringer would be willing to pay to license the patent). *See generally* Jerry A. Hausman et al., *Patent Damages and Real Options: How Judicial Characterization of Noninfringing Alternatives Reduces Incentives to Innovate*, 22 BERKELEY TECH. L.J. 825, 832 (2007) (suggesting the use of an "Edgeworth Box" to determine "the minimum royalty that the patent holder would accept (while still being better off than without a license) and the maximum royalty the infringer would be willing to pay (while still being better off than without a license)").

[56] *Georgia-Pac. Corp*., 318 F. Supp. at 1120.

[57] *See* Durie & Lemley, *supra* note 36, at 641 (proposing that "factors one, two, and twelve relate

1. The royalties received by the patentee for the licensing of the patent insuit, proving or tending to prove an established royalty.

2. The rates paid by the licensee for the use of other patents comparable to the patent in suit.

12. 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.[59]

This evidence would in theory provide exactly what the "hypothetical negotiation" strives to determine, and therefore would in principle be strong evidence for the fact-finder to consider.[60] However, such evidence is often unavailable or unreliable, making it less probative in practice.[61] Nonetheless, perhaps due to its ostensible value, many courts tend to rely heavily on such evidence.[62]

B. Common Criticisms of the Georgia-Pacific Test & Potential Fixes

Here, I address three major drawbacks of reasonable royalty determinations: difficulty of application and related unpredictability; circularity; and discriminatory impact on R & D incentives. While there are certainly other drawbacks, these three problems are the most serious in my view and therefore serve as sufficient illustration of the test's difficulties.[63]

1. Difficulty of Application & Unpredictability

Perhaps the most common criticism of the *Georgia-Pacific* test is that it is unwieldy and unpredictable.[64] Its fifteen factors make it one of the bulkiest—perhaps

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to . . . actual royalties charged for this or other comparable inventions in the industry").

58 *See id.*

59 *Georgia-Pac. Corp*., 318 F. Supp. at 1120.

60 *See* Durie & Lemley, *supra* note 36, at 641 (stating that "the point of the reasonable royalty negotiation is to mimic what a willing buyer and willing seller would have agreed to"); Federal Circuit Bar Association Model Patent Jury Instructions § 6.7, Reasonable Royalty – Relevant Factors (emphasizing comparable licenses and factors related to the value the invention contributes (or not) to the accused product), *available at* https://fedcirbar.org/Portals/0/File%20Manager/Resources/Other%20Materials/Jury%20Instructions/FCBA%20Model%20Patent%20Jury%20Instructions%202016.pdf?ver=2016-03-01-154441-277.

61 *See* Durie & Lemley, *supra* note 36, at 642 (explaining that actual royalties "cannot simply be used as a basis on which to calculate damages" and "must be enhanced to counteract the discount that negotiating parties place on the likelihood that the patent is valid and infringed"); Robert F. Reilly, *Intangible Asset Market Approach Valuation Methods for Property Tax Compliance and Controversies*, 28 PRAC. TAX LAW. 39, 41 (2014) ("It may be difficult to obtain arm's-length license royalty rate data for certain types of intangible assets.").

62 *See* Durie & Lemley, *supra* note 36, at 642; Seaman, *supra* note 34, at 1688.

63 *See* Seaman, *supra* note 34, at 1689–1703 (discussing a wider variety of drawbacks with the *Georgia-Pacific* test).

64 *See id*. at 1665 ("the current 'gold standard' for awarding reasonable royalty damages—the so-called *Georgia-Pacific* test—has become increasingly difficult for juries to apply in lengthy and complex patent trials, resulting in unpredictable damage awards"); David A. Haas, John R. Bone & Bruce W. Burton, *An Interview of Judge Richard A. Posner on Patent Litigation*, Stout Risius Ross

the bulkiest—of all factor-based tests in any area of law.[65] The numerosity of the factors is of particular concern because neither the *Georgia-Pacific* case nor later cases have made any concerted effort to rank the importance of each factor.[66] The lengthy list of factors means that a wide range of evidence may be used to support any one of the factors, leading to "cherry-picked and manipulated factors" to justify awards.[67]

The *Georgia-Pacific* case itself foreshadowed the problem of how courts may arbitrarily deem certain factors more important than others given the absence of guidance.[68] In that case, the district court placed strong emphasis on factors four, five, eight, and thirteen, heavily weighing evidence such as the patentee's general policy of maintaining exclusivity.[69] Yet the appeals court lowered the damages by one-third, emphasizing that the district court erred in not leaving Georgia-Pacific with a reasonable profit.[70] Indeed, David Taylor has gone so far as to claim that the *Georgia-Pacific* test presents two different paradigms from which courts may choose in calculating royalties: one centered on the value of patent "rights" (e.g., factors one, two, five, and six) and the other on the value of patented "technology" (e.g., factors eight, nine, ten, eleven, and thirteen).[71]

The tension between "rights" and "technology" is present in many contexts, but perhaps no more so in the context of multi-component products.[72] The *Georgia-Pacific* test was created in a case involving a simple product, where there was only one patent in dispute.[73] The rapid advancement in technology and electronics has resulted in products containing many components that may be covered by several hundreds or even thousands of patents.[74] Applying the *Georgia-Pacific* test in these situations may lead to the so-called royalty stacking and apportionment problems.[75]

Journal, July 10, 2013, http://www.srr.com/article/interview-judge-richard-posner-patent-litigation ("[T]he *Georgia-Pacific* test is baloney. Fifteen factors, that's ridiculous.").

65 *See* Seaman, *supra* note 34, at 1703 (stating that unpredictability "is partially due to the test's lengthy list of fifteen nonexclusive factors" and "broad, multifactor tests have been criticized as being poorly designed and containing duplicative or overlapping factors").

66 *See* Steven J. Shapiro, *Pitfalls in Determining the Reasonable Royalty in Patent Cases*, 17 J. LEGAL ECON. 75, 76 (2010).

67 *See* Seaman, *supra* note 34, at 1706; Durie & Lemley, *supra* note 36, at 632; F. Russell Denton, *Rolling Equilibriums at the Pre-Commons Frontier: Identifying Patently Efficient Royalties for Complex Products*, 14 VA. J.L. & TECH. 48, 83–84 (2009) (arguing that "[t]he myriad of possibilities for parties to . . . cherry-pick [from *Georgia-Pacific*'s] constellation of fifteen separate factors probably doomed the reproducibility of outcomes from the outset").

68 *See* Seaman, *supra* note 34, at 1686.

69 *See id*.

70 *See id*. at 1687.

71 Taylor, *supra* note 6, at 121–22.

72 *See* Seaman, *supra* note 34, at 1689 (explaining that "in the information technology, electronics, and telecommunications industries, where a single integrated product may include hundreds of separate components," it is difficult to "determine the total royalty burden borne by the product").

73 *Id.* at 1687.

74 *See id*. at 1687–88.

75 *See id.* at 1693, 1698. (stating that apportionment makes it "virtually impossible to explain the importance of all the other, noninfringing components and features contained in complex products

Although the extent of these problems is widely contested, they certainly highlight underlying conceptual flaws in the *Georgia-Pacific* test.[76]

Specifically, royalty stacking may occur when a single product infringes numerous patents and the infringer bears multiple royalty burdens that are "stacked" together in a manner that greatly exceeds any reasonable royalty for technology used in the product as a whole.[77] Even if patentees claim minimal percentages as reasonable royalties, stacked royalties could potentially result in awards that may "swallow up a product's profit margin."[78] Furthermore, a complex product may make it difficult to apportion damages that are truly attributable to the patented invention.[79]

To be certain, factor thirteen calls for a "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."[80] Nonetheless, a product and related patents may be so technologically complex that the breadth of evidence needed to make such a determination accurately is simply beyond the scope and competence of juries (and most judges).[81]

In this regard, the *Georgia-Pacific* test was originally designed for judges, not juries.[82] Yet today, juries typically decide the appropriate amount of patent damages.[83] Moreover, juries usually weigh the evidence and factors without highlighting

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like computer operating systems or smartphones" and "complex technologies . . . where literally thousands of patents may be implicated, the royalty stacking issue is readily apparent"); Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEXAS L. REV. 1991, 1993 (2007) ("royalty stacking magnifies the problems associated with injunction threats and holdup, and greatly so if many patents read on the same product").

76 *See* Taylor, *supra* note 6, at 129 (stating that, while Lemley and Shapiro's royalty stacking analysis has been criticized, "one thing Lemley and Shapiro highlight is their belief that it is possible in particular situations for reasonable royalties to exceed the value of patented technology"); Seaman, *supra* note 34, at 1694, 1697–98 (recognizing that "in the context of royalty stacking . . . rates for comparable licenses may conflict with economic reality" and that juries "often receive little or no information regarding 'all the other things that contribute to the success' of the accused product").

77 *See* Seaman, *supra* note 34, at 1689, 1693.

78 *Id.* at 1693 (explaining the decision in *Lucent Techs. Inc. v. Gateway* where "the jury awarded Lucent a $1.53 billion royalty for infringement of two MP3-related patents, even though Microsoft had already licensed other 'essential' patents for the MP3 standard for significantly less").

79 *See id.* at 1697.

80 *Georgia-Pac. Corp.*, 318 F. Supp. at 1120 (emphasis omitted). A related problem of "holdup" may occur in the context of complex products where the accused infringer is faced with very high switching costs to change an infringing component to a non-infringing one. *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 546 ("[T]he threat of an injunction coupled with high switching costs can enable the patentee to extract more than the social value of its invention in rents from the potential user."). Indeed, the switching costs in some situations may dwarf the value of the component. *See id.*

81 *See, e.g.*, Lemley, *supra* note 12, at 665.

82 *See* Seaman, *supra* note 34, at 1688 (explaining that "damages in the Georgia-Pacific case, like most patent infringement litigation at that time, were tried to and determined by a judge, who had the time and expertise to consider complicated financial and technological evidence and prepare a detailed opinion explaining the court's findings and conclusions").

83 *See id.* at 1705.

one or more of the factors in their verdict forms.[84] This makes it difficult for courts to determine the factual basis for the jury's calculation,[85] which often leads courts to "give up" and blindly defer to whatever the jury awards.[86] Furthering this black-box approach, in *Monsanto*, the Federal Circuit held that jury damages "must be upheld unless the amount is grossly excessive or monstrous, clearly not supported by the evidence, or based only on speculation or guesswork."[87] The difficulty in determining a jury's factual basis for the calculation of damages, coupled with *Monsanto*'s strong deference to jury awards, has resulted in just a little over a one percent rejection or modification of damage awards as a matter of law.[88]

As a result of these and other difficulties, some commentators assert that courts have biased reasonable royalty determinations upward in an attempt to compensate patent owners who should have probably pursued the lost profits remedy.[89] Indeed, the test has resulted in several jury verdicts of over $100 million, which some scholars have considered a "systematic overcompensation for patent owners in certain industries."[90] Other commentators have argued that reasonable royalties can result in systematic undercompensation.[91] The essential impossibility of sorting out accurate measures of damages under the *Georgia-Pacific* test oddly may imply that both sides can lay a legitimate claim to being correct.

2. Circularity

In an insightful article, Jonathan Masur unpacks yet another problem of reasonable royalties that is often expressed but not suitably explained: royalty determinations are substantially circular, leading to paradoxes and other conundrums that cannot easily be solved.[92] The basic intuition is straightforward. Courts attempt to

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84 *Id.* at 1707.

85 *Id.* at 1709.

86 Durie & Lemley, *supra* note 36, at 632–33.

87 Monsanto Co. v. McFarling, 488 F.3d 973, 981 (Fed. Cir. 2007).

88 Durie & Lemley, *supra* note 36, at 634.

89 *See* Oskar Liivak, *When Nominal Is Reasonable: Damages for the Unpracticed Patent*, 56 B.C. L. REV. 1031, 1040 (2015); *see also* Seaman, *supra* note 34, at 1666.

90 Seaman, *supra* note 34, at 1663–66.

91 One reason that undercompensation may arise is because many courts have been averse to admitting licenses negotiated in settlement of litigation. *See, e.g.*, LaserDynamics v. Quanta Computer, 694 F.3d 51, 77–78 (Fed. Cir. 2012). Specifically, although reasonable royalties should assume the patent is valid and infringed at the time of the hypothetical negotiation, licenses negotiated outside of litigation are much more likely to discount royalty rates by the possibility that the patent-at-issue could be found invalid or noninfringed. *See* Jonathan S. Masur, *The Use and Misuse of Patent Licenses*, 110 NW. U.L. REV. 115, 124–25 (2015).

92 *See* Masur, *supra* note 91, at 137–38 (stating that "[t]he circularity problem thus squarely infects a broad swath of patent cases, and it does so with a sharpness that no other area of law can match"). For additional insightful analysis, see Mark Schankerman & Suzanne Scotchmer, *Damages and Injunctions in Protecting Intellectual Property*, 32 RAND J. ECON. 199, 202–04 (2001) ("[W]hen the source of profit is licensing revenue, the [reasonable royalty] doctrine involves a circularity, with the consequence that a whole range of damage measures may be logically consistent with it.").

value patents in reasonable royalty determinations by looking to the market.[93] Yet market actors must bargain in the shadow of the law. Hence, a circularity.[94]

For ordinary private law scholars, the response generally would be, "Who cares?" Assuming violations of the law are not a regular occurrence, the market can still set reliable rates sufficiently divorced from judicial pronouncements. Slightly modifying an example in Masur's article, take for instance the tort of conversion.[95] This cause of action allows private owners of goods that have been stolen, or simply borrowed and damaged substantially, to recover the fair market value of the good from the wrongdoer.[96]

In conversion, determining the fair market value of an ordinary, tangible good—say a bicycle that has been stolen—is not too difficult.[97] Just assess what the good is selling for on average, and damages are fairly well-determined.[98] However, imagine that the government and courts decided today that conversion was the only legal action owners could take if their goods were stolen for damages and the only punishment inflicted on the wrongdoer (i.e., criminal theft is abolished).[99] In this instance, there would be a huge incentive to steal the bicycle in the street, because the worst that could happen for the wrongdoer is paying the fair market value of the bicycle (setting aside litigation costs for a moment), and the best would be getting the bicycle for essentially nothing.[100] As Masur indicates, such an instance is akin to a "heads I win, tails I tie" outcome, not providing much of a deterrent.[101]

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93 Masur, *supra* note 91, at 134 (arguing that "[a]s much as courts would like to rely upon market measures in estimating damages, there is no reliable route out of this circularity").

94 Going one step backwards, many have criticized the *Georgia-Pacific* test because it assumes that the parties would have known all the facts available to them at the time of the negotiation, and that the parties could have or would have reached a license agreement at all for the patented technology. Often this is not the case, though, as potential licensees may decide to forgo the use of the patented technology entirely or infringe the patent and risk litigation. *See* Seaman, *supra* note 34, at 1679.

95 *See* Masur, *supra* note 91, at 137 (stating that circularity arises in other areas of law, such as tort law).

96 *See id.*

97 *See id.* (using the example of a bicycle to illustrate that "the influence of judicial decisions on market values is very slight" in other areas of law, such as tort).

98 An immediate concern and associated question arises, however—if damages for conversion are merely the fair market value of the good, then why wouldn't third parties routinely pilfer goods? The answer mainly lies in the fact that the pilferer may be criminally liable for theft and locked away. The severe punishment of imprisonment is generally enough to deter people from stealing, making the tort of conversion relatively rare. As such, the marketplace can set prices for goods without worrying too much about whether courts properly value such goods in tort actions. *See id.* (explaining that tort law does not face the problem of circularity by illustrating that a person stealing goods, such as a bicycle, is faced with the "threat of injunction, jail time, reputational sanctions, or any number of other factors beyond the price a thief will be forced to pay").

99 *Id.*

100 *See id.* (explaining that "the value of a patent depends entirely on its likely fate in court," unlike misappropriation of other goods, such as bicycles, for which the value does not depend solely on market price, but is also backed by other punishment).

101 Masur, *supra* note 91, at 132.

The result is that the price of bicycles would fall—because they could be easily stolen or, alternatively, to compensate for increased amounts spent on locks and other theft-prevention devices (which I assume, for sake of argument, are separate products from the bicycle).[102] Of course, the price could only fall only so far because the marginal cost to produce a bicycle sets a minimum price floor.[103] But, again, for the sake of argument, imagine that these costs are negligible.[104] As prices fall, courts set the damages from conversion lower and lower, thereby increasing the incentive to steal bicycles even more.[105] The feedback loop between the market and courts would eventually cause the price of bicycles to decline rapidly, potentially killing the market itself.[106]

This may be an unrealistic characterization for bicycles, but not for patented inventions.[107] As Masur recognizes, for unpracticed patents, a civil suit for reasonable royalties is typically the only way to recover for infringement.[108] In this regard, since the Supreme Court's *eBay* decision, for most patentees seeking reasonable royalties, injunctive relief is unavailable, implying that the only remedy is money damages—for past and future infringement.[109] Next, because the marginal costs of producing an additional good covered by a patent are often small—think pharmaceutical drugs—there is no hard floor to stop prices from falling, at least *ex post*.[110] Finally, unlike bicycles, patents are relatively unique assets, making them very difficult to value, and the key information to determine reasonable royalties lies with the parties, who tend to massively exaggerate or understate patent value via their experts in court.[111]

Thus, the usual way out of the circularity dilemma of contract and tort remedies—injunctive relief, price floors, stable valuations, and background criminal sanctions—is not typically available for reasonable royalties.[112] Like conversion absent criminal or other sanctions, as courts look to the marketplace and as infringers

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[102] *See id*. at 137.
[103] *See id*.
[104] *See id*.
[105] *See id*.
[106] *See id*.
[107] *See id.* at 134 ("The downward spiral is driven entirely by the parties' belief that the court will improperly rely upon prior licenses as evidence of the patent's value.").
[108] *See id*. at 118 (explaining that "[o]ver the past decade, courts have used a reasonable royalty as the measure of damages in 81% of cases").
[109] *See id.* at 117; Christopher B. Seaman, *Permanent Injunctions in Patent Litigation After* eBay*: An Empirical Study*, 101 IOWA L. REV. 1949, 1950 (2016).
[110] *See* Shubha Ghosh, *Intellectual Property Rights: The View from Competition Policy*, 103 NW. U.L. REV. COLLOQUY 344, 347 (2009) ("The high fixed costs of pharmaceutical research and development and the low marginal cost of producing a pharmaceutical compound, once discovered, combine to create a firm level cost structure that requires developing pharmaceutical companies to recoup costs of production through some form of regulation.").
[111] *See* Masur, *supra* note 91, at 149 (arguing the inconsistencies in parties using experts are because "it involves using objective information to answer a fundamentally subjective question").
[112] *Id.* at 137 (stating that tort law may escape the problem of circularity, while "[p]atent law has no such escape").

take their chances, reasonable royalties could generally spiral downward to the potential demise of patents altogether.[113]

Further complicating this landscape, patentees—realizing as much—will, like someone engaging in a fraudulent insurance scheme, do all they can to inflate the nominal value of licenses so that courts impose damages greater than the "fair market value" of the patent.[114] For example, in addition to providing a naked license to the patent, patentees can price consulting services, know-how, or other benefits into the apparent royalty rate.[115] For patentees that sell products to licensees, they can inflate the royalty rate and discount product prices.[116] As courts look to these increased licensing rates, the market will respond by increasing the rates on ordinary licenses, ballooning licensing fees.[117]

Perhaps all of these effects negate each other? Unfortunately (for society), Masur is again dead on the mark: "It may be tempting to conclude that these effects will balance one another out, or at least come close enough to doing so that it is safe to ignore them. But this would be error. It would be pure fortuity . . . ."[118]

So, what is the upshot? Although Masur recounts that it is usually "in the nature of legal scholarship to write comedies rather than tragedies," reasonable royalties appear to be the recalcitrant exception.[119] While actual valuation of the patented invention relative to the next best (unpatented) alternative would escape these dilemmas, estimating these amounts has remained notoriously difficult.[120]

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[113] *See id.* at 133 (arguing that circularity "will force the patent into an artificial downward spiral in value . . . [and] drive expected trial outcomes lower, which will in turn drive future licenses lower, which will in turn drive future expected trial outcomes even lower, and so forth").

[114] *See id.* at 144 (stating that "[a]s courts rely more and more upon licenses for measuring reasonable royalties, patent owners will have incentives to inflate licensing prices and then attempt to obscure or conceal that inflation by any means available to them").

[115] *See id.* at 135 (explaining that, along with licensing for a patent, "the patent holder would transfer technical knowledge . . . and this latent knowledge may well be more valuable than any technical information disclosed by the patent itself" that may lead "to a provision of valuable information and services above and beyond a license for the patent itself").

[116] *See id.* at 142 (describing a hypothetical situation between P and L1, where P "may promise L1 a discount on future patent licenses, package the patent license with a trademark license or other intellectual property, or any number of other inducements" and sell the good for less than what it is worth, but noting that it "is still worthwhile for P if it will increase the royalties it might eventually receive from" future parties in litigation).

[117] There are other concerns with relying on licenses negotiated in the private market. For instance, past licensing agreements may be highly inaccurate if there is a drastic change in industry customs, technology, or profitability by the time of infringement. *See* Shapiro, *supra* note 66, at 77 (finding problems in comparisons based on proprietary databases that provide access to licensing transactions such as ktMINE, RoyaltyStat.com and RoyaltySource.com).

[118] Masur, *supra* note 91, at 144.

[119] *Id.* at 156.

[120] *See* Thomas F. Cotter, *Four Principles for Calculating Reasonable Royalties in Patent Infringement Litigation*, 27 SANTA CLARA COMPUT. & HIGH TECH. L.J. 725, 742–43 (2011) (noting the "practical difficulties" involved with determining the cost of a next-best alternative); MICHAEL A. EPSTEIN, MARTIN S. LANDIS & FRANK L. POLITANO, DRAFTING LICENSE AGREEMENTS § 21.03 (2016) (stating that the next-best alternative is "difficult to estimate").

3. Discriminatory Impact

The next major problem with reasonable royalty determinations is not so much one of reasonable royalties, but of its companion, lost profits damages. However, illustrating this weakness assists in discerning the conceptual flaws underlying reasonable royalties, and all of patent damages for that matter.[121] Although this article discusses the flawed theoretical foundation of patent damages in more detail below, it is worth noting here that reasonable royalty determinations limit damages in ways that lost profits do not.[122] For instance, the *Georgia-Pacific* test reduces royalties to the extent unpatented factors or components contribute to the success of the patented invention.[123] However, lost profits determinations—by awarding the patentee the full amount of the profit it otherwise would have earned had the patent not been infringed—implicitly does not make such reductions.[124] Even if unpatented components contributed to ninety percent of the profit of the invention, a lost profits patentee will be entitled to the full amount of the profit if it can show the sale would not have been made "but for" the patented component.[125] Although this may seem "reasonable," consumer demand may be driven by many "essential" components, some of which are patented and others of which are not (or fall under unasserted patents).[126] Lost profits determinations, however, do not effectively apportion these additional components while reasonable royalty determinations do.[127] Nor do lost profits determinations reduce damages when sales are driven by savvy marketing, consumer lock-in, and other factors not directly related to the technological value of the invention.[128]

The upshot is that lost profits damages are usually substantially larger than reasonable royalty determinations for the same underlying invention.[129] This diver-

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[121] *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 551–52 (describing the problem of discriminatory impact in patent damages).

[122] *See* Lemley, *supra* note 12, at 660 ("Once a patentee proves entitlement to lost profits, the scope of the resulting award can be quite expansive . . . [p]atentees are even entitled to capture sales by the defendant after the patent has expired, if those sales were made possible by infringing preparatory activity by the defendant during the term of the patent.").

[123] Georgia-Pac. Corp. v. U.S. Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y 1970), (stating that factor thirteen considers "[t]he 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.").

[124] Lemley, *supra* note 12, at 660 (stating that a patentee entitled to lost profits "can capture the defendant's sales of unpatented goods that compete with the patented invention . . . [and] are entitled to capture the value of sales of an entire product based on a single patented component if they can prove that the patented feature is what caused the sale").

[125] *Id.* (arguing that the expansive nature of the "lost profits doctrine aims to put patentees in the position they would have been in but for the infringement").

[126] *Cf.* Seaman, *supra* note 34, at 1698 (arguing that "it would be virtually impossible to explain the importance of all the other, noninfringing components and features contained in complex products . . . such a presentation likely would take weeks or months of highly technical testimony").

[127] *See id.* at 1697.

[128] *See generally* Lemley, *supra* note 12, at 660 (explaining the entire market value rule).

[129] *Cf. id.*, at 662 (stating that "if the recipients of reasonable royalty damages are in fact competitors who failed to meet the rigorous requirements of proof of lost profits, the result may be that those

gence is premised on the statutory language of the Patent Act, which seemingly requires that the patent owner be made whole in the event of infringement.[130] Yet, as I argue in the next Part, making the patentee whole does not always best further the aims of patent law.[131] Put simply, when the putative aim of patent law is to incentivize invention, why should a practicing patentee earn more in litigation than a non-practicing patentee that produced the same invention? One immediate response might be that the practicing patentee should be rewarded more because it commercialized the invention.[132] However, the standard reward theory of patent law holds that commercialization is not an aim of patent law, at least for most inventions.[133] Thus, barring some alternative approach to patent law, there appears to be little theoretical justification for discriminating between practicing and non-practicing patentees when it comes to damages.[134]

4. The Limitations of Proposed Solutions

Many solutions have been proposed either to supplant or modify the *Georgia-Pacific* test. Here, I address some of the major ones, explaining why these solutions are insufficient to fully rectify the previously mentioned problems.

First, several commentators—such as Jorge Contreras, Thomas Cotter, Daralyn Durie, Richard Gilbert, Mark Lemley, and Chris Seaman—have suggested that we should pay more attention to "the marginal contribution of the patented invention over the prior art" and those "other inputs . . . necessary to achieve that contribution."[135] Although I am very sympathetic to such a view—particularly because it better promotes patent law's underlying goal of promoting innovation—

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patentees are undercompensated by a traditional reasonable royalty approach").

130 35 U.S.C. § 284 ("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 . . . .").

131 *See infra* Part III.A.

132 *See* Liivak, *supra* note 89, at 1064 (arguing that the current view of patent damages supports that "[t]o establish the existence of harm from infringement by independent inventors, a patentee must necessarily make an effort to commercialize the patent . . . [and] therefore, must be a necessary element for substantial patent damages, including reasonable royalties.").

133 *See* Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 344 (2010) ("The dominant 'reward' theory of patenting, which undergirds much of today's law, perceives little to no need to protect risky and costly post-invention development and commercialization efforts.") [hereinafter Sichelman, *Commercializing Patents*].

134 *See* John M. Golden, *"Patent Trolls" and Patent Remedies*, 85 TEX. L. REV. 2111, 2117 (2007) ("A per se rule of discrimination based on a patent holder's business model could act as an undesirable drag on the efficiency and competitiveness of markets for innovation."); Ted Sichelman, *The Vonage Trilogy: A Case Study in "Patent Bullying"*, 90 NOTRE DAME L. REV. 543, 544–53 (2014) (contending that the common arguments against non-practicing entities contradict the dominant theories of patents and are based primarily on unsubstantiated, anecdotal evidence).

135 Durie & Lemley, *supra* note 36, at 629*; see also* Cotter, *supra* note 43, at 742 ("From a purely economic perspective, the value of a patent at any given point in time is no more (and no less) than the present value of the expected profit (or cost saving) attributable to the use of the patented invention in comparison with the next-best available alternative."); Seaman, *supra* note 34, at 1711; Jorge L. Contreras & Richard J. Gilbert, *A Unified Framework for Rand and Other Reasonable Royalties*, 30 BERKELEY TECH. L.J. 1451 (2015).

implementing this advice can be daunting.[136] Granted, these determinations may be feasible when the invention results in cost savings.[137] For instance, Durie and Lemley properly remark, "If a patented technology saves me 3% in costs over my existing alternative, I won't pay more than 3% for the right to use it."[138] Yet when the value of the invention turns on increased consumer demand, and the invention is a mere component of a more complex invention, determining the "marginal contribution" over the prior art and to the product as a whole is typically fraught with difficulty.[139] For these reasons, it is not unusual for competing expert valuations of such components to differ by a factor of a hundred.[140] As such, these sorts of suggestions do not adequately address the evidentiary and analytical limitations[141] that are inherent in the *Georgia-Pacific* approach.[142]

Second, Masur suggests that we recalibrate the rules regarding which licenses should be probative of underlying royalty rates.[143] For instance, because royalty awards must assume a patent is valid and infringed, he suggests that licenses negotiated in settlement may be more probative than commonly believed.[144] Although I agree with this point, licenses in settlement still suffer from other problems not commonly identified—such as distortion from agency costs and risk aversion (e.g., a general counsel very worried about losing a case settling for much more than the otherwise optimal amount).[145] But even setting these concerns aside, the reality is

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136 *See supra* note 120 and accompanying text.

137 *See* Durie & Lemley, *supra* note 36, at 639.

138 *Id.*

139 *See* Cotter, *supra* note 43, at 742–43 ("Realistically, of course, determining the difference between the user's expected profits at time t with and without the use of the patented invention is at best an imperfect undertaking."); *see also* Stuart Graham et al., *Final Report of the Berkeley Center for Law & Technology Patent Damages Workshop*, TEX. INTELL. PROP. L.J. (forthcoming) ("Estimating reasonable royalties for a demand-enhancing invention often involves econometric techniques . . . which turn critically on assumptions, quality and quantity of data, significance of the patented technology, nature of the marketplace, attributes of the products/services, and tradeoffs.").

140 *Cf.* John B. Scherling & Ryan M. Sullivan, *Rational Reasonable Royalty Damages: A Return to the Roots*, 4 LANDSLIDE 55, 56 (2011) (noting the "often . . . outlandish royalty opinions" in patent cases).

141 Seaman attempts to solve these problems by focusing on the cost differential to an infringer of an "acceptable noninfringing substitute" at the time of infringement to better estimate the marginal utility of the patented invention. *See* Seaman, *supra* note 34, at 1711–12. Although this formulation does assist in actual calculations, it still is subject to substantial uncertainty and manipulation, and many patented inventions do not have an acceptable noninfringing substitute. *See infra* Part III.B.

142 A related unsolved issue is whether the marginal contribution of the invention should be measured as the value to actual consumers or society as a whole. *See* Taylor, *supra* note 6, at 133. Often, these values diverge considerably. *See* Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 268 (2007) ("There is no question that inventions create significant social benefits beyond those captured in a market transaction.").

143 *See* Masur, *supra* note 91, at 147–48.

144 *See id.*

145 *Cf.* Landers, *supra* note 12, at 373 (arguing that "[t]o the extent that final awards are excessive, there is a risk that entities may not engage in innovative activity, even if such activity is noninfringing, for fear of incurring large costs in a damages judgment").

that in most cases, no licenses for *the patent-in-suit* are available, leading to the ever-present problem of determining exactly which licenses for other patents are "comparable."[146] This more pressing concern has no readily available solution.

Third, to address overcompensation, some commentators have suggested limiting damages for certain classes of patentees. For example, Oskar Liivak has suggested that non-practicing entities that have "not undertaken any efforts to commercialize the invention" and have "asserted [the patent] against an independent inventor" should only be entitled to nominal damages.[147] However, such an approach in my view would lead to systematic *under*compensation or would result in perverse incentives for inventors and commercializers to vertically integrate.[148] Although—contrary to the dominant reward view—both invention and commercialization are important aims of any well-functioning patent system,[149] not all inventors should be required to engage in commercialization efforts.[150] In other words, a bare contribution of a disclosure in a patent application of information sufficient to enable one of skill in the art to build and practice the claimed invention can often be valuable in itself, and inventors should be rewarded for such disclosures.[151] At the same time, I agree with Liivak that some added incentive is needed to encourage commercialization, and I return to this concern below when proposing adding innovation factors to the *Georgia-Pacific* test.[152]

In sum, although many of these suggestions are useful, none is a silver bullet. At the very least, there is certainly room for additional solutions. In this regard, nearly all proposed solutions largely work within the existing paradigm of restoring the patentee to the *status quo ante*—that is, a state of the world before any infringement.[153] As I argue in the next Part, changing this paradigm may be needed to fully solve the problems of reasonable royalty determinations.[154]

III. The Flawed Conceptual Framework of Patent Law Remedies

Private law—such as tort, property, and contract law—generally provides remedies for the infliction of wrongs on private individuals and entities.[155] For example,

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[146] *Cf.* Taylor, *supra* note 6, at 122–23 (stating that "the hypothetical negotiation construct . . . includes some assumptions that make it consistent with real licensing negotiations, but other assumptions and doctrines distinguish it from real licensing negotiations").

[147] *See id.*

[148] *See* Sichelman, *supra* note 133, at 367.

[149] *See id.* at 355.

[150] *See id.*

[151] *See id.* at 401.

[152] *See infra* Part IV.A.

[153] Earlier work of mine, as well as that by Michael Risch and David Taylor, proposes eliminating the hypothetical negotiation construct of *Georgia-Pacific*. *See* Sichelman, *Purging Patent Law*, *supra* note 20, at Part II.C; Risch, *supra* note 1; Taylor, *supra* note 6, at 126–27. I address these approaches below. *See infra* Part IV.B.

[154] *See infra* Part III.A.

[155] *See* ERNEST J. WEINRIB, THE IDEA OF PRIVATE LAW 143 (1995) ("When the remedy takes the form of an award of damages, a single amount undoes the injustice both of what the defendant has done and of what the plaintiff has suffered."); Ezra Ripley Thayer, *Public Wrong and Private Action*, 27

if a rambunctious bar patron punches you on the nose while you quietly sip a martini, you can sue the patron in tort for battery, collecting damages via a "liability" rule for at least the harm inflicted and—in many cases—an injunction via a "property" rule going forward to prevent future harm.[156] Tort law would provide you these sorts of remedies because we as a society believe the optimal state of the world is for you to go on quietly sipping your drink, free from the interference and physical damage caused by the rowdy patron. In other words, tort law—at least traditionally—tends to assume that a world free from interference into an individual's or private entity's "sphere of autonomy" is the ideal state of the world.[157] As such, it generally seeks to return the private actor that has been harmed to the *status quo ante*, through damages, an injunction, or both.[158]

As explained in the previous sections, patent law follows the same *status quo ante* principle in attempting to compensate the patentee for infringement so as to return it to the state of the world in which infringement did not occur.[159] Yet, patent law is not designed to remedy private wrongs. Rather, its major aim is to promote innovation.[160] In this Part, I argue that the fundamental premise of patent law reme-

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HARV. L. REV. 317, 326–27 (1914) (discussing private civil rights of action in tort).

156 *See* DAN B. DOBBS, LAW OF REMEDIES § 8.10, at 692 (2d ed. 1993) (observing how injunctions against ongoing risky practices may accompany tort damages in personal injury cases); Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092 (1972) (proposing the property–liability rule distinction); *see also* 4 WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND, CHAPTER 1, at 4 (arguing that private law remedies redress violations of private rights "by either restoring to [the victim] his right" or providing remuneration sufficient to compensate for the violation).

157 *See* Donald P. Judges, *Of Rocks and Hard Places: The Value of Risk Choice*, 42 EMORY L.J. 1, 63 (1993) ("Tort law generally seeks to protect the autonomy of plaintiffs by compensating for and deterring the forced intrusions of defendants' tortious conduct."). Of course, there are those exceptional cases for which intentional intrusions into a person's sphere of autonomy are considered excused or justified, such as self-defense, duress, and the like. *See, e.g.*, RESTATEMENT (SECOND) OF TORTS § 65 (1965) (setting forth factors for establishing self-defense).

158 *See* Aaron Xavier Fellmeth, *Civil and Criminal Sanctions in the Constitution and Courts*, 94 GEO. L.J. 1, 60 (2005) ("In tort law, injunctions are granted . . . when the remedy of compensatory damages will not suffice to restore the status quo ante."); Karen E. Sandrik, *Reframing Patent Remedies*, 67 U. MIAMI L. REV. 95, 102 (2012) ("Further, patent and tort remedies largely mirror one another in that the goal of both remedial structures is to restore the aggrieved party to the status quo ante.") (citing an earlier version of this Article); *see also* RESTATEMENT (SECOND) OF TORTS § 936 (1979) (setting forth factors for when injunctions are appropriate).

159 Mark A. Lemley, *Distinguishing Lost Profits From Reasonable Royalties*, 51 WM. & MARY L. REV. 655, 674 (2009) ("Patent damages are supposed to compensate patent owners for their losses, putting them back in the world they would have inhabited but for infringement."); *see also* Cotter, *supra* note 43, 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.").

160 *See* U.S. CONST. art. I, § 8, cl. 8 ("To *promote the Progress* of Science and useful Arts . . . .") (emphasis added); Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, 229–31 (1964) ("Patents are not given as favors, as was the case of monopolies given by the Tudor monarchs . . . but are meant to encourage invention by rewarding the inventor with the right . . . to exclude others from the use of his invention."); Peter S. Menell, *Intellectual Property: General Theories*, *in* 2 ENCYCLOPEDIA OF LAW AND ECONOMICS 129, 130–33 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000) ("The United States Constitution expressly conditions the grant of power to Congress to create patent and copyright laws upon a utilitarian foundation . . . ."). By using the term *innovation*, I intend to in-

dies—to restore the *status quo ante*—does not optimally incentivize innovative activity. With this realization in place, it becomes not only useful, but essential, to jettison the more specific premise of reasonable royalty analysis that its aim is to replicate a hypothetical negotiation between patentee and infringer just prior to the infringement. Removing this construct paves the way not only to better solutions, but also more workable ones.[161]

A. Towards an Innovation-Centric Model of Patent Remedies

The *status quo ante* of "no infringement" occurs when third parties, including competitors, do not practice the patent or pay license fees to permissibly perform otherwise infringing acts.[162] Historically, patent law typically provided for damages for past infringement and injunctions on a going-forward basis to restore the *status quo ante*.[163] In the context of reasonable royalties, backward-looking damages compensate the patentholder for forgone royalties.[164] Forward-looking injunctions restore the patentholder to the equitable *status quo ante* at the time of patent issuance, providing the holder an absolute right—backed by contempt sanctions—to prevent third parties from infringing the patent.[165]

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clude not only invention, but also the commercialization and dissemination of the invention. *See, e.g.*, Jan Fagerberg, *Innovation: A Guide to the Literature*, *in* THE OXFORD HANDBOOK OF INNOVATION 1, 4 (Jan Fagerberg et al. eds., 2005) ("Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice.").

161 Portions of Part III of this Article appear in Sichelman, *Purging Patent Law*, *supra* note 20.

162 *See* 35 U.S.C. § 271(a) (2006) ("[W]hoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent therefor, infringes the patent."). There is also a fairly limited "experimental use" exception to patent infringement, which excuses otherwise infringing acts. *See* 5 DONALD S. CHISUM, CHISUM ON PATENTS § 16.03[1] (2012) (collecting cases addressing the experimental use doctrine).

163 *See, e.g.*, Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1247 (Fed. Cir. 1989) (reaffirming the long-standing rule of issuing injunctions to successful patentees); Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 1548 (Fed. Cir. 1983) ("[A] patent is a form of property right, and the right to exclude recognized in a patent is but the essence of the concept of property."); *see also* Smith Int'l, Inc. v. Hughes Tool Co., 718 F.2d 1573, 1577–78 (Fed. Cir. 1983) (reasoning that the incentive to engage in research would be diminished without the right to injunctive relief); Ben Depoorter, *Property Rules, Liability Rules and Patent Market Failure*, 4 ERASMUS L. REV. 59, 61 (2008) ("[T]he equitable remedy of injunction has dominated the law of intellectual property.").

164 *See* 35 U.S.C. § 284 (2006 & Supp. V 2012) (providing for "no . . . less than a reasonable royalty for the use made of the invention by the infringer"); Lemley, *supra* note 6, at 655 ("Patent damages are designed to compensate patentees for their losses, not punish accused infringers or require them to disgorge their profits."); *see also* ROGER D. BLAIR & THOMAS F. COTTER, INTELLECTUAL PROPERTY: ECONOMIC AND LEGAL DIMENSIONS OF RIGHTS AND REMEDIES 12 (2005) (noting that damages for an infringement "may include an award of the plaintiff's lost profits attributable to the infringement; the amount of an established royalty; or a reasonable royalty").

165 *See* Osborn v. Bank of U.S., 22 U.S. (9 Wheat.) 738, 749 (1824) (stating that patent owners may obtain injunctions to prevent others from using the patent based on "the principle[] that the injury was consequential, not direct, and that it would be difficult, if not impossible, to estimate the damages"); Rite Hite Corp. v. Kelley Co., 56 F.3d 1538, 1562 (Fed. Cir. 1995) ("An injunction preserves the patentee's exclusive right to market embodiments of the patented invention.").

As noted in the discussion of the *Georgia-Pacific* test's circularity, injunctions help to ensure that licensing rates generated in the marketplace are at least somewhat tied to underlying value, rather than solely the courts' estimates of value.[166] Yet, in *eBay v. MercExchange,*[167] the Supreme Court shifted the calculus by holding that injunctions are not mandatory and should instead be awarded on the basis of a set of equitable factors.[168] In an influential concurrence,[169] Justice Kennedy argued that entities that do not practice their patents (so-called non-practicing entities or "NPEs")—typically, by forgoing manufacturing and product sales in favor of licensing—generally should not be awarded an injunction because it would give them "undue leverage" over third parties, particularly when the patent covers a "small component" of a complex product.[170] Of course, NPEs are the very entities that generally use reasonable royalties because, by definition, lost profits are not available to them.[171]

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166 *See supra* Part II.B.2.

167 eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388 (2006).

168 *See id*. at 391–92 (holding that the well-established principles of equitable relief "apply with equal force to disputes arising under the Patent Act"); Carl Shapiro, *Injunctions, Hold-Up, and Patent Royalties*, 12 AM. L. & ECON. REV. 280, 282 (2010) ("The Supreme Court ruled unanimously that the district court has discretion whether to grant or deny injunctive relief based on traditional principles of equity, using a four-factor test.").

169 *See eBay*, 547 U.S. at 395–97 (Kennedy, J., concurring). A large number of opinions have specifically cited Justice Kennedy's concurring opinion with approval. *See, e.g.*, Robert Bosch LLC v. Pylon Mfg. Corp., 659 F.3d 1142, 1150 (Fed. Cir. 2011); Salinger v. Colting, 607 F.3d 68, 82 (2d Cir. 2010); N. Am. Med. Corp. v. Axiom Worldwide, Inc., 522 F.3d 1211, 1228 (11th Cir. 2008); ATCS Int'l LLC v. Jefferson Contracting Corp., 807 F. Supp. 2d 516, 519 (E.D. Va. 2011); i4i Ltd. P'ship v. Microsoft Corp., 670 F. Supp. 2d 568, 600 (E.D. Tex. 2009); Hynix Semiconductor Inc. v. Rambus Inc., 609 F. Supp. 2d 951, 966 (N.D. Cal. 2009); Amgen, Inc. v. F. Hoffman-La Roche Ltd., 581 F. Supp. 2d 160, 211 (D. Mass. 2008); MGM Studios, Inc. v. Grokster, Ltd., 518 F. Supp. 2d 1197, 1215–16 (C.D. Cal. 2007); Commonwealth Sci. and Indus. Research Org. v. Buffalo Tech. Inc., 492 F. Supp. 2d 600, 605 (E.D. Tex. 2007); MPT, Inc. v. Marathon Labels, Inc., 505 F. Supp. 2d 401, 419–20 (N.D. Ohio 2007); z4 Techs., Inc. v. Microsoft Corp., 434 F. Supp. 2d 437, 441 (E.D. Tex. 2006). Additionally, a well-known empirical study indicates that Justice Kennedy's opinion has been far more influential than Chief Justice Roberts's opinion, which suggested following the historical practice of typically awarding injunctive relief. *See eBay*, 547 U.S. at 394–95 (Roberts, C.J., concurring) ("From at least the early 19th century, courts have granted injunctive relief upon a finding of infringement in the vast majority of patent cases . . . . When it comes to discerning and applying those standards, in this area as others, a page of history is worth a volume of logic." (internal quotation marks omitted)); FTC, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION app. b at 256–59 (2001), *available at* http://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patentreport.pdf (presenting the results of Steven Malin's survey of post-*eBay* cases, which found that district courts have denied injunctions to nonpracticing entities more than 50% of the time).

170 *See eBay*, 547 U.S. at 396–97 (Kennedy, J., concurring) ("When the patented invention is but a small component of the product . . . and the threat of an injunction is employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest.").

171 *See* Wechsler v. Macke Int'l Trade, Inc., 486 F.3d 1286, 1293 (Fed. Cir. 2007) ("'Normally, if the patentee is not selling a product, by definition there can be no lost profits.' The only exception is

Implicit in Justice Kennedy's reasoning is the tort law *status quo ante* rationale: because an NPE would license its patents, a liability rule providing damages on a forward-looking basis—assuming it adequately reflected the market royalty rate—would return the NPE exactly to that state of the world that would have existed but for the infringement.[172] Conversely, Justice Kennedy assumed that a practicing entity would not generally license its patents, instead choosing to leverage its patents by earning supernormal profits from selling products and services in the marketplace.[173] Importantly, both the historical doctrine and slightly modified approach of *eBay*[174] assume that the *status quo ante* endgame, to the extent it can be costlessly and accurately implemented by a court, is in fact the ideal remedy.[175] In other words, the courts—and nearly all of the academic literature—have assumed

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where the patentee has the ability to manufacture and market a product, but for some legitimate reason does not. Even in these situations, though, 'the burden on a patentee who has not begun to manufacture the patented product is commensurately heavy.'" (citations omitted) (quoting Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1548 (Fed. Cir. 1995) (en banc) and Hebert v. Lisle Corp., 99 F.3d 1109, 1120 (Fed. Cir. 1996))).

[172] *See id.* at 396 ("For [NPEs], an injunction, and the potentially serious sanctions arising from its violation, can be employed as a bargaining tool to charge exorbitant fees to companies that seek to buy licenses to practice the patent."). Presumably, Justice Kennedy viewed the fees generated from an injunction as "exorbitant," *see id.*, for NPEs, but not for practicing entities, because—by widely licensing instead of practicing (or exclusively licensing) their patents—NPEs do not seek to exclude others from practicing their patents in the marketplace, nor do NPEs market products potentially subject to an accused infringer's patents. *See* FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, at 38–39 (Oct. 2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf ("The potential for [holdup] to result in mutually assured destruction means firms actively participating in the industry—patent practicing entities (PPEs)—are unlikely to employ this hold-up strategy against each other . . . . [H]owever, identified firms referred to as non-practicing entities (NPEs) . . . can successfully employ a hold-up strategy without fear of retaliation."), *cited in eBay*, 547 U.S. at 396 (Kennedy, J., concurring). As such, any leverage gained by NPEs from the threat of curtailing such activity via an injunction as litigation remedy is "undue" on this view. *eBay*, 547 U.S. at 396–97 (Kennedy, J., concurring).

[173] *See eBay*, 547 U.S. at 396 (Kennedy, J., concurring) ("An industry has developed in which firms use patents not as a basis for producing and selling goods but, instead, primarily for obtaining licensing fees.").

[174] Justice Thomas's and Chief Justice Roberts's opinions in *eBay* make no explicit distinction between practicing entities and NPEs. *See id.* at 390–95 (majority opinion and Roberts, J., concurring). Following *eBay*, however, lower courts have followed Justice Kennedy's distinction—routinely granting injunctions to practicing entities but denying them to NPEs. *See* FTC, *supra* note 13 (presenting findings that, in cases in which practicing and nonpracticing entities were distinguished, district courts granted injunctions to practicing entities about 85% of the time, but only about 45% of the time to NPEs following *eBay*); Seaman, *supra* note 109.

[175] *See* Aro Mfg. Co. v. Convertible Top Replacement Co., 377 U.S. 476, 507 (1964) (holding that in determining damages, the question is "had the Infringer not infringed, what would Patent Holder-Licensee have made?" (internal quotation marks omitted)); Pall Corp. v. Micron Separations, Inc., 66 F.3d 1211, 1223 (Fed. Cir. 1995) ("[T]he purpose of compensatory damages is not to punish the infringer, but to make the patentee whole."); *see also* Amy L. Landers, *Patent Valuation Theory and the Economics of Improvement*, 88 TEX. L. REV. SEE ALSO 163, 166 (2009) ("[P]atent damages are a make-whole remedy, intended to restore the patentee to the same position as before infringement.").

that treating the patentee like a private right holder entitled to traditional private law remedies optimally promotes innovation.[176]

I argued in a previous article however, that the traditional view is wrong in at least three contexts.[177] First, along the lines of Justice Kennedy's suggestion, when a patent covers a minor component of a complex product that a third party has already implemented—and there are large switching costs in implementing a substitute for the patented component—then providing any patentee, *practicing or not*, with an injunction on a going-forward basis may yield market rewards (or settlement payments) far in excess of the value of the innovative component to society.[178] This potential windfall to the patentee results in the patent system providing too great an incentive for component and incremental innovations relative to discrete, whole product innovations.[179] Indeed, Mark Lemley and Carl Shapiro have convincingly argued as much in the context of non-practicing entities.[180] Yet, because Lemley,

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[176] *See* General Motors Corp. v. Devex Corp., 461 U.S. 648, 653–55 (1983) ("When Congress wished to limit an element of recovery in a patent infringement action, it said so explicitly . . . . Congress' overriding purpose of affording patent owners complete compensation."); 6 JOHN GLADSTONE MILLS III ET AL., PATENT LAW FUNDAMENTALS § 20:65 (2d ed. 2013) ("[I]t is only by means of injunctive relief that a patentee can realize 'the right to exclude others' . . . ."); Roger D. Blair & Thomas F. Cotter, *Rethinking Patent Damages*, 10 TEX. INTELL. PROP. L.J. 1, 4 (2001) ("[W]e recommend the application of traditional tort-law doctrines of cause-in-fact and proximate cause to patent questions, and generally reject the idea that patent infringement is materially different . . . ."); Frank H. Easterbrook, *Intellectual Property Is Still Property*, 13 HARV. J.L. & PUB. POL'Y 108, 109 (1990) ("Patents give a right to exclude, just as the law of trespass does with real property."); Paul J. Heald, *Optimal Remedies for Patent Infringement: A Transactional Model*, 45 HOUS. L. REV. 1165, 1171 (2008) ("In establishing what constitutes infringement and what remedies apply, patent law's secondary function looks like tort law."); Amy L. Landers, *Liquid Patents*, 84 DENV. U.L. REV. 199, 252–53 (2006) (contending that patent remedies should differ as between practicing and nonpracticing entities because each incurs different kinds of "harm"); Lemley & Shapiro, *supra* note 75, at 2036 (2007) (arguing that retaining injunctions for practicing entities "is justified in part for reasons of equity"); *see also* Megan M. La Belle, *Patent Law as Public Law*, 20 GEO. MASON L. REV. 41, 41 (2012) ("Patent litigation historically has been regarded as private law litigation, meaning disputes between private parties about private rights." (internal quotation marks omitted)).

[177] Sichelman, *Purging Patent Law*, *supra* note 20, at 522–25. Shortly after that article was published, David Taylor independently made similar assertions. *See* Taylor, *supra* note 6, at 126–27 (contending that reasonable royalties should focus on the value of the patented technology rather than the value of the patent rights per se, which implies that the construct of the hypothetical negotiation attempting to restore the patentee to the *status quo ante* should be discarded).

[178] *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 522–23.

[179] For instance, such differential incentives may unduly increase incentives to innovate—or at least seek patent protection for plausible innovations—in the software industry relative to the pharmaceutical industry. *See* Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 26 n.94 (2001) (noting that a patented invention typically covers a small part of a software product as compared with an entire pharmaceutical product). Relatedly, it may provide an inefficient advantage to large firms, which tend to incrementally innovate, relative to small firms, which tend to radically innovate. *See* Jonathan M. Barnett, *Is Intellectual Property Trivial?*, 157 U. PA. L. REV. 1691, 1736–37 (2009) ("[L]arge firms tend to undertake low-risk, incremental innovation projects that preserve market share while small firms tend to undertake high-risk, radical innovation projects that seek to capture market share.").

[180] *See generally* Lemley & Shapiro, *supra* note 75 (discussing some of the problems associated with

Shapiro, and Justice Kennedy fall prey to the assumption that patent remedies should mirror traditional private law remedies, they mistakenly conclude that injunctions should still be generally available to practicing entities.[181] Rather, their arguments against issuing injunctions to NPEs are often just as applicable to practicing entities.[182]

Second, in many contexts, the patent system provides excessive incentives to generate needed R & D and commercialization activity.[183] For example, the costs of invention and commercialization in the software industry are far below those in the pharmaceutical industry.[184] Yet, the duration of software and pharmaceutical patents are exactly the same (indeed, in practice, software patents last longer),[185] and—at least in rough conceptual terms—the scope of software patents often exceeds the scope of pharmaceutical patents.[186] If the broad scope and long duration afforded

providing injunctive relief to patentees). As an important point of clarification, Lemley would effectively treat an NPE that exclusively licenses a patent as a practicing entity, since the NPE essentially stands in the shoes of the sole practicing entity from a market perspective. *See* Lemley, *supra* note 6, at 673.

181 *See infra* Part III.B.

182 *See id.*

183 *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1058–65 (2005) (positing that providing patents with the full social value of an invention would often result in overcompensation); *see also* Vincenzo Denicolò, *Do Patents Over-Compensate Innovators?*, 22 ECON. POL'Y 679, 713 (2007) (proposing a model to determine whether patent owners are overcompensated by comparing profit ratios to the elasticity of the supply of inventions); *cf.* Peter S. Menell, *The Challenges of Reforming Intellectual Property Protection for Computer Software*, 94 COLUM. L. REV. 2644, 2646 (1994) ("Excessive protection for first generation innovation can impede later stages, thereby undermining some of the salutary effects of strong intellectual property protection.").

184 *See* Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1581–82 (2003) (noting that R & D costs for software are considerably lower than those for pharmaceuticals); Gregory N. Mandel, *Will America Reinvent Itself? Patent Reform in 2011*, BUS. L. TODAY, Aug. 2011, at 1, 2 ("Developing a new drug or biologic routinely takes a decade or more, costs hundreds of millions or billions of dollars, and often requires testing hundreds of alternatives or compounds . . . . New software applications can be produced on much shorter time scales and for a much more limited investment . . . ."); *see also* PETER TOLLMAN ET AL., THE BOS. CONSULTING GRP., A REVOLUTION IN R&D: HOW GENOMICS AND GENETICS ARE TRANSFORMING THE BIOPHARMACEUTICAL INDUSTRY 12 (2001) (estimating that the cost to discover, develop, and commercialize each patented drug is about $880 million); Shanling Li et al., *Why Do Software Firms Fail? Capabilities, Competitive Actions, and Firm Survival in the Software Industry from 1995 to 2007*, 21 INFO. SYS. RES. 631, 642–43 tbl.1 (2010) (surveying 870 publicly owned software companies and finding that average R & D expenditures per company were approximately $27 million annually).

185 *See* Emily Michiko Morris, *The Myth of Generic Pharmaceutical Competition Under the Hatch-Waxman Act*, 22 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 245, 266–67 (2012) (noting that the effective patent term for pharmaceuticals, even with patent term restoration under the Hatch-Waxman Act, is fourteen years while the effective term for non-pharmaceutical patents is eighteen-and-a-half years); *see also* Daniel R. Cahoy, *An Incrementalist Approach to Patent Reform Policy*, 9 N.Y.U. J. LEGIS. & PUB. POL'Y 587, 648 (2006) (arguing that the effective patent term for software patents is too long and for pharmaceutical patents is too short).

186 *See* Emily Michiko Morris, *Res or Rules? Patents and the (Uncertain) Rules of the Game*, 18 MICH. TELECOMM. & TECH. L. REV. 481, 498–99 (2012) (stating that the scope of software patents is defined more by concepts than by physical or functional structures, unlike chemical patents,

software patents is unnecessary to incentivize innovation in that industry, then the rewards provided by the patent system are excessive.[187] This result can create windfalls for innovators, which in turn can foster needless consumer deadweight losses, particularly when (1) the patentholder enjoys the ability to price its patented goods over the competitive price,[188] or (2) when multiple parties needlessly duplicate R & D in "racing" for an excessive patent prize.[189]

Third, when reasonable minds differ over whether a given patent is infringed, valid, or enforceable, it may be economically efficient for third parties to forgo large transaction costs in negotiating a license, choosing instead to infringe.[190] Like the theory of efficient breach in contract law,[191] I have posited that "efficient infringement" can occur when the transaction costs of negotiation dwarf the value of the innovation at issue, which can result when there is large uncertainty in the underlying patent rights or simply when the economic value of the innovation is fairly

whose scope corresponds only to a limited number of chemical structures); *see also* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 843 (1990) (explaining that effective patent scope depends on the type of technology at issue).

187 *See* Burk & Lemley, *supra* note 184, at 1687 ("While most biotechnological and chemical inventions require broad patent protection because of their high cost and uncertain development process, the opposite is true in the case of software development. Software inventions tend to have a quick, cheap, and fairly straightforward post-invention development cycle."); Linda R. Cohen & Roger G. Noll, *Intellectual Property, Antitrust and the New Economy*, 62 U. PITT. L. REV. 453, 469 (2001) (arguing that software patents provide excessive protection); Richard R. Nelson, *Intellectual Property Protection for Cumulative Systems Technology*, 94 COLUM. L. REV. 2674, 2674 (1994) (arguing for a moderate protection scheme to meet the protective needs of the software industry).

188 WILLIAM D. NORDHAUS, INVENTION, GROWTH, AND WELFARE: A THEORETICAL TREATMENT OF TECHNOLOGICAL CHANGE 76 (1969) (describing a model for determining an optimal patent term by balancing increased incentives for innovation against greater deadweight losses); Jonathan M. Barnett, *Private Protection of Patentable Goods*, 25 CARDOZO L. REV. 1251, 1269 (2004) (noting that a patent's social costs include "supracompetitive pricing power exerted by the patent holder (or, more specifically, the deadweight loss resulting from the patent holder's output restrictions)").

189 *See* SUZANNE SCOTCHMER, INNOVATIONS AND INCENTIVES 112–13 (2004) (discussing that broad intellectual property rights can incite "races" for patents, resulting in duplicated costs from different inventors expending time and money to achieve the same goal inefficiently); Partha Dasgupta & Joseph Stiglitz, *Uncertainty, Industrial Structure, and the Speed of R&D*, 11 BELL J. ECON. 1, 11–14 (1980) (describing how parties engage in duplicative R & D in a monopolistic controlled market in a race to attain the monopoly pricing prize); Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 308 (1992) ("The defect in the system is that if multiple inventors expend resources in competition for the patent monopoly, the benefit to society of having the invention will be dissipated by the cost of numerous, redundant, development efforts."); *see also* Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 252 n.14 (1994) ("A further aspect of rent seeking beyond unnecessary duplication of R&D expenditures is that the race for the patent will cause R&D expenditures to be made at a faster than optimal rate.").

190 *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 557–58 (developing the concept of "efficient patent infringement").

191 *See* Ian R. Macneil, *Efficient Breach of Contract: Circles in the Sky*, 68 VA. L. REV. 947, 950–53 (1982) (positing that "efficient breach" is efficient when the transaction costs of renegotiating the contract outweigh the transaction costs from breach).

minimal.[192] In these situations, it may be optimal to deviate from make-whole remedies in order to foster efficient infringement.[193]

On the other hand, although full compensatory damages may be excessive in the three situations described above, there are at least two other situations in which compensatory damages may be *too low* to generate optimal innovation incentives. First, if detection of infringement is difficult, damages should be enhanced to compensate for undetected infringement—activity for which the accused infringer reaps profit but pays no reward to the patentee.[194] This condition should apply regardless of whether the infringer was "willful," unless the willfulness somehow increases the odds of non-detection. Second, if the private economic value of a patented innovation to a single patentee is substantially less than the social value of the innovation—so much so that the patentee has insufficient incentives to invest in R & D and commercialization to produce the innovation—then the patentee will need more reward than mere compensatory damages in the event of infringement.[195] However, this reward multiplier arguably should not be borne by the infringer—who, like the patentee, generally enjoys none of the greater social benefits of the innovation—but rather by society as a whole (for example, the government).[196]

B. Innovation-Centric Remedies in Practice

These theoretical nuances have important practical implications for patent law remedies. Instead of focusing on the substantive rule at issue—here, identifying those actions that should count as "patent infringement"—policymakers and scholars should also examine ways to adjust the manner of enforcement, judicial procedure, and remedies to achieve effective substantive aims. When the cost of particu-

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[192] *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 557–58.

[193] *Cf.* Sichelman, *Commercializing Patents*, *supra* note 133, at 345–47 (proposing a new "commercialization" patent that would grant an affirmative equitable right to make and sell a product that could infringe a traditional "invention" patent).

[194] *See* Michael Abramowicz, *A Unified Economic Theory of Noninfringement Opinions*, 14 FED. CIR. B.J. 241, 254 (2004) ("If infringers pay full damages, their conduct will be optimized, so if patentees will enforce their rights only some of the time, enhanced damages are appropriate, with the enhanced damages multiplier equal to the inverse of the probability of detection."); Roger D. Blair & Thomas F. Cotter, *An Economic Analysis of Damages Rules in Intellectual Property Law*, 39 WM. & MARY L. REV. 1585, 1591 (1998) (remarking that damage multipliers may be necessary to compensate for low detection levels).

[195] As I argue below, most patentees will not require the full social value of their invention to appropriately incentivize them. *See infra* Part III.B. However, there will surely be situations for which that is not so. *Cf.* Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 31 (1991) (arguing that the only way to ensure that socially desirable innovations are researched is to allow research firms to "collect as revenue all the social value they create"); Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 529 (2001) ("[I]ncentives to invest in research are inadequate because monopoly profits are less than the social surplus created by an innovation.").

[196] *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 526; *see also* Taylor, *supra* note 6, at 133 (discussing whether reasonable royalties should reflect the value to the patent owner, the infringer, or society as a whole).

larized substantive rulemaking is high, as in the case of patent law,[197] particularized enforcement, procedure, and remedies may provide a better route for achieving optimal outcomes.[198]

Unfortunately, modifying enforcement approaches has generally been overlooked as a means for compensating for defects in the primary substantive law at issue.[199] Most analytical treatments of enforcement emphasize its costly nature and concern various mechanisms for increasing compliance while maintaining or reducing administrative costs.[200] In these models, if enforcement were costless, the ideal approach would be to punish legal actors for every violation of the law in order to ensure 100% compliance.[201]

However, Ian Ayres and Paul Klemperer have offered an alternative model,[202] extended by me in other work,[203] in which *the aim of enforcement is less than 100%*

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[197] Patent law is rife with industry variation in the economics of innovation incentives, but Congress and the courts have had difficulty in substantially differentiating the law for specific industries. Alan Devlin, *Patent Law's Parsimony Principle*, 25 BERKELEY TECH. L.J. 1693, 1707 (2010) ("[B]ecause it is so difficult to determine why particular inventors innovate, patent law has typically declined to incorporate inventor- or even industry-specific principles into its doctrine. Instead, the patent laws generally operate on a 'one-size-fits-all' basis, attempting to spur optimal levels of innovation through the provision of largely uniform reward structures." (footnotes omitted)). Burk and Lemley argue that patent law is effectively differentiated in application. *See* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?* 17 BERKELEY TECH. L.J. 1155, 1156–57 (2002) (discussing the fact that general legal standards lead to diverse results in different technology areas such as software and pharmaceuticals); Burk & Lemley, *supra* note 184, at 1577 ("[D]espite the appearance of uniformity, patent law is actually as varied as the industries it seeks to foster."). However, such differentiation is ultimately constrained by patent law's textual uniformity and cannot achieve fully efficient differentiation. *See* Clarisa Long, *Our Uniform Patent System*, FED. LAW., Feb. 2008, at 44, 48 ("At present, the patent statute does provide for some technology-specific variation and exempts certain groups from liability, but these are the rare exceptions rather than the rule.").

[198] *Cf.* Leandra Lederman & Ted Sichelman, *Enforcement as Substance in Tax Compliance*, 70 WASH. & LEE L. REV. 1679, 1747–49 (2013) (contending that tailoring enforcement rates by industry and product markets can sometimes reduce deadweight losses and other social costs resulting from taxation more efficiently than modifying the substantive tax law).

[199] *See id.* at 1681 ("Scholars often assume that perfect enforcement of the laws, though unrealistic, is the ideal, and have focused on achieving the highest level of compliance possible at the lowest cost.").

[200] *Id.*; *cf.* Gary S. Becker & George J. Stigler, *Law Enforcement, Malfeasance, and Compensation of Enforcers*, 3 J. LEGAL. STUD. 1, 1 (1974) ("Both the normative and positive approaches to legislation, however, generally have taken enforcement of laws for granted, and have not included systematic analyses of the cost of enforcing different kinds of laws.").

[201] Lederman & Sichelman, *supra* note 198, at 1690–93; *see also* Blair & Cotter, *supra* note 37, at 1619 ("In order to deter infringement, we must have a set of rules that renders an infringement unprofitable."); Blair & Cotter, *supra* note 12, at 9 (assuming that infringement will necessarily reduce "incentive[s] to innovate" below the optimal level).

[202] Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 MICH. L. REV. 985, 989 (1999) ("[T]his Article shows that a regime with some uncertainty and delay can produce this reward more efficiently than a regime in which enforcement is instantaneous and certain.").

[203] *See* Ted Sichelman, *Quantum Game Theory and Coordination in Intellectual Property* 5 (San Diego Legal Studies, Working Paper No. 10-035, 2010), *available at*

compliance.[204] Specifically, these works show that imperfect, probabilistic enforcement of a patent may result in welfare outcomes superior to ironclad enforcement.[205] Such a counterintuitive goal is justified when the applicable substantive rule generates substantial unnecessary costs—for example, deadweight losses and duplicated development—and these costs cannot be easily remedied at the legislative level.[206] In these instances, modifying enforcement in the judicial or executive domains may significantly reduce the costs imposed by the substantive rule. If these modification costs are relatively low, then modifying enforcement or remedies to change the effect of a substantive rule may be a superior alternative to modifying the substantive rule directly via legislation or regulation.[207]

Nonetheless, allowing judges to tailor remedies so as to effectively modify the substantive law has potential downsides. First, it may threaten traditional separation of powers and related democratic concerns.[208] Nonetheless—and although Congress would need to provide the courts additional discretion to fully eliminate the make-whole approach—the courts have long retained a significant level of equitable discretion to fashion remedies in a manner that does not threaten democratic concerns.[209] Second, a system unmoored from make-whole remedies could raise innovation costs by increasing overall uncertainty.[210] On the other hand, in the next part of this article, I present the details of a modified approach that could substantially increase overall certainty.[211] Third, judges may not be sufficiently competent and knowledgeable to impose forward-looking damages in place of injunctions.[212] Partially agreeing with this line of critique, I have advocated—and further explicate here—a near-term regime whereby traditional remedies are essentially kept intact

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http://ssrn.com/abstract=1656625 (extending the Ayres and Klemperer model to the context of patent races).

204 *See* Ayres & Klemperer, *supra* note 202, at 994–1000 (exploring the potential benefits of a patent regime in which remedies for infringement are awarded only a fraction of the time); Sichelman, *supra* note 203 (expanding and analyzing the Ayers and Klemperer model using a variant of quantum game theory).

205 *See* Ayers & Klemperer, *supra* note 202, at 994–1000 (demonstrating "how uncertainty and delay can produce higher welfare than an 'idealized' patent regime"); Sichelman, *supra* note 203, at 14–20 (same).

206 *See infra* Part III.C.1; Burk & Lemley, *supra* note 184, at 1635 ("[R]ewriting the patent law for each industry would involve substantial administrative costs and uncertainties.").

207 *See* Lederman & Sichelman, *supra* note 198, at 1685 (proposing a regime of "measured enforcement" wherein the government intentionally engages in imperfect enforcement so as to reduce deadweight losses from taxation).

208 *See id.* at 1738–39 ("Legislation usually involves public bills and rulemaking often involves notice to the public with an opportunity to comment, while enforcement generally has neither of these aspects.").

209 *Cf. id.* at 1736 (noting that enforcement agencies have historically enjoyed broad discretion).

210 *See id.* at 1732–33.

211 *See infra* Part IV.

212 *See* Thomas F. Cotter, *Make No Little Plans: Response to Ted Sichelman, Purging Patent Law of "Private Law" Remedies*, 92 TEX. L. REV. SEE ALSO 25, 33 (2014) (discussing a variety of potential practical problems with jettisoning traditional approaches to patent law remedies); *see also* Lederman & Sichelman, *supra* note 198, at 1734–35 (discussing similar issues in the context of agency expertise).

for most situations, but are jettisoned in those cases that clearly lead to inefficient results.[213] However, I propose a long-term regime in which remedies in all cases are fashioned with an eye towards optimizing innovation incentives.[214] As the next Part illustrates, adding "innovation factors" to the mix of existing *Georgia-Pacific* factors helps accomplish both these near-term and long-term ends.

IV. Adding Innovation Factors to the *Georgia-Pacific* Test

As noted earlier, the *Georgia-Pacific* factors are not mandated by statute, and courts have recognized that additional factors may be relevant. In this Part, I first propose three additional "innovation" factors—plus a fourth factor that is a modified version of an earlier proposal by Chris Seaman—not only to better align reasonable royalties with overall innovation incentives, but to make the *Georgia-Pacific* test more consistent, accurate, and coherent.[215]

Following this discussion, I address whether the Patent Act would need to be amended to implement my proposal, and conclude that the answer is "no."[216] This is true so long as these factors are implemented so as to provide a more faithful estimate of what the patentee would have been entitled to in the private market prior to the commencement of infringement. However, notwithstanding potential textualist arguments in favor of jettisoning the *status quo ante* approach entirely, in view of the long-historical pedigree of make-whole remedies, using innovation factors to deviate from such an approach should be authorized by Congress.[217] This conclusion leads to a two-staged implementation of the innovation factors—in the near-term, to more accurately determine the result of the hypothetical negotiation under the *Georgia-Pacific* test, and in the long-term, as the primary factors driving reasonable royalty determinations, even if that means deviating from make-whole damages.[218]

A. Proposing Three New Innovation Factors (Plus Modifying a Previous Proposal)

1. R & D, Commercialization, and Opportunity Costs

a. Costs and Incentives in Technological R & D and Commercialization

When a technology firm needs to invest substantial capital during the R & D or commercialization process, the firm will generally conduct a return-on-investment (ROI) analysis to determine if the investment is sensible.[219] Such an analysis will

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213 *See infra* Part IV.A.
214 *See infra* Part IV.B.
215 *See* Seaman, *supra* note 34, at 1667–68; *infra* Part IV.A.
216 *See infra* Part IV.B.
217 *See id.*
218 *See infra* Parts III.A-B.
219 *Cf.* Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 623 (1984) ("No one will invest in costly information if he cannot earn a return on it.").

consider all of the costs—including the opportunity costs of investing the capital elsewhere—and potential revenue streams that result at the end of the R & D or commercialization process.[220] Although a variety of methods (e.g., discounted cash flow, options valuation) may be used to perform the calculations—the question is always the same: Is the investment cost-justified?[221]

Third-party competition, particularly free-riding, will generally diminish the net benefit of an investment in technological R & D or commercialization.[222] Patents, by design, suppress such competition by providing their holders with rights to exclude third parties from making, selling, and using the claimed invention.[223] Thus, if patents are to perform their function, they must—along with other barriers to entry—suppress competition sufficiently so that the innovator can earn a suitable return on investment.[224]

Oddly, although courts implementing the *Georgia-Pacific* test often inquire as to whether the prospective infringer-licensee would earn a profit under a given royalty rate, they almost never inquire whether the patentee-licensor would earn such a profit.[225] However, assuming the invention offers substantial incremental value relative to alternatives—a consideration explored in the next sub-section—and if patent law is to achieve its goal, it must ordinarily ensure the royalty rate provides a profit sufficient to generate appropriate innovation incentives.[226]

One way to ensure this result is to examine the actual costs—R & D, commercialization, and related opportunity costs—of the invention at hand.[227] R & D costs include the proportionate amounts for wages and benefits given to employees and consultants who work on the patented invention, as well as the amounts for materials, equipment, and facilities that can be allocated to work on the patented inven-

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220 *See* Rita Gunther McGrath & Atul Nerkar, *Real Options Reasoning and a New Look at the R&D Investment Strategies of Pharmaceutical Firms*, 25 STRATEGIC MGMT. J. 1, 3–7 (2004).

221 *See* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 276–77 (1977) (analyzing the role of patents in facilitating investment in innovative activity).

222 *See* Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX. L. REV. 503, 537 (2009) ("If the investment required to develop and commercialize an invention is significant and—like the initial research—vulnerable to free-riding imitators, then patent protection becomes increasingly important for the results of both high- and low-risk research projects.").

223 *See* Christopher R. Leslie, *The Anticompetitive Effects of Unenforced Invalid Patents*, 91 MINN. L. REV. 101, 115 (2006) ("[O]ur patent system attempts to strike a balance between encouraging innovation and suppressing competition.").

224 *See id*.

225 *See supra* Part II (explaining the factors used under the *Georgia-Pacific* test).

226 *See* Leslie, *supra* note 223.

227 *Cf.* Glynn S. Lunney, Jr., *E-Obviousness*, 7 MICH. TELECOMM. & TECH. L. REV. 363, 412 (2001) (suggesting that the grant of a patent, in contrast to damages, occur "only [for] those desirable inventive efforts that would not earn sufficient innovation rents in the absence of a patent"); Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1597 (2011) ("Under a rigorously enforced inducement standard, patents would cover only those innovations that otherwise would not be created or disclosed."). *See also* John M. Golden & Karen E. Sandrik, A Restitution Perspective on Reasonable Royalties 34 (Aug. 15, 2016) (working paper) (on file with author) (arguing that patent damages should follow a restitution approach, which would take into account innovation costs in determining awards).

tion.[228] Importantly, these costs should only reflect the direct amounts spent to perform R & D on the patented invention.[229] This ensures that these amounts are incremental relative to costs incurred for other inventions or other activities of the firm. Similarly, commercialization costs include those costs incurred by the patentee (or an exclusive licensee) for non-R & D activities, such as marketing, market testing, clinical and safety testing, pricing analysis, and other costs directly related to transforming the invention into a commercial product.[230] As I discuss below, commercialization activity that arguably would have been undertaken absent patent protection should be excluded from these costs.[231] Although just how much commercialization is dependent on patenting is controversial among commentators; in any event, for most patentees subject to reasonable royalty analysis, commercialization costs will be little to nothing, as these patentees tend to be non-practicing entities (NPEs).[232]

Last, opportunity costs generally refer to revenues the firm could have earned had it not undertaken the R & D and commercialization of the patented invention.[233] In essence, opportunity costs help to set an appropriate return on investment for a given expenditure of R & D and commercialization costs.[234] In this sense, given that invested capital includes investment not only in successful projects that result in patented inventions that are ultimately infringed by others, but unsuccessful projects, both the costs of successes and failures related to a particular problem the patented invention seeks to solve must be included in overall costs, so as to determine an ap-

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[228] *See* MELVIN SIMENSKY & LANNING G. BRYER, THE NEW ROLE OF INTELLECTUAL PROPERTY IN COMMERCIAL TRANSACTIONS 72 (1994). In this instance, R & D costs would also include any costs for securing patent protection and commercialization costs would include any costs incurred in attempting to license the patent.

[229] *Cf.* Lemley & Shapiro, *supra* note 75, at 1994 ("[O]ur goal is to make sure that the reward patent owners can reap bears some reasonable relationship to the value of the ideas they contribute . . . .").

[230] *See* Sichelman, *Commercializing Patents*, *supra* note 133, at Part I, 347 (discussing the variety of stages in transforming an invention into a viable commercial product); Ted Sichelman, *Taking Commercialisation Seriously*, 33 EUR. INT. PROP. REV. 200 (2011) (explaining the importance of commercialization concerns in intellectual property law).

[231] *See infra* Part IV.B.

[232] *See* Sichelman, *Commercializing Patents*, *supra* note 133, at Part II (discussing various scholarly views on the role patents play in commercialization).

[233] *See* J. Gregory Sidak, *Bargaining Power and Patent Damages*, 19 STAN. TECH. L. REV. 1, 21 (2015) (explaining an economic theory in the context of reasonable royalties, Sidak defines opportunity costs as "the highest valued opportunity necessarily forsaken" or "[t]he highest net benefit of all opportunities forgone . . . of a chosen course of action") (citations omitted).

[234] *See* Sebastian Zimmeck, *A Game-Theoretic Model for Reasonable Royalty Calculation*, 22 ALB. L.J. SCI. & TECH. 357, 402 (2012) (discussing opportunity costs in the context of patent damages). In this regard, although a patentee's innovation costs are "sunk" in any given case, the primary aim of patent damages is to provide appropriate signals to *future* researchers so as to incentivize innovation. *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 13 (2003) ("[A] firm is less likely to expend resources on developing a new product if competing firms that have not borne the expense of development can duplicate the product and produce it at the same marginal cost as the innovator; competition will drive price down to marginal cost and the sunk costs of invention will not be recouped.").

propriate level of opportunity costs, and hence return on investment.[235] In simplest form, suppose an innovative firm invests $10 million in R & D and patent-driven commercialization costs over a set of successful and unsuccessful projects to acquire the patents-in-suit. If that firm requires an internal rate of return of 30% to perform such projects over time, then in a very rough sense, patent damages should roughly be $13 million.[236]

Such an inquiry into these additional innovation factors serves two important functions in achieving optimal innovation incentives. First, for inventions that do provide significant advantages over the next best alternative—assuming that value is substantially greater than actual R & D and commercialization costs to produce the invention—then the aggregate of these costs (less any applicable revenues realized by the patentee) sets a rough floor of potential damages across all infringers, even under the hypothetical negotiation.[237] Barring other means of recouping investment, the level of these costs specifically aids in eliminating royalty rates that are far too low to achieve optimal incentives. Second, although opportunity costs are often difficult to determine—even in industries with massive rates of failure (e.g., pharmaceuticals)—there are reasonable upper limits to such costs.[238] Thus, reasonable opportunity costs also aid in eliminating royalty rates that are far too high relative to what is sufficient to achieve optimal incentives.

In this manner, evidence of R & D, commercialization, and opportunity costs would work to set a range of "reasonable royalties" in view of additional evidence relating to the other factors of the *Georgia-Pacific* test. On this approach, these innovation factors would tend to constrain the often widely disparate estimates proffered by the parties in damages disputes.[239] As courts become more expert in developing rules to consistently and accurately determine such costs, especially

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[235] *See* Damien Geradin & Anne Layne-Farrar, *Patent Value Apportionment Rules for Complex, Multi-Patent Products*, 27 SANTA CLARA COMPUTER & HIGH TECH. L.J. 763, 781–82 (2011) (arguing that, in the context of royalty rates, sole consideration of "R&D costs directly linked to the development of a given technology would be under-inclusive as innovative firms usually have to engage in dozens of research projects to develop one successful technology[,]" thus "costs of failed projects would thus have to be taken into account"); Brennan, Kapczynski, Monahan & Rizvi, *supra* note 20, at 316 ("Protecting incentives to innovate and reasonably compensating patentees, we think, also requires courts, where possible (*i.e.*, where the patentee is able to put forth credible evidence on the point) to compensate patentees not just for R&D expenditures but also the *risk* associated with those expenditures.").

[236] Although internal rates of return will vary by project for a given firm and from firm-to-firm and industry-to-industry, they are unlikely to vary so widely as to render such calculations too uncertain for adjudicative fact-finding. *See supra* note 140 and accompanying text. This is particularly so when compared to the uncertainty present in determining appropriate royalty rates under the *Georgia-Pacific* test. *See supra* Part II.B.

[237] Thus, to the extent the patent has been licensed, any net revenue from licensing should reduce the amount of total potential damages.

[238] *See infra* Part IV.

[239] *See* Scherling & Sullivan, *supra* note 140 and accompanying text.

opportunity costs—as I explain in more detail below—these factors could play a more central role in damages determinations to better promote patent law's aim.[240]

b. The Practicalities of Assessing Innovation Costs

The above discussion begs the question of whether R & D, commercialization, and opportunity costs can be measured accurately enough for these purposes.[241] The pharmaceutical industry presents a strong example that such measurement is indeed feasible. Specifically, the pharmaceutical industry has created a standard R & D and commercialization paradigm for the drug development process.[242] Drug discovery and development proceed along a well-documented sequence of phases and activities.[243] Using retrospective cost accounting from survey data from multiple pharmaceutical companies, the average cost at each pre-clinical and clinical phase can be calculated.[244] Not only can the cost of each stage of development be calculated, but the probability of entering into the next stage can be determined as well, which can provide some measure of risk and related opportunity costs.[245]

As noted earlier, costs for failed inventions may substantially increase effective R & D costs for successful inventions.[246] Along with technical risks, a variety of drivers of out-of-pocket and opportunity costs are measured in the pharmaceutical industry, including cash outlays, approval and development times, and the cost of capital.[247] A variety of methods can be used to incorporate risk into the financial assessment of a particular project.[248] The result is a quantified probability of success and risk-adjusted cost for each development phase.[249]

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240 *See infra* Part IV.B.

241 *See* Golden & Sandrik, *supra* note 227, at 34 ("Cost measurement can raise difficult accounting questions and could encourage manipulation of accounts simply for the purpose of making patent protection more effective.").

242 *See* Joseph A. DiMasi et al., *Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs*, 47 J. HEALTH ECON. 20, 21 (2016).

243 *See id*.

244 *See id.*; Steve Morgan et al., *The Cost of Drug Development: A Systemic Review*, 100 HEALTH POL'Y 4, 6 (2011).

245 *See* DiMasi, *supra* note 242, at 23; Joseph A. DiMasi et al., *The Price of Innovation: New Estimates of Drug Development Costs*, 22 J. HEALTH ECON. 151, 166 (2003) [hereinafter DiMasi et al., *The Price of Innovation*]. Although the DiMasi studies have been criticized as inflating overall innovation costs for pharmaceutical development, the potential variance in accurate estimates is far less than variance in expert testimony on appropriate royalty rates in typical *Georgia-Pacific* determinations. *See supra* note 140 and accompanying text; *infra* note 266 and accompanying text.

246 *See* DiMasi, *supra* note 242, at 28.

247 *See id.*; Jeffrey J. Stewart et al., *Putting a Price on Biotechnology*, 19 NAT. BIOTECHNOLOGY 813, 815 (2001).

248 *See id.*; WILLIAM SCHMEISSER ET AL., INNOVATION PERFORMANCE ACCOUNTING: FINANCING DECISIONS AND RISK ASSESSMENT OF INNOVATION PROCESSES 92 (2010).

249 SCHMEISSER ET AL., *supra* note 248, at 92. In this regard, risk should also capture reasonable levels of risk aversion. *Cf.* Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 69 (1992) (arguing that the nonobviousness requirement may deter large-scale R & D projects "where initial experimentation is very costly" because it fails to sufficiently account for risk aversion among inventors and their firms).

The analysis can become even more fine-grained. By calculating what the R & D costs would have been if a single parameter was changed, pharmaceutical firms can run sophisticated analyses of the sensitivity of costs to various internal and external conditions.[250] Because the percentage of failed inventions has been measured at each stage of development, the percentage of R & D costs representing these failures can be calculated.[251] Similarly, the category of the invention can be used to assess R & D costs.[252] Specifically, the costs by therapeutic category and by expenditures for new drugs or already-approved drugs can be further determined from survey data.[253]

In addition to the R & D phase, commercialization efforts have a strong, positive effect on product performance.[254] In the pharmaceutical industry, commercialization costs includes the costs of drug approval as well as post-approval research and marketing.[255] Marketing costs specifically are measured by looking at the advertising-to-sales ratios.[256] Advertising entails spending on print media, radio, television, billboards, and the costs of sales representatives.[257] These costs can also be estimated by utilizing pre-approval R & D estimates together with aggregate pharmaceutical industry data regarding the development and marketing process.[258]

Although some opportunity costs are calculated in the aforementioned approaches, it is still necessary to determine full opportunity costs in order to choose among various technological projects.[259] Opportunity costs reflect what R & D expenditures might be worth if they were invested elsewhere.[260] In the pharmaceutical industry, estimations of opportunity costs begin with out-of-pocket costs and the duration of development.[261] Specifically, duration is estimated from the average phase lengths and average gaps or overlaps between successive clinical phases.[262] The average pharmaceutical firm weighted cost of capital for the time period is used as a

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250 SCHMEISSER ET AL., *supra* note 248, at 92.

251 *See id.* at 22.

252 *Cf.* Burk & Lemley, *supra* note 184, at 1581 ("[T]he cost of R&D varies widely from industry to industry and from innovation to innovation.").

253 *Id.*; Steve Morgan et al., *The Cost of Drug Development: A Systemic Review*, 100 HEALTH POL'Y 4, 10 (2011).

254 Bou-Wen Lin et al., *R&D Intensity and Commercialization Orientation Effects on Financial Performance*, 59 J. BUS. RES. 679, 684 (2006).

255 Ernest R. Berndt, *The U.S. Pharmaceutical Industry: Why Major Growth in Times of Cost Containment?*, 20 HEALTH AFF. 100, 109–10 (2001).

256 *Id.* at 110.

257 *Id.*; Marc-André Gagnon & Joel Lexchin, *The Cost of Pushing Pills: A New Estimate of Pharmaceutical Promotion Expenditures in the United States*, 5 PLOS MED. 29, 30 (2008).

258 DiMasi et al., *supra* note 242, at 26.

259 *See id.*

260 Michael Dickson & Jean Paul Gagnon, *Key Factors in the Rising Cost of New Drug Discovery and Development*, 3 NAT. REVS. DRUG DISCOVERY 417, 425 (2004).

261 Joseph A. DiMasi, *R&D Costs and Returns by Therapeutic Category*, 38 DRUG INFO. J. 211, 213 (2004).

262 DiMasi et al., *The Price of Innovation*, *supra* note 245, at 164.

discount rate.[263] By including these opportunity costs, the full economic cost of developing a drug is measured.[264]

Similar methods of valuation to those in the pharmaceutical industry presumably exist—or could be adopted—in other industries. To the extent particular components are patented, one would expect that patentees would have some fairly reliable method of allocating R & D costs to particular patented components, even after the fact.[265] Of course, one might be concerned that companies would have incentives to inflate documented costs relative to actual costs—similar to Masur's example of inflating royalty rates—but given tax, accounting, and related penalties from such inflation (at least as a general rule), arguably there are more constraints on estimating these costs than the values underlying the existing *Georgia-Pacific* factors.[266]

The same constraints allay the concern that adding innovation factors would do little to erase the circularity present in the existing *Georgia-Pacific* test. In contrast to royalty rates divorced from injunctions, R & D investments would depend largely on factors separate from the awards provided by courts. Specifically, because R & D expenditures involve out-of-pocket expenditures on inputs such as labor, materials, and the like, the cost of which is determined primarily by market prices independent of judicial decisionmaking, the value of these expenditures as reflected on a company's books would tend to be relatively accurate and reliable.[267] Opportunity costs, on the other hand, would not reflect actual out-of-pocket costs, and thus potentially could fall prey to circularity.[268] Yet, like R & D costs, there are external

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263 DiMasi, *supra* note 261.

264 *Id*.; *see also* Brennan, Kapczynski, Monahan & Rizvi, *supra* note 20, at 322–30 (presenting a calculation of a suitable return on R & D, including opportunity costs, for the development of drugs targeted at Hepatitis C).

265 *See generally* Leandro Canibano et al., *Accounting for Intangibles: A Literature Review*, 19 J. ACCT. LIT. 102, 113–15 (2000) (exploring a variety of methods for valuing R & D).

266 For instance, even critics of the DiMasi studies do not vary wildly—that is, by more than a factor of ten—in their estimates of the R & D and related costs of pharmaceutical innovation. *See* MARCIA ANGELL, THE TRUTH ABOUT THE DRUG COMPANIES: HOW THEY DECEIVE US AND WHAT TO DO ABOUT IT 40–41 (2005) (estimating that, in contrast to DiMasi et al.'s $802 million per new drug figure from 2003, the average maximum pre-tax cost was $265 million per new drug and additionally noting that Public Citizen found the number to be closer to $100 million); Donald W. Light & Rebecca N. Warburton, *Extraordinary Claims Require Extraordinary Evidence*, 24 J. HEALTH ECON. 1030, 1030–31 (2005) (explaining that the DiMasi costs are roughly two to four times higher than other estimates). *See generally* Theodore Sougiannis, *The Accounting Based Valuation of Corporate R&D*, 69 ACCT. REV. 44, 44–45 (1994) (discussing the R & D valuation literature).

267 As such, while government grants are a form of cost-based rewards for innovative activity, they differ considerably from the proposal here, which preserves the direct tie between innovation incentives and market signals. In this regard, the innovator in the approach proposed here is only rewarded with cost-based damages if a third-party infringes, which the third party will only do if it believes that the use of the invention will be profitable, thereby retaining strong incentives for innovators to generate market-worthy inventions. *See infra* notes 281–284 and accompanying text.

268 *Cf.* Jim Leitzel, *Reliance and Contract Breach*, 52 L. & CONTEMP. PROBS. 87, 87–88 (1989) ("The protection of reasonable reliance potentially involves circular arguments: Courts will protect the amount of reliance in which a reasonable person would engage, but a reasonable person would rely

constraints on opportunity costs that would substantially diminish, if not largely erase, any tendency to circularity. First, in most industries, it appears patents are not the primary, much less the sole, means of appropriating value from innovation.[269] This is so even for startup companies.[270] Thus, return of investment metrics would depend largely on mechanisms other than patent awards, at least in all but perhaps the pharmaceutical, medical device, fabless semiconductor, and effectively fabless wireless technology sectors.[271] Second, in these industries, *ex ante* licensing tends to be common, because search and notice costs tend to be much lower than other industries. If courts set opportunity costs too high, this would induce licensees to become inventors (or to find suitable alternatives), diminishing the profits of would-be licensors. Anticipating as much, licensors would price under the court-set rates, which would provide a feedback signal to the courts to lower their opportunity cost estimates. Thus, in equilibrium, in industries with low search and notice costs, the court-set rates should roughly reflect market rates in the long run.[272] So while some circularity would persist, arguably it would be substantially less than in the current system.

Unlike R & D costs, which are typically driven by patents or similar incentives,[273] not all commercialization costs need to be protected by patents or other bar-

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up to the extent that courts will protect.").

269 *See* WESLEY M. COHEN, RICHARD R. NELSON & JOHN P. WALSH, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* 3 (Nat'l Bur. Econ. Res., Working Paper No. W7552, Feb. 2000); Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 797 (1987).

270 Stuart J.H. Graham, Robert P. Merges, Pam Samuelson & Ted Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1312–14 (2009).

271 Ideally, one would determine the opportunity cost of engaging in R & D for a particular product—rather than an industry-wide, average opportunity cost—but industry-wide costs would form a useful starting point, and would constrain the level of product-level opportunity costs to reasonable amounts. *See* Brennan, Kapczynski, Monahan & Rizvi, *supra* note 20, at 309 (discussing the use of industry-based opportunity costs in the context of determining "reasonable" compensation of patentees when the government appropriates patented drugs).

272 One might be concerned that these constraints would not apply to inventions and related patents generated solely for assertion in litigation. As an initial matter, the number of such ab initio-assertion patents is probably not as high as generally believed. Many, if not most, NPE patents appear to originate with companies that are, were, or anticipated being practicing entities. *See* Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457, 485, 495–96 (2012). Additionally, presumably assertion-centric patents would have relatively low provable R & D and commercialization costs, plus fairly low opportunity costs, resulting in a low level of damages. Thus, while these patents might be subject to more circularity than others, the risk of substantial over- or under-compensation appears low. On the other hand, search, notice, and licensing costs could remain high for patents held by startups and independent inventors in these patent-intensive sectors, exacerbating circularity problems when determining opportunity costs. But, again, even these entities have tax, accounting, investment, and other constraints that would arguably lessen these problems, at least in comparison to the existing approach.

273 Though, again, in determining opportunity costs and corresponding risk premiums one would want to take into account other barriers to entry, such as trade secrecy, trademarks, and copyrights, and various incentives for R & D, such as grants, subsidies, tax credits, and the like. I thank Lisa Ouel-

riers to entry.[274] Indeed, some commentators argue that patents should play little to no role in commercialization efforts, at least outside of pharmaceuticals and related biomedical inventions required to undergo post-invention safety and efficacy testing.[275] Whatever the appropriate amount of commercialization needed to be spurred by patents, at least a sizeable share of these costs should not be taken into account in patent damages (and this applies to lost profits as well, illustrating the weakness of that approach).[276] It would be more ideal to have an approach that excludes commercialization costs for which patenting plays little role.[277] Of course, doing so would need to turn on a well-accepted theory of how patents affect commercialization, which is currently lacking. Nonetheless, perhaps all could agree that some categories of commercialization costs—particularly those turning on routine and fungible processes, such as delivery of the product, most packaging, and the like, could be removed from this category of costs.[278] In any event, taking into account the full slate of commercialization costs (and other costs) at worst sets an upper bound for reasonable royalties, which appears substantially better than the current state of affairs—particularly so for reasonable royalties, because (as noted earlier) most patentees subject to these damages are NPEs with little to no commercialization costs.[279]

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lette for this suggestion. In an article appearing in this volume, Ouellette insightfully addresses in detail how grants, subsidies, tax credits, and other alternative incentive mechanisms could be taken into account in setting patent damages, particularly in the cost-based approach presented here. Lisa Larrimore Ouellette, *Adjusting Patent Damages for Nonpatent Incentives*, __ TEX. INTELL. PROP. L.J. __ (2017). Because Ouellette's article was written well after this one, and given that I view her analysis as correct, I refrain from commenting on it here.

274 *See* Sichelman, *Commercializing Patents*, *supra* note 133, at Part II.

275 *See* Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129, 135–36 (2004); *see also* Ted Sichelman, *Markets for Patent Scope*, 1 IP THEORY 42, 44 (2010) (discussing a variety of scholarly views on the role patents should play in promoting commercialization efforts).

276 Ted Sichelman, *Commercializing Information with Intellectual Property*, 92 TEX. L. REV. *See also id.* at 35, 44 (2014) (discussing potential limits to commercialization theory).

277 For instance, if there is wide demand to license a non-commercialized patent on a non-exclusive basis, this indicates that legal protection for commercialization activities is likely unnecessary. *Cf.* Ian Ayres & Lisa Ouellette, *A Market Test for Bayh-Dole Patents*, 102 CORNELL L. REV. 271, 275–76 (2017) (arguing that no damages should be awarded when a university patent stemming from federally funded R & D is licensed widely on a non-exclusive basis, thereby negating any commercialization rationale for the award of the patent).

278 *See generally* Sichelman, *Commercializing Patents*, *supra* note 133, at 352 (discussing the role of distribution in the commercialization process).

279 *See supra* note 171 and accompanying text. Some defendants have argued that the cost of acquiring a patent or portfolio should set an upper bound to the amount of damages collectible in litigation. For example, in a recent case an accused infringer argued to bar the request of a large patent aggregator, Intellectual Ventures, for over $300 million in licensing fees on the ground that it acquired the asserted patent for only $750,000. *See* Dan Levine & Tom Hals, *Exclusive: Intellectual Ventures Faces Novel Attack on Patent Business*, REUTERS, Oct. 29, 2013, http://www.reuters.com/article/us-intellectual-ventures-lawsuit-idUSBRE99S05120131029. However, these arguments differ from the ones here in that the appropriate level of R & D, commercialization, and opportunity costs should be determined *ex ante*, from the perspective of an innovator deciding whether to make an investment, rather than *ex post*, once the fate of the investment is known. Otherwise, incentives will be misaligned. Relatedly, as Tom Cotter has aptly explained,

Perhaps a more pressing concern is that if innovation factors become the focus of the reasonable royalty test, this would provide too great an incentive to engage in risky R & D and commercialization.[280] On this view, as long as the innovator produces some patented product or service that is significantly "better" than the state of the art, it is to some degree "guaranteed" that it will earn a suitable return on its investment regardless of its actual social value. Yet, a crucial assumption in this argument is that third parties actually infringe the patent on the product or service. As noted earlier, if the costs of infringement grow too large, and third parties are on notice of the patent, they will not infringe.[281] Of course, a large share of infringement is "accidental" in the sense that the infringer is unaware of the corresponding patents.[282] One response to this concern is that new forms of search technology—particularly those incorporating artificial intelligence—will soon make it much less costly to identify relevant patents.[283] Setting this aside, even for accidental infringers, one can still apply the existing principle that royalties should not be so high that the infringer cannot earn a profit after paying a reasonable royalty, both ameliorating the potentially harsh effects in such cases and reducing the concern of providing over-incentives.[284] Moreover, given that the private value of invention is often much less than the social value, erring on the side of spurring more R & D and commercialization would likely be beneficial.

In contrast, another potential concern with using the innovation factors is that the result would undercompensate certain types of innovative activity, such as "serendipitous" inventions, startup and independent inventor R & D, and low private-

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Patent Assertion Entities (PAEs) are a "type of intermediary or broker, providing a service and the spread between the price they buy and the price they sell is their compensation for that service. Plus, there's always some risk they won't get anything." *Id.*

280 In an article appearing in the same volume, Michael Abramowicz provides a perspicacious assessment of the costs and benefits of the cost-based approach presented here. Michael Abramowicz, *Cost-Plus Patent Damages*, __ TEX. INTELL. PROP. L.J. __ (2017). Because Abramowicz's article was written well after this one, and given that I view his analysis as mainly correct, I refrain from commenting on it here.

281 *See generally* Peter S. Menell & Michael J. Meurer, *Notice Failure and Notice Externalities*, 5 J. LEGAL ANALYSIS 1 (2013) (discussing notice costs in intellectual property).

282 *See* Christopher B. Seaman, *Willful Patent Infringement and Enhanced Damages After* In Re Seagate, 97 IOWA L. REV. 417, 421 (2012) ("Patent infringement 'is a strict liability offense,' and thus an accused infringer can be held liable for unintentional or accidental infringement.").

283 Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards For Defeating*, 19 BERKELEY TECH. L.J. 667, 710 (2004) ("[T]ext-based computer search technology makes it easier than ever for a patentee to find pertinent prior art publications and patents.").

284 *See* ROBERT A. MATTHEWS, JR., 4 ANNOTATED PATENT DIGEST § 30:93 (2017) ("Generally, a reasonable royalty rate resulting from the "hypothetical negotiation" calculus should leave the infringer with some expected profit based on the circumstances and expectations existing as of the date of the negotiation.") (citing cases). This effective cap on damages is also important for ensuring that infringers do not shoulder too large a portion of the entire cost-based reward due to a patentee, which should be spread across all direct users of the patented technology. Additionally, such a cap helps to prevent the undertaking of innovative activity that is unlikely (ex ante) to lead to, or has not (ex post) led to, a socially valuable invention, because the patentee by definition cannot collect damages on an unprofitable invention.

value but high social-value innovations.[285] The key response is that an innovator should only be rewarded the amount that precisely incentivizes the innovation, and no more or no less. In other words, patents are utilitarian in nature and—as the Supreme Court elucidated in 1858 in *Kendall v. Winsor*[286]—any private benefit that an inventor receives from a patent is merely a means to an end of providing a benefit "to the public or community at large."[287] Thus, the serendipitous, independent inventor who generates a new invention merely through a "flash of genius" without any large expenditure arguably should be awarded less than a large inventive team that toils for years with huge cash outlays. Such an approach ensures that innovators are sufficiently compensated without providing windfalls that needlessly raise deadweight losses.[288] With that said, the costs of the serendipitous inventor in preparing to occupy a place in which a "flash of genius" is likely to occur—such as investments in previous unsuccessful efforts, opportunity costs, and the like—should fully be taken into account.[289] Indeed, for high social-value inventions (whether serendipitous or not), one would want to err on the side of higher opportunity costs to sufficiently incentivize invention.[290]

2. The "Technological" Value of the Invention

Using innovation factors—such as R & D, commercialization, and opportunity costs—to assess an invention's value and, in turn, an appropriate level of damages is only sensible if the invention offers significant advantages relative to the next best alternative, particularly unpatented alternatives.[291] In the 1865 case *Suffolk Co. v. Hayden*,[292] the U.S. Supreme Court entertained a dispute in which the winning patentee proffered no evidence pertaining to lost profits or a clearly established roy-

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285 *See* Kapczynski et al., *supra* note 20, at 321-22 (discussing potential undercompensation concerns in a cost-based model of damages).

286 62 U.S. (21 How.) 322, 328 (1858).

287 *Id.* at 327–28.

288 *See* Brennan, Kapczynski, Monahan & Rizvi, *supra* note 20, at 321–22 (explaining how their approach to "reasonable" compensation in cases of government appropriation of patented inventions can substantially diminish deadweight losses).

289 Additionally, to the extent startups and independent inventors could not diversify risk through large patent portfolios—given the benefits of a diversified, "open innovation" system—presumably, opportunity costs should be increased in such a circumstance. *See* Michael J. Burstein, *Patent Markets: A Framework for Evaluation*, 47 ARIZ. ST. L.J. 507, 533 (2015) ("One of the benefits of a portfolio strategy is that it diversifies the cash flow returns from a large number of patents."); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 27, 37–41 (2005).

290 In this vein, the opportunity costs of engaging in litigation itself should be taken into account, so as not to provide incentives to forgo licensing in favor of litigation. Alternatively, one can accomplish as much via a rule that opportunity costs in litigation should not be discounted by any probability that the patent would be found to be non-infringed or invalid, though on an innovation-centric model, this could theoretically lead to overcompensation of the patentee. *See* Lemley & Shapiro, *supra* note 75, at 2019–20 (discussing whether "kickers" should be applied in the context of traditional reasonable royalty analysis).

291 *See supra* Part IV.A.

292 70 U.S. (3 Wall.) 315 (1865).

alty for the patent-in-suit, as was standard at the time.[293] However, the lower court allowed an expert to testify on a range of issues that were relevant to the jury's assessment of the patent's value.[294] The accused infringer appealed, contending that such evidence could not be used to impose damages, but the Supreme Court disagreed:

> There being no established patent or license fee in the case, in order to get at a fair measure of damages, or even an approximation to it, general evidence must necessarily be resorted to. And what evidence could be more appropriate and pertinent than that of the utility and advantage of the invention over the old modes or devices that had been used for working out similar results?[295]

Of particular note is the Court's reference to the "utility and advantage of the invention over the old modes or devices"[296] Unlike the *Georgia-Pacific* test, which ultimately attempts to recreate market negotiations, determining the marginal "utility and advantage of the invention" directly relates to the innovation-centered goals of the patent system.[297]

Nominally, the marginal utility of the invention is reflected in the factors of the *Georgia-Pacific* test, particularly factor nine, which states "[t]he utility and advantages over the patent property over the old modes or devices, if any, that had been used for working out similar results."[298] However, marginal utility is often disregarded in actual cases because it is too difficult to quantify.[299] Nonetheless, as noted earlier, several commentators have argued that this factor should be reinvigorated and that it should become the dominant concern in reasonable royalty analysis.[300] Most of these proposals do not suggest new methods that overcome the usual valuation difficulties in determining marginal utility. However, Chris Seaman has cleverly proposed that these difficulties can be overcome in many cases by using the following test: "when an acceptable noninfringing substitute for the patented technology exists, the cost of that substitute should serve as a 'ceiling' on a reasonable royalty."[301]

Such a formulation is certainly an improvement because it focuses on costs, which are much easier to measure, than the generic "marginal value."[302] However,

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293 *See id.* at 320.
294 *See id.* at 317.
295 *Id.* at 320.
296 *Id.*
297 *See supra* Part III.A; Taylor, *supra* note 6, at 91–95 (distinguishing between the value of patent "rights" and the value of the patented "technology").
298 Georgia-Pac. Corp. v. U.S. Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970).
299 *See* Durie & Lemley, *supra* note 36, at 637–39.
300 *See* Seaman, *supra* note 34, at 1711. Durie and Lemley make related arguments. *See* Durie & Lemley, *supra* note 36, at 628–29.
301 Seaman, *supra* note 34, at 1711.
302 *Id.* at 1721 (proposing a cost-focused alternative, arguing that "a reasonable royalty award should be effectively 'capped' by the sum of the cost to acquire an acceptable noninfringing substitute . . . ; the costs associated with implementing the substitute . . . ; and the marginal benefit, if any, conferred by the patented technology over the substitute . . . ").

this formulation still presents several difficulties. First, even admitting that imperfect substitutes can be "acceptable" alternatives—which is contestable—many patented products and components still do not have acceptable substitutes.[303] For instance, many pharmaceutical drugs are unique in their ability to treat certain diseases.[304] Perhaps more importantly, a much larger share of patented products and components do not have acceptable, *unpatented* substitutes.[305] If the substitute is patented, then Seaman's test will in many cases provide little to no aid in determining differential cost because one must engage in the same sort of reasonable royalty determinations to estimate the cost of *patented* substitutes.

Second, Seaman improperly assumes that inventions in the public domain are "available" at a "minimal" acquisition cost.[306] However, a mere invention is often not in a commercially useable form—rather, it exists as a design, prototype, or other pre-commercial embodiment that requires substantial cost to transform into an actual "available" substitute.[307] Additionally, many "substitute" inventions that may happen to exist somewhere in the world are relatively obscure because they are little used or not widely marketed.[308] To the extent a patentee's invention is widely used—and arguably an important aim of patent law is the dissemination of invention—then it would distort innovation incentives merely to allow an accused infringer to point to an obscure invention as an "available" substitute.[309] Indeed, it seems likely that when these considerations are taken into account, the true "availability" of unpatented substitutes decreases substantially.

An alternative approach would be simply to determine if there would have been viable noninfringing alternatives (patented or unpatented) for a substantially lower cost than the patented invention as a gating mechanism to using the innovation factors to determine ultimate damages. In this instance, it is not critical to determine an exact cost-differential relative to a substitute. Rather, if the gulf is wide, one can infer that the substitute was "available," which would massively discount the reasonable royalty of the patent-at-issue.[310] From there, the more reliable and

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303 *See* Blair & Cotter, *supra* note 164, at 19 (illustrating the difficulties in assessing adequate substitutes and suggesting there are instances where no adequate substitutes to a certain product exist).

304 Jerry A. Hausman et al., *Patent Damages and Real Options: How Judicial Characterization of Noninfringing Alternatives Reduces Incentives to Innovate*, 22 BERKELEY TECH. L.J. 825, 834–35 (2007) (describing a situation where there would be no available substitute "in the pharmaceutical industry because a patent may cover the chemical compound that causes a given drug to work").

305 Paul M. Janicke, *Contemporary Issues in Patent Damages*, 42 AM. U.L. REV. 691, 701 (1993) ("[U]npatented substitutes virtually never have all the attributes or desirable qualities that validly patented inventions do.").

306 Seaman, *supra* note 34, at 1719.

307 *See* Sichelman, *Commercializing Patents*, *supra* note 133, at Part I.

308 *Cf.* Paul Stoneman & Myung-Joong Kwon, *The Diffusion of Multiple Process Technologies*, 104 ECON. J. 420, 430 (1994) (finding that when nearly simultaneously invented technologies are more substitutes than complements, the less likely simultaneous adoption will occur).

309 *See* Sichelman, *Commercializing Patents*, *supra* note 133, at Part II (assessing the role patents should play in promoting commercialization, including dissemination, of inventions).

310 Moreover, to the extent innovation factors play a central role in reasonable royalty determinations, they could be used to better determine the cost of a *patented* substitute. *See supra* note 305 and ac-

accurate innovation factors—R & D, commercialization, and opportunity costs (as well as other reliable and accurate *Georgia-Pacific* factors) would be used to determine the exact level of reasonable royalty damages.[311] In any event, these criticisms should diminish the importance of examining the merit of the patented invention relative to alternatives existing at the time of infringement.

B. Implementing the Innovation Factors

1. Would the Patent Act Need to be Amended to Add Innovation Factors to the Georgia-Pacific Test?

Section 284 of the Patent Act states: "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 . . . ."[312] One immediate question is whether this language can countenance the addition of innovation factors, or the measurement of the technological value of the invention primarily by the innovation factors (rather than the value to end- or intermediate-users).[313]

As noted earlier, the phrase "adequate to compensate" has generally been interpreted to require make-whole damages that attempt to restore the patentee to the *status quo ante*.[314] Such an "expectation damages" approach[315] has been the norm

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companying text (discussing the difficulties in determining the costs of patented substitutes).

311 *See supra* Part IV.A.1; *see* Sichelman, *Purging Patent Law*, *supra* note 20, at 565 ("For instance, courts can hear evidence on R&D, testing, and commercialization costs (including the cost of failures); technological and market risk; increased profits versus baseline profits; the value of other patented components; the value of noninfringing alternatives; and so forth, in order to determine when injunctions and make-whole damages might lead to grossly excessive awards.").

312 35 U.S.C. § 284 (2012).

313 *Cf.* Landers, *supra* note 12, at 336 ("Although § 284 similarly mandates that the reasonable royalty award be that which is 'adequate to compensate for the infringement,' some courts have built a deterrence function into the reasonable royalty calculation that permits considerable upward movement from the market value of the use of the invention at the time of infringement.").

314 *See supra* Parts I.A, II. With that said, there are certainly limits on this principle, such as restrictions on recovering for lost sales of unpatented "convoyed" products, which nominally differentiate patent infringement from damages traditionally collectible in cases of intentional torts, like trespass. *See* Sheldon Nahmod, *Constitutional Damages and Corrective Justice: A Different View*, 76 VA. L. REV. 997, 1020–21 (1990) ("[T]he Restatement of Torts permits liability for all damage resulting from intentionally tortious conduct unless, through hindsight, the resulting harm appears extraordinary."); RESTATEMENT (SECOND) OF TORTS § 435b (AM. LAW. INST. 1965). However, foreseeability tends to be of little to no issue in most patent suits, effectively mirroring the rule for intentional torts. Additionally, to the extent patent damages partake of contract-like approaches to damages, nearly all contract claims contain some foreseeability limit on damages. *See* Nicola W. Palmieri, *Good Faith Disclosures Required During Precontractual Negotiations*, 24 SETON HALL L. REV. 70, 104 (1993) ("Damages for breach of contract are ordinarily restricted to those that were foreseeable and contemplated by the parties at the time of the contract's execution.") (citing Hadley v. Baxendale, 156 Eng. Rep. 145 (1854)). As such, these limits do not alter the essential make-whole character of patent damages as they exist today.

315 In contract law, expectation damages are based on the future expectations created by a promise made by one party to another. *See* 24 WILLISTON ON CONTRACTS § 64:2 (4th ed. 2016). The damages amount is that needed to make the injured party whole again, and no more or no less. *See id.*

even well before the U.S. Supreme Court explicitly authorized reasonable royalty awards in its 1915 decision in *Dowagiac Manufacturing Co. v. Minnesota Moline Plow Co.*,[316] in which the Court stated "in the absence of proof of lost sales or injury by competition, the only measure of damages was such sum . . . [that] would have been a reasonable royalty for the defendant to have paid" the patentee.[317]

In 1922, Congress explicitly incorporated this reasonable royalty test into the Patent Act.[318] In 1946, Congress further affirmed the make-whole approach by discarding the disgorgement remedy and explicitly using the phrase "reasonable royalty" in the Patent Act.[319] The 1952 Act used similar language to the 1946 Act,[320] and the 1952 Act's legislative history made clear that its "codification was not intended to make substantive modifications in the provisions relating to recovery."[321]

As such, to the extent that the innovation factors proposed earlier caused a fact-finder to deviate from the traditional *status quo ante* approach, this would arguably violate a faithful interpretation of the statute.[322] Although one could apply a textual argument to read "adequate to compensate" quite flexibly—for instance, so as to authorize reliance rather than expectation damages[323]—such an approach seems strained given that the Patent Act should be read in view of historical practice.[324] (Though, to be certain, the Supreme Court itself has engaged in such strained

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316 235 U.S. 641, 648 (1915).

317 *Id.* at 649. The Court derived its rule from lower court opinions, which in turn derived their rules from earlier opinions. *See id.* at 649 (quoting Hunt Bros. Fruit-Packing Co. v. Cassiday, 64 F. 585, 587 (9th Cir. 1894) (citing earlier cases)). One year earlier, the Sixth Circuit stated that in "instances where no market value [for the patent] existed and where no loss or impairment of sales can be definitely proved," the patentee can still recover "a 'reasonable royalty.'" U.S. Frumentum Co. v. Lauhoff, 216 F. 610, 616–18 (6th Cir. 1914). These lower court cases, in turn, relied on the Supreme Court's earlier decision in *Suffolk Co. v. Hayden*, authorizing damages in the absence of lost profits or an established royalty rate for the patent-in-suit. *See supra* notes 292-297 and accompanying text.

318 Act of Feb. 18, 1922, Pub. L. No. 67-147, 42 Stat. 389, 392 (codifying patent infringement damages as "the payment by the defendant to the complainant of a reasonable sum as profits or general damages for the infringement").

319 Act of Aug. 1, 1946, Pub. L. No. 79-587, 60 Stat. 778, 778 (granting a patentee "general damages which shall be due compensation for making, using, or selling the invention, not less than a reasonable royalty therefor, together with such costs, and interest, as may be fixed by the court").

320 Act of July 19, 1952, Pub. L. No. 82-593, 66 Stat. 792, 813 (granting a patentee "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").

321 Georgia-Pacific Corp. v. U.S. Plywood Corp., 243 F. Supp. 500, 521 (S.D.N.Y. 1965).

322 *See* Cotter, *supra* note 43, at 736 (arguing that one of the main principles in the law of patent damages "should attempt simply to restore the status quo ante—that is, to make the patentee neither worse nor better off than it would have been, but for the infringement").

323 *See infra* notes 329–30 and accompanying text (explaining the difference between expectation and reliance damages).

324 *See* Peter S. Menell, *Forty Years of Wondering in the Wilderness and No Closer to the Promised Land: Bilski's Superficial Textualism and the Missed Opportunity to Return Patent Law to Its Technology Mooring*, 63 STAN. L. REV. 1289, 1308–11 (2011) (describing the traditional, common-law approach to interpreting the Patent Act).

textualist interpretations of the Patent Act in recent years.[325]) On the other hand, to the extent that the innovation factors could be used to improve the accuracy of the current "hypothetical negotiation" standard of *Georgia-Pacific*—which, as noted earlier, has never been considered an exhaustive list of useable factors[326]—then these factors could clearly be added without transgressing statutory authority.[327] These conclusions naturally lead to a short-term and long-term strategy in modifying the *Georgia-Pacific* test.[328]

2. Near-Term and Long-Term Implementation: Towards Reliance Damages

In the short-term, as explained earlier, the innovation factors should be used to help cabin and ground the existing reasonable royalty determination.[329] Such a limited use would both adhere to statutory dictates and not strain judicial competence or resources, thereby increasing overall certainty and accuracy at relatively low cost (that is, compared with the current approach).[330] In this fashion, the innovation factors would to some degree serve as secondary "objective" factors for reasonable royalty determinations, akin to the secondary factors that help ground nonobviousness determinations.[331]

In the long-term, as courts, parties, and juries become more accustomed to using the innovation factors to determine reasonable royalties, Congress could amend the Patent Act so that these factors would become the focus on the *Georgia-Pacific* test, perhaps even replacing it, and in the least displacing the centrality of a "hypothetical negotiation" between willing licensor-patentee and licensee-infringer.[332] In

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[325] *See id.* at 1307, 1313 (describing the recent turn to textualist approaches to interpreting the Patent Act).

[326] *See supra* note 40 and accompanying text.

[327] *See* Cotter, *supra* note 43, at 740–41 (suggesting that courts may depart from the "status quo ante" language in Section 284 in some circumstances).

[328] *See infra* Part IV.B.2.

[329] *See supra* note 232 and accompanying text.

[330] *See supra* Part IV.B.1. Of course, this approach would not solve the problem of juries' competence being strained by the *Georgia-Pacific* test. *See infra* note 332 (suggesting alternative institutional approaches to determining patent damages).

[331] *See* Natalie A. Thomas, *Secondary Considerations in Nonobviousness Analysis: The Use of Objective Indicia Following KSR v. Teleflex* 86 N.Y.U. L. REV. 2070, 2073 (2011) ("Patent case law provides for the use of secondary-considerations evidence—also referred to as objective indicia of nonobviousness—to aid the obviousness inquiry.").

[332] *See supra* note 231. One might be skeptical of whether courts, especially juries, could ever implement such an approach. Although the same might be said for the *Georgia-Pacific* test, I have advocated elsewhere that for complex technical cases—be it patent, antitrust, environmental, or otherwise—courts could transform themselves into "judicial agencies," comprising a staff of permanent scientific, economic, and other experts to aid the court and jury with its decisionmaking. Another option would be to lodge such determinations in "rate setting"-like, executive-branch agencies—such as within the Commerce Department—subject to the usual notice and rulemaking requirements. *Cf.* Robert Cassler, *Copyright Royalty Tribunal: Balancing the Record*, 41 J. COPYRIGHT SOC'Y U.S.A. 217, 225 (1994) (describing and analyzing an administrative agency that sets royalties for certain uses of copyrighted works). Although such an agency might be more accurate in theory than courts, they would also be subject more to capture, resulting in over-compensation and

essence, this shift would be from a make-whole expectation damages regime to an incentive-focused, reliance damages regime. In contract law, reliance damages operate to restore the aggrieved party to the position it occupied at the moment of contract formation, *prior to* the parties undertaking their promises under the contract.[333] In contrast to expectation damages—which provide the full, ex post benefit of the contractual bargain—reliance damages restore the plaintiff's ex ante expenditures, including opportunity costs, that were made in reliance on the defendant's promise to perform.[334] Such damages are nearly identical with patent law's normative goal to incentivize optimal investment in innovation—a return of all R & D, commercialization, and opportunity costs to the patentee made in reliance on the promise by third parties not to infringe the patent.[335] Any more than this level of damages would by definition overcompensate the patentee, leading to windfalls, potentially diminishing innovation.[336] Anything less than this level would undercompensate the patentee, leading to too little innovation.[337] A focus on the innovation factors seems

related potential "goldplating" problems. *See* PETER W. HUBER ET AL., FEDERAL TELECOMMUNICATIONS LAW 114 (2nd Ed. 1999) ("[W]hen regulators allow a rate of return that is too high, rate-of-return regulation may induce . . . companies to make unnecessary investments (a phenomenon known as 'goldplating')."). In any event, the Seventh Amendment—at least as currently interpreted—would likely present obstacles to a purely administrative approach. *See* Apple Inc. v. Motorola, Inc., 757 F.3d 1286, 1315 (Fed. Cir. 2014) (stating that damages determinations are "for the jury"); B.D. Daniel, *The Right of Trial by Jury in Patent Infringement Cases*, 28 REV. LITIG. 735, 737 (2009) ("Similarly, the assessment of monetary damages in the form of a royalty would appear to be a quintessential jury issue."). *But cf.* Paice LLC v. Toyota Motor Corp., 504 F.3d 1293, 1315–16 (Fed. Cir. 2007) (finding that there is no jury right to ongoing royalties determinations).

333 *See* E. ALLAN FARNSWORTH, CONTRACTS 842 (2d ed. 1990).

334 *See* Lon Fuller & William Perdue, *The Reliance Interest in Contract Damages*, 46 YALE L.J. 52, 55, 60 (1936); Michael Kelly, *The Phantom Reliance Interest in Contract Damages*, 1992 WIS. L. REV. 1755, 1761 ("The reliance interest must include some measure of the opportunities the plaintiff gave up in order to enter into the contract with the defendant."); Leitzel, *supra* note 268; Lewis A. Kornhauser, *Reliance, Reputation, and Breach of Contract*, 26 J.L. ECON. 691, 699–700 (1983); William P. Rogerson, *Efficient Reliance and Damage Measures for Breach of Contract*, 15 RAND J. ECON. 39 (1984); Steven Shavell, *Damage Measures for Breach of Contract*, 11 BELL J. ECON. 466 (1980). *Cf.* Golden & Sandrik, *supra* note 227, at 34–38 (proposing a restitutionary framework to capture a patentee's ex ante expenditures in damages calculations).

335 In this regard, because the full measure of basic research costs would be included in an innovation-factors approach, it may provide stronger patent-based incentives for basic research than under today's market-demand driven system. Indeed, recent data indicates that the overall level of federally funded basic research has remained flat or is dropping. NAT'L SCI. BD., RESEARCH AND DEVELOPMENT: ESSENTIAL FOUNDATION FOR U.S. COMPETITIVENESS IN A GLOBAL ECONOMY, (Jan. 2008), http://www.nsf.gov/statistics/nsb0803/start.htm (stating "Federal Government support for academic R&D began falling in 2005 for the first time in a quarter century" and federal support for basic research has remained flat in recent years).

336 To be certain, as I noted in Part III.A, "if the private economic value of a patented innovation to a single patentee is substantially less than the social value of the innovation—so much so that the patentee has insufficient incentives to invest in R & D and commercialization to produce the innovation—then the patentee will need more reward than mere compensatory damages in the event of infringement." *Supra* text accompanying note 195. In this sense, a pure cost-based approach will never be perfectly optimal.

337 *See* William F. Lee & A. Douglas Melamed, *Breaking the Vicious Cycle of Patent Damages*, 101 CORNELL L. REV. 385, 387 (2016) ("Undercompensating patent holders gives them inadequate in-

precisely optimal to implement a reliance damages regime in patent law. Indeed, for the same reasons, such a reliance regime should apply not only to reasonable royalties but also lost profit determinations.[338]

V. Conclusion

Over two centuries of patent remedies, jurisprudence has essentially attempted to restore the patentee to the *status quo ante* in the event of infringement. When damages merely took the form of lost profits or established royalty rates, such an expectation-centric approach was not terribly problematic. However, when the courts and Congress transformed nominal damages to "reasonable royalties," the flaws inherent in make-whole damages soon became apparent. From uncertainty to circularity to holdup to over-compensation (and under-compensation), today's *Georgia-Pacific* test hardly seems the quintessential capstone to the completion of infringement, validity, and enforceability inquiries in litigation. By returning to patent law's core aim of promoting innovation, such difficulties can be substantially overcome. The key lies in recognizing that reliance damages better promotes this aim than expectation damages. By covering a patentee's investment in R & D and commercialization costs for a patented invention made in reliance on the promise of others not to infringe, reliance damages would reward the patentee with the funds necessary to optimally promote innovative activity.

centives to invent . . . ."). Of course, to the extent that inventors are incentivized by non-monetary rewards, the level of compensation necessary to provide adequate incentives would be less than reliance damages. *See, e.g.*, Lucas S. Osborn et. al., *A Case for Weakening Patent Rights*, 89 ST. JOHN'S L. REV. 1185, 1228 (2015) (describing how the presence of non-monetary incentives favor weakening the patent system).

338 *See supra* Part II.B.3 (describing how differences in lost profits and reasonable royalty awards can result in "discriminatory impact" that negatively affects innovation incentives). To be certain, I do not intend an innovation factors-based award of monetary damages to substitute for the use of a forward-looking injunction when a property rule remedy does not impose costs beyond its benefits, thus allowing the parties to leverage private information to fashion a more market-oriented solution. *See* Sichelman, *Purging Patent Law*, *supra* note 20, at 566 ("[A] default rule of injunctive relief and make-whole damages seems more appropriate, at least until we are quite confident in the abilities of adjudicators.").