EXCESSIVE OR UNPREDICTABLE? AN EMPIRICAL ANALYSIS OF PATENT INFRINGEMENT AWARDS

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ABSTRACT:

Over the past several years, the US patent reform debate has considered the question of excessive infringement damages. More recently, claims that awards are unpredictable have gained prominence in policy discussions. This paper evaluates the charges of excessive and unpredictable awards by analyzing the outcomes of 340 cases decided in US federal courts between 1995 and 2008 in which infringement was found and damages were awarded. Our data include the amount awarded, along with information about the litigants, case specifics and economic value of the patents-at-issue. We find (1) no evidence of systematic excessiveness and (2) a high correlation between award value and *ex ante*-identifiable factors. First, we find that the largest eight awards are isolated occurrences that represent nearly half of the aggregate amount of damages over the target period. Second, we construct an econometric model that explains over 75% of the variation in awards. These data and findings refute claims that infringement awards are systematically excessive or unpredictable and provide empirical support for the approach recently taken in the America Invents Act. More generally, they counsel for increased focus on econometric analysis as the tool for identification of problem areas and prescription of policy solutions in legal systems.

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INTRODUCTION

The debate over excessive patent infringement damage awards reached critical mass in recent years amid patent reform efforts in Congress. Up until March 2011, both the Senate and House patent reform bills included various forms of procedural and substantive damages reforms designed to address concerns that "damage awards . . . are too often excessive and untethered from the harm that compensatory damages are intended to measure."[1] In addition, perhaps in response, a host of recent Federal Circuit decisions have revisited infringement damages jurisprudence and articulated novel and arguably more restrictive standards for calculating certain types of awards.[2] However, in an eleventh hour amendment to S.23, the Senate version of the America Invents Act, the "gatekeeper" damages provision[3] and other litigation reforms

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1 Senate Report on the patent reform Act of 2009, S. Rep. 111-18, at 8 (May 12, 2009) [hereinafter "2009 Senate Report"].

2 *See infra* Section I.D.

3 The "gatekeeper" proposal would have augmented the judge's role as evidentiary gatekeeper by requiring the judge to exclude all methodologies and factors used in calculating infringement damages that are not supported by "sufficient" evidence. *See* S. 515 § 4 (proposed amendment to 35 U.S.C. § 284(b)(1))

were dropped.[4] At the time of this writing, the corresponding House bill, H.R. 1249, which is pending vote, similarly abandoned its earlier "prior art subtraction" reform proposal.[5]

Yet, the claims that patent infringement damages are systematically excessive have not been refuted. More importantly, the lack of empirical understanding as to damages that permitted these claims to persist has not been addressed. Further, claims that patent damages are unpredictable have remained unanswered.[6]

What has come clearly into focus through the legislative patent reform debates is that very little systematic empirical understanding of patent infringement awards exists. Few empirical studies of patent infringement damage awards have been conducted; fewer still, if any, focus on the incidence of excessive awards or the predictability of awards. This study aims to bridge the data gap by providing a comprehensive picture of damage awards over a 14-year period. We find no evidence of systematically excessive awards. We further find that *ex ante*-observable factors of the litigants, case specifics and economic value of the patents-at-issue explain over 75% of the variation of the resulting infringement awards.

In our study, we systematically catalogue the size of damage awards and explore factors that contribute to the observed dollar amount of awards. We analyze 340 patent infringement damage awards granted by a judge or jury in United States district courts from 1995 to 2008, using the economic value of patents as a benchmark.[7] These data were derived from a proprietary dataset owned by PricewaterhouseCoopers ("PwC") and licensed to us for use in this study. The PwC dataset, which informed the proposed patent reform legislation,[8] contains over 1,300 final patent decisions in US district courts from 1995 to 2008. We supplement the PwC dataset by reviewing the original case records for data regarding the damages theories used, asserted patents, procedural disposition, as well as venue and party characteristics. We then code these data for over 120 variables describing various aspects of the cases and awards, and analyze them using standard statistical methods. The result is a comprehensive empirical evaluation of the nature and characteristics of patent infringement damage awards in US district courts during this 14 year period.[9]

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4 *See* S. 23, 111th Cong. § 4 (2010) (proposed amendment to 35 U.S.C. § 284(b)(1)).

5 "Prior art subtraction" would limit reasonable royalty damages to a patent's "specific contribution over the prior art," requiring a restrictive form of apportionment to be applied in all cases involving reasonable royalty damages. *See* H.R. 1260, 111th Cong. § 5 (2009) (proposed amendment to 35 U.S.C. § 284 for damages). The current version of the House bill does not amend damages. *See* H.R. 1249, 112th Cong. (2011) (not proposing substantive amendments to 35 U.S.C. § 284 regarding damages).

6 For example, the influential 2011 FTC Report describes the "lottery ticket mentality" surrounding patent litigation by specialized Patent Assertion Entities. *See* 2011 FTC Report, *infra* note 88, at 161-62.

7 We refer to the economic literature on patent valuation to build a statistical model based on factors that have been shown to affect the economic value of patents. *See* note 184, *infra*, and accompanying text.

8 *See, e.g.*, 2009 Senate Report, *supra* note 1, at 9 n.40 (*citing* 2007 PwC Study).

9 Our analysis may miss some patent infringement damage awards from cases where relevant information was not reported (though we believe the impact on our conclusions to be minimal). Further, as the dataset only contains awards in US district courts before appeal, we cannot make definitive statements about the

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Our key findings are as follows:

- Based on empirical analysis of the distribution of awards, there is no systematic or pervasive problem of excessive patent damages.
- The largest awards, many of which garnered media attention and attracted scrutiny from policy makers, occurred idiosyncratically. They comprise over 47% of the aggregate awards amount and are not excessive outliers with respect to our model.
- Infringement damages are highly predictable using the factors we included as explanatory variables. Our econometric model accounts for over 75% of variation across the dataset.

Section I analyzes the law of patent infringement damages, perceived problems and various proposals to address them, prior empirical studies of patent infringement damages, and recent relevant case law from the Federal Circuit and certain district courts. Section II outlines the research methodology employed in this article and presents descriptive statistics about the dataset. Section III provides the results of the empirical analysis. Finally, Section IV concludes by discussing policy implications and questions for future study.

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effect of the higher courts' decisions on final patent damage awards. Caveats regarding our findings are discussed further in our concluding section.

I. BACKGROUND

This Section provides relevant background for our empirical analysis. Part A outlines the statutory and case law of patent infringement damages. Part B discusses the concerns regarding excessive and unpredictable awards as they have been articulated in the patent reform debates. Part C surveys precedent empirical studies of patent infringement damages. Part D discusses recent federal case law regarding damages, and finally Part E explores certain implications of these decisions.

A. The Law of Patent Infringement Damages

A patent confers the right to exclude others from making, using, selling, offering for sale or importing the invention defined by its claims.[10] Section 284 of the Patent Act of 1952 provides damages for infringement of patent rights. Pursuant to Section 284, a successful claimant is entitled to receive "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."[11] The statute affords no further explanation of the composition or calculation of compensatory damages, which has given rise to extensive litigation and a library of legal scholarship. The following subsections describe the established legal framework for determining patent infringement damages.

1. Framework

The two primary theories for awarding patent infringement damages are lost profits and reasonable royalties.[12] As its name suggests, lost profits awards the patentee[13] the profits that it lost as a result of the infringement.[14] To recover these damages, the claimant bears the burden of proving it is entitled to, and the amount of, lost profits.[15] By contrast, a claimant is entitled to a reasonable royalty upon proof of infringement, but nonetheless bears the burden of proving its claimed amount of reasonable royalty damages by a preponderance of evidence.[16] Properly

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10 35 U.S.C. § 271.

11 § 284.

12 Panduit Corp. v. Stahlin Bros. Fibre Works, Inc., 575 F.2d 1152 (6th Cir. 1978) (lost profits); Georgia-Pacific Corp. v. US Plywood Corp. 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970) (reasonable royalties); *see also* State Indus., Inc. v. Mor-Flo Indus., Inc., 883 F.2d 1573 (Fed. Cir. 1989) (alternate methodologies); *see generally* RICHARD CAULEY, WINNING THE PATENT DAMAGES CASE: A LITIGATOR'S GUIDE TO ECONOMIC MODELS AND OTHER DAMAGES STRATEGIES (Oxford University Press 2008).

13 Note that "patentee," as used herein, refers to any party with standing to claim damages for patent infringement. This may include the original patent owner, assignees, or certain exclusive licensees.

14 JANICE M. MULLER, PATENT LAW 498 (3rd ed. 2009).

15 John M. Skenyon, Christopher S. Marchese & John Land, Patent Damages Law and Practice § 1:3 (Aug. 2008).

16 *Id.* § 1:3.

construed, a reasonable royalty is merely "the floor below which damages shall not fall."[17] A claimant may elect whether to proceed on a theory of lost profits or claim reasonable royalty damages without seeking lost profits.[18] The following subsections address lost profit damages and reasonable royalty damages, as well as the theory of apportionment of damages and applicable standards of review.

2. Lost Profits

As the Supreme Court has stated, any theory damages for patent infringement focuses on the amount that the patentee has "suffered by the infringement."[19] Causation is the key question in the lost profits analysis; as the Court phrased it: "[H]ad the Infringer not infringed, what would [claimant] have made?"[20] Necessarily, lost profit damages require some degree of competition between the patentee and the infringer.[21] To prove the amount of lost profit damages, the patentee must construct the counterfactual of what the patentee would have earned "but-for" the infringement.[22] Calculation of lost profits is therefore complex,[23] often involving expert analysis of market conditions, supply and demand dynamics,[24] profit margins and incremental production costs,[25] as well as other case-specific factors.[26]

Included under the rubric of lost profit damages is compensation for several distinct types of economic injuries, including: lost sales,[27] price erosion,[28] collateral sales,[29] future lost profits,[30] injury to goodwill and business reputation,[31] increased expenses,[32] and impaired

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17 Bandag, Inc. v. Gerrard Tire Co., 704 F.2d 1578, 1583 (Fed. Cir. 1983).

18 *Id.*

19 Aro Mfg. Co. v. Convertible Top Co., 377 US 476, 507 (1964) ("The question to be asked in determining damages is 'how much had the Patent Holder and Licensee suffered by the infringement. And that question (is) primarily: had the Infringer not infringed, what would Patent Holder-Licensee have made?").

20 *Id.*

21 Competition between the patentee and infringer can occur in a variety of ways. In the simplest case, the parties compete directly with one another in the relevant market, and the patented product and infringing product are direct substitutes. However, lost profit damages permits recovery under different competitive circumstances as well. A patentee can also recover lost profits on sales of a different product than its product covered by the patent that was infringed. For example, if the patentee holds a patent on its product being sold as well as a patent on possible substitutes, and the defendant infringes the patent on the substitute, the patentee can recover lost sales of its sale product. See Skenyon, Marchese & Land, *supra* note 15, § 1:7.

22 Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1545 (Fed. Cir. 1995) ("[The lost profits analysis] surely states a 'but-for' test.").

23 Skenyon, Marchese & Land, *supra* note 15, § 1:9.

24 *Id.* at § 2:15.

25 *Id.* at § 2:14.

26 *See generally* Cauley, *supra* note 12.

27 Muller, *supra* note 14, at 498; *see* Panduit Corp. v. Stahlin Bros. Fibre Works, Inc., 575 F.2d 1152 (6th Cir. 1978) (listing four factors for determining whether lost profits are an appropriate measure for patent infringement damages).

28 Skenyon, Marchese & Land, *supra* note 15, § 1:8.

29 *Id.* at § 1:15.

30 *Id.* at § 1:8.

growth.[33] With each, however, the patentee must establish causation of the harm due to the infringement.[34] Importantly, "the purpose of compensatory damages is not to punish the infringer, but to make the patentee whole."[35] Therefore, analysis must take into account all relevant factors, and assess the difference between patentee's pecuniary condition after the infringement, and what this condition would have been if the infringement had not occurred.[36]

A commonly-used methodology for calculating lost profit damages is known as the *Panduit* analysis.[37] This framework considers total market demand for the patented product, including the availability of acceptable non-infringing substitutes. It further assesses the patentee's manufacturing and marketing capacity to exploit increased demand in the absence of infringement. On this basis, it evaluates the amount of additional profit the patent owner would have earned but-for the infringement.[38]

3. Reasonable Royalties

Proof of infringement entitles a patentee to reasonable royalty damages, although the patentee still bears the burden of establishing the amount of such damages.[39] Under Section 284, reasonable royalty damages represent "the floor below which damages shall not fall."[40] There are three established theories for a plaintiff to prove the amount of reasonable royalty damages. As recently articulated by the Federal Circuit:

> A reasonable royalty can be calculated from an established royalty, the infringer's profit projections for infringing sales, or a hypothetical negotiation between the patentee and infringer based on the factors in [*Georgia-Pacific*].[41]

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31 *Id.*

32 *Id.*

33 *Id.*

34 *Id.* at § 1:3.

35 Pall Corp. v. Micron Separations, Inc., 66 F.3d 1211, 1223 (Fed. Cir. 1995)

36 Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1324 (Fed. Cir. 2009) (*quoting* Yale Lock Mfg. Co. v. Sargent, 117 US 536, 552 (1886)).

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

38 Skenyon, Marchese & Land, *supra* note 15, § 1:8.

39 *Id.* at § 1:12. Note, however, that "[c]ourts have recognized that a reasonable royalty analysis necessarily involves an element of approximation and uncertainty. The infringer must bear the burden and the entire risk where it is impossible to make a mathematical or estimated apportionment between infringing and non-infringing items. In other words, uncertainty is resolved against the infringer where the infringer's actions have caused the evidentiary imprecision." *Id.*

40 Bandag, Inc. v. Gerrard Tire Co., 704 F.2d 1578, 1583 (Fed. Cir. 1983).

41 WordTech Sys., Inc. v. Integrated Network Solutions, Inc., 609 F.3d 1308, 1319 (Fed.Cir. 2010), (citing Georgia-Pacific Corp. v. US Plywood Corp. 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970)).

The third, "hypothetical negotiation" or "willing licensor-willing licensee" approach, is widely recognized as the most common of the reasonable royalty methodologies.[42] This assesses the factors that would have influenced negotiations between the parties in an attempt to determine the royalty that would have been agreed to for licensing the patents in suit in the absence of infringement.[43] The calculation proceeds by determining a rate of royalty, either as a percentage or per-unit value, and multiplying that by a relevant base amount, such as the infringer's sales revenue or number of units sold. The Federal Circuit has recognized that the analysis "necessarily involves an element of approximation and uncertainty."[44] In other opinions, and perhaps more aptly, the Federal Circuit has characterized the task as "a difficult judicial chore, seeming often to involve more the talents of a conjurer than those of a judge."[45] Case law for determining the reasonable royalty rate and base, respectively, are discussed below.

The second approach of considering the "infringer's profit projections for infringing sales" is sometimes called the "analytical" approach,[46] and is based on projections for the infringing item at the time the infringement began.[47] This involves "subtract[ing] the infringer's usual or acceptable net profit from its anticipated net profit realized from sales of infringing devices."[48] A portion of the infringer's profit projections are then allocated to the patentee, to represent what the infringer would have paid under a reasonable license.[49]

Two points are worth noting. First, the term "reasonable royalty" is sometimes used as a catch-all for any award that is not lost profits, including when a patentee attempts to prove its claimed amount of lost profit damages but fails to prove such amount.[50] The resulting so-called "reasonable royalty" may differ from what would be calculated using the established reasonable royalty methodologies.[51]

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42 *See* Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1324 (Fed. Cir. 2009) ("The second, more common approach, called the hypothetical negotiation or the 'willing licensor-willing licensee' approach, attempts to ascertain the royalty upon which the parties would have agreed had they successfully negotiated an agreement just before infringement began.").

43 *Id*. at 1324 ("The hypothetical negotiation tries, as best as possible, to recreate the ex ante licensing negotiation scenario and to describe the resulting agreement.").

44 *Id*. at 1324-25, (quoting Unisplay v. Am. Elec. Sign Co., 69 F.3d 512, 517 (Fed. Cir. 1995)).

45 ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 860, 869 (Fed. Cir. 2010), (quoting Fromson v. Western Litho Plate & Supply Co., 853 F.2d 1568, 1574 (Fed. Cir. 1988)).

46 Skenyon, Marchese & Land, *supra* note 15, § 1:13.

47 *Id*.

48 TWM Mfg. Co. v. Dura Corp., 789 F.2d 895, 899 (Fed. Cir. 1986).

49 Skenyon, Marchese & Land, *supra* note 15, § 3:4.

50 *See id*. § 1:12; *see* Mark A. Lemley and Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 Tex. L. Rev. 1991, 2030 (2007).

51 As mentioned above, the "reasonable royalty" under 35 U.S.C. § 284 is the "floor below which damages shall not fall," and the amount awarded under failed proof of lost profits damages must not be less, though could be *more*, than the theoretical limit of "a reasonable royalty for the use made of the invention by the infringer." § 284. *See* Skenyon, Marchese & Land, *supra* note 15, § 1:12 (discussing the confusion regarding calling an award for which proof of lost profits was not made a "reasonable royalty"); *see also id.* Lemley & Shapiro at 2030 (finding only fifty-eight true "reasonable royalty" cases in their dataset, despite many more damage awards in which proof of lost profits was not made).

Second, under the three theories for calculating "reasonable royalty" amounts, the first approach (basing an award on an established royalty) overlaps somewhat with the third (the hypothetical negotiated royalty), given that one of the *Georgia-Pacific* factors for determining the hypothetical royalty instructs the fact-finder to consider actual royalties earned "for the licensing of the patent in suit."[52]

4. Royalty Rate: *Georgia-Pacific* Factors

The determination of the rate of reasonable royalty considers all factors applicable to hypothetical *ex ante* bilateral negotiations between the patentee and infringer. The widely-cited *Georgia-Pacific* case articulated an inclusive list of fifteen possible factors.[53] Importantly, not all factors apply to a given case;[54] indeed, the Federal Circuit has characterized the list provided in *Georgia-Pacific* as "comprehensive" but "unprioritized and often overlapping."[55]

There is also a certain degree of conceptual redundancy in the fifteen *Georgia-Pacific* factors. For ease of reference, the factors are often grouped into the following three general categories of inquiries:

1. The patented invention's significance with respect to the product and market demand;
2. The existing royalty rates that people have been willing to pay for the patented invention or for similar technologies in the industry; and
3. Expert testimony regarding the patent's value.[56]

Certain assumptions concerning the structure of the hypothetical license that would have been negotiated also inform the *Georgia-Pacific* analysis. These include such details as whether

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52 Georgia-Pacific Corp. v. US Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y.1970); *see also* ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 860, 869 (Fed. Cir. 2010) (emphasizing that this factor "considers only past and present licenses to the actual patent and the actual claims in [the present] litigation"). Notably, the first and third methodologies articulated above are not identical. The *Georgia-Pacific* factors collectively apply to determining a royalty rate to which hypothetical negotiating parties would have agreed, which is then multiplied by a royalty base to calculate the amount of damages. By contrast, the "established royalty" methodology looks solely to actual amounts received by the plaintiff for licensing the patents in suit under similar circumstances.

53 *Id.* at 1120.

54 Wright v. United States, 53 Fed.Cl. 466, 475 (2002) ("*The Georgia-Pacific* factors, however, serve primarily as a general guide to the reasonable royalty rate inquiry. 'While the *Georgia-Pacific* factors are often probative of a reasonable royalty rate, the court is neither constrained by them nor required to consider each one where they are inapposite or inconclusive.'" (*citing* Brunswick Corp. v. United States, 36 Fed. Cir. 204, 211-12 (1996)); *see also* Skenyon, Marchese & Land, *supra* note 15, § 1:12 ("Importantly, *no* single accepted method exists for how a court must determine 'reasonable royalty' *damages*.") (emphasis in original).

55 *ResQNet.com*, 594 F.3d at 869.

56 Lemley & Shapiro, *supra* note 50, at 2018.

it would be exclusive or non-exclusive,[57] what would be its geographical scope and duration,[58] and whether it would be a paid-in-full amount or a running royalty.[59]

Given the prevalence of its use in assessing reasonable royalty damages, and certain blockbuster verdicts that have resulted from such use, the *Georgia-Pacific* analysis have been heavily scrutinized in the patent reform debate.[60] These factors have also received judicial scrutiny under recent Federal Circuit cases; as discussed below, these decisions have arguably articulated heightened requirements for applying these factors.[61]

5. Royalty Base: Apportionment of Damages

Perhaps the most controversial concept in damages jurisprudence is apportionment of damages (or, more precisely, the lack of apportionment in certain cases). Apportionment is principally used for products comprising multiple components, a subset of which is covered by the patents-at-issue. Apportionment is the default rule under such circumstances, and requires that the patentee recover damages based solely on the value of the patented invention—market value attributable to other features must be excluded from the basis of the patentee's recovery.[62] The exception to this principle is known as the "entire market value rule" ("EMVR"), which "allows for the recovery of damages based on the value of an entire apparatus containing several features."[63] In order for the EMVR to apply, the patentee bears the burden of proving that the patented feature constitutes the "basis for consumer demand" of the entire infringing product.[64] Recent cases have addressed concerns that the EMVR has been applied too liberally in the past and called for economic evidence establishing the "basis for consumer demand."[65]

Apportionment, and the EMVR, apply in both lost profits and reasonable royalty analyses. In a lost profits calculation, apportionment requires that the patentee only recover lost profits

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57 *Georgia-Pacific*, 318 F.Supp. at 1120 ("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."); Skenyon, Marchese & Land, *supra* note 15, § 1:14.

58 *Id.*

59 Lemley & Shapiro, *supra* note 50, at 2018-19.

60 2009 Senate Report, *supra* note 1, at 9 n.41 ("It is difficult for the Committee (let alone a lay juror) to recite all 15 of the [*Georgia-Pacific*] factors without reading them in print.")

61 *See infra* Section I.D.

62 *See* Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1337 (Fed. Cir. 2009), (*quoting* Garretson v. Clark, 111 US 120, 121 (1884) ("The patentee . . . must in every case give evidence tending to separate or apportion the defendant's profits and the patentee's damages between the patented feature and the unpatented features.")).

63 *Id.* at 1336 (*quoting* TWM Mfg. Co. v. Dura Corp., 789 F.2d 895, 901 (Fed. Cir. 1986)).

64 Rite-Hite Corp. v. Kelley Co., Inc., 56 F.3d 1538, 1549 (Fed. Cir. 1995) (internal quotations omitted).

65 *See, e.g.*, *Lucent*, 580 F.3d at 1336-37.

attributable to the patented component, whereas the EMVR permits recovery of lost profits of unpatented components sold in combination with it.[66]

In a reasonable royalty analysis, apportionment may be applied to determine either the royalty rate, the base, or both. Apportionment may be applied to limit the royalty base to the "value of the patented invention, when it is but one part or feature among many."[67] Alternately, or in addition, *Georgia-Pacific* factor thirteen considers 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."[68]

Given the fact that the final reasonable royalty award is determined by multiplying the rate by the base, an appropriate amount may be obtained by applying apportionment to only a single variable to a sufficient degree. As the Federal Circuit recently explained, "the base used in a running royalty calculation can always be the value of the entire commercial embodiment, as long as the magnitude of the rate is within an acceptable range."[69] Indeed, if appointment of the royalty base were required, it could be necessary as a corollary to prevent apportionment of the royalty rate, so as to avoid under-compensating the patent-holder for its actual damages.[70]

6. Standards of Review

The amount of damages awarded for patent infringement is a question of fact, to be decided by the jury or, in a bench trial, by the judge as fact-finder. A bench award of damages is reviewed on appeal for "an erroneous conclusion of law, clearly erroneous factual findings, or a clear error of judgment amounting to an abuse of discretion."[71] By contrast, jury awards, which have been a focal point in the "excessive damages" debate, are accorded special deference.[72] The Federal Circuit has articulated the standard of review as follows:

> The jury's award of damages is entitled to deference. Specifically, the jury's damages award must be upheld unless the amount is grossly excessive or

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66 American Seating v. USSC Grp., Inc., 514 F.3d 1262 (2008) (*citing Rite-Hite*, 56 F.3d at 1550).

67 *Lucent*, 580 F.3d at 1337.

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

69 *Lucent*, 580 F.3d at 1338-39.

70 *See, e.g.*, John W. Schlicher, *Patent Damages, the patent reform Act, and Better Alternatives for the Courts and Congress*, 91 J. Pat. & Trademark Off. Soc'y 19 (2009).

71 Amstar Corp. v. Envirotech Corp., 823 F.2d 1538, 1542 (Fed. Cir.1987), citing TWM Mfg. Co. v. Dura Corp., 789 F.2d 895, 898 (Fed. Cir. 1986), *cert. denied*, 479 US 852 (1986)).

72 Monsanto Co. v. McFarling, 488 F.3d 973, 981 (Fed. Cir. 2007) ("In reviewing damage awards in patent cases, we give broad deference to the conclusions reached by the finder of fact.").

monstrous, clearly not supported by the evidence, or based only on speculation or guesswork.[73]

The "grossly excessive or monstrous" language has been decried by proponents of sweeping patent damages reforms.[74] However, this standard is not unique to patent cases, and the phrase "grossly excessive or monstrous" itself derives from appellate opinions reviewing jury determinations of non-patent awards.[75] Moreover, despite the deference that the words connote, appellate review of patent jury awards can be highly exacting. A series of recent decisions, as discussed below, have emphasized that a plaintiff must produce "sound economic proof of the nature of the market and likely outcomes with infringement factored out of the economic picture in *all* damages calculations."[76]

B. Perceived Problems with Patent Damages Law

Concerns over excessive and unpredictable infringement awards have long featured prominently in the patent reform debates. Indeed, some suggest they nucleated the push for legislative overhaul.[77] Yet, despite their tenure, significant gaps have existed in their evidentiary record—the empirical record in particular has long lacked sufficient definition to support or refute these concerns.

1. Excessive Damages

Concerns over excessive damages have featured prominently in the legislative debates. One House Report, for example, asserts as a matter of fact that "current litigation practices often produce a royalty award substantially in excess of a reasonable royalty."[78] A Senate Report baldly claims that "[n]o doubt several alarming cases . . . represent the tip of the iceberg" of excessive awards.[79] Another claims that "damage awards . . . are too often excessive and untethered from the harm that compensatory damages are intended to measure."[80] Despite these

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73 *See* Monsanto Co. v. Ralph, 382 F.3d 1374, 1383 (Fed. Cir. 2004) (internal citations omitted).

74 *See, e.g.*, H.R. Rep. No. 110-314, at 25 (2007) (*quoting* the "grossly excessive or monstrous" standard) [hereinafter "2007 House Report"].

75 *See* Los Angeles Memorial Coliseum Commission v. National Football League, 791 F.2d 1356, 1360 (9th Cir. 1986), *cert. denied*, 484 US 826 (1987) (an antitrust case).

76 IP Innovation LLC v. Red Hat, Inc., 2010 WL 986620 at *1 (E.D. Tex. Mar. 2, 2010) (C.J. Rader sitting by designation) (internal citations omitted) (granting in part defendant's motion to exclude plaintiff's damages expert's testimony and report on reasonable royalty damages), *quoting* Grain Processing Corp. v. Am. Maize-Prods. Co., 185 F.3d 1341, 1350 (Fed. Cir. 1999).

77 *See* Kevin E. Noonan, *Few "Reform" Provisions Remain in S. 23 Relating to the Judiciary* (March 21, 2011), *available at* http://www.patentdocs.org/2011/03/few-reform-provisions-remain-in-s-23-relating-to-the-judiciary.html.

78 2007 House Report, *supra* note 74, at 26.

79 Senate Report on the patent reform Act of 2007, S. Rep. 110-259, at 12 (January 24, 2008) [hereinafter "2007 Senate Report"].

80 2009 Senate Report, *supra* note 1, at 8.

assertions, there is no empirical evidence that damages are systematically "excessive," or even that the "alarming cases" represent statistical outliers of an appropriate damages distribution.

Another major focal point has been reasonable royalty damages calculated using the *Georgia-Pacific* factors. Yet, it should be noted at the outset that there is little and arguably conflicting evidence of the incidence and impact of reasonable royalty awards. One study found that "[s]ince 2000, reasonable royalties have overtaken lost profits as the most frequent basis of damage awards in patent cases."[81] By contrast, another identified only 58 reported reasonable royalty awards from 1984 to 2005.[82] To the extent these figures, taken together, indicate that reasonable royalty damages have only recently gained popularity, the recent case law refining their application may obviate the need for legislative reform.

One commonly cited concern is that juries frequently err in calculating reasonable royalty damages. The 2009 Senate Report argued that the "current damages statute is vague and provides little guidance to judges or juries determining the proper damages award, particularly when the award is based on the reasonable royalty standard."[83] The *Georgia-Pacific* framework is seen as particularly problematic, due to its complexity.[84]

Another prevalent concern is that apportionment of damages is not utilized frequently or aggressively enough, which, it has been argued, "can lead to excessive damage awards."[85] However, there is no data confirming a correlation between excessive damages and either reasonable royalties or a failure to apportion damages. One large-scale empirical study of jury verdicts versus bench awards found that the median jury awards in recent years have been on average five times the median amounts of bench awards.[86] Of course, this does not confirm whether jury verdicts are in fact excessive.[87]

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81 2007 PwC Study, *infra* note 95, at 22 (2007).

82 Lemley & Shapiro, *supra* note 50, at 2030.

83 2009 Senate Report, *supra* note 1, at 9; *see also* 2007 Senate Report, *supra* note 79, at 11-12 (January 24, 2008) ("Juries are given little useful guidance in calculating that reasonable royalty"); 2007 House Report, *supra* note 74, at 25 ("Courts often simply provide juries all of *Georgia-Pacific*'s 15 possible factors for assessing a reasonable royalty and then direct the juries to determine a reasonable royalty without much other guidance.").

84 See *id.* 2009 Senate Report.

85 2007 House Report, *supra* note 74, at 27.

86 2009 Senate Report, *supra* note 1, at 9 n.40, *citing* 2007 PwC Study.

87 The 2007 Senate Report also contains anecdotal arguments against either purported cause of excessive damages. The minority objections of Senators Feingold and Coburn argue as follows:

> The truth is that, with the exception of a few possibly excessive awards, current law on damages is working. The fifteen Georgia-Pacific factors, which the courts have adopted, preserve flexibility for jury calculations by covering a wide range of real business circumstances. The royalty base may exclude the value added by an infringer and include the full value of products and services in demand principally due to the patented invention. *See* 2007 Senate Report, *supra* note 79, at 68.

Like the assertion that patent damages are systematically excessive, the claim that the system is "working" is similarly unsupported by empirical evidence.

2. Unpredictable Damages

In addition to claims that patent damages are "excessive," substantial focus has been placed on claims that awards are unpredictable. For example, the most recent iteration of the Federal Trade Commission's report, *The Evolving IP Marketplace, Aligning Patent Notice and Remedies with Competition*,[88] highlights a "lottery ticket mentality" in some circles towards litigation outcomes.[89] Factors asserted to contribute to perceived unpredictability of awards include the prevalence of damages determined by juries, particularly given the large disparity between awards in jury vs. bench trials[90] and the perceived risk of jury errors in calculating reasonable royalties.[91] According to the 2011 FTC Report, unpredictability helps support the business models of patent assertion entities (PAEs), which can impede innovation efforts.[92]

Another indicator that patent infringement awards are perceived to be unpredictable is the high costs spent in litigating patent trials. The most recent AIPLA survey assessed average litigation expenditures to be $6.25 million in cases with over $25 million at stake.[93] Litigants may be more likely to spend high amounts to prosecute and defend infringement claims if they think award amounts are a black box and variability is high. However, high litigation expenditures may also result from prospects of injunctions, the complexity of patent trials and other factors.

C. Previous Empirical Studies

Certain previous studies have undertaken large-scale analysis of patent damage awards.[94] A 2007 PricewaterhouseCoopers study (the "2007 PwC Study") finds a fivefold disparity between median jury verdicts and median bench awards.[95] A 2008 update to the study (the "2008 PwC Study") provides supplementary data and analysis.[96] A 2009 update to the study (the "2009 PwC Study") provides supplementary data and new analysis of the impact of

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88 Federal Trade Commission, *The Evolving IP Marketplace, Aligning Patent Notice and Remedies with Competition* (March 2011), *available at* www.ftc.gov/os/2011/03/110307patentreport.pdf [hereinafter "2011 FTC Report"].

89 *See id.* at 162 note 9 and accompanying text.

90 *See id.* at 161-62.

91 *See supra*, Section I.B.1.

92 *See* 2011 FTC Report, *supra* note 88, at 162 n. 9 and accompanying text. So-called Patent Assertion Entities (PAEs) operate like venture funds in that they allocate resources to acquire and assert a spectrum of patents in the hopes for a few successes to generate reforms. They are seen as a drain on innovation in part because they operate *ex post* commercialization of the patents being asserted and challenge companies bringing products to market.

93 Am. Intell. Prop. Law Ass'n., REPORT OF THE ECONOMIC SURVEY I-131 (2009).

94 Many of these studies were cited in the 2011 FTC Report as the "available statistics on patent litigation outcomes and damage awards." 2011 FTC Report, *supra* note 88, at 162. As described below, significant data gaps exist in this precedent.

95 PricewaterhouseCoopers, 2007 Patent and Trademark Damages Study [hereinafter "2007 PwC Study"].

96 PricewaterhouseCoopers, A Closer Look—Patent Litigation Study: Damage Awards, Success Rates and Time-To-Trial (2008) [hereinafter "2008 PwC Study"].

nonpracticing entities ("NPEs") engaging in patent litigation.[97] A 2007 study by Lemley & Shapiro addresses reasonable royalty awards and apportionment in multi-component products.[98] One recent study by Allison, Lemley & Walker address patent litigation in different industry sectors, and find that litigation rates and litigant characteristics vary significantly by industry.[99] Finally, Opderbeck conducts empirical analysis that questions the assumption that patent infringement awards are systematically excessive.[100]

1. 2007 PwC Study

The 2007 PwC Study aggregated bench awards and jury verdicts in the years 1980 to 2005. It contained two findings relevant to the present focus. First, it found that median jury awards were on average five times larger than median awards in bench trials, during the years studied.[101] Second, the study provided trend data on royalty rates, finding that average awarded royalty rates have declined in recent years.[102]

The analytic methodology utilized in the 2007 PwC Study is as follows:[103]

- "PricewaterhouseCoopers identified legal records in two Westlaw databases, Federal Intellectual Property—Cases (FIP-CS) and Combined Jury Verdicts and Settlements (JV-ALL), from 1980 through June 2006."
- "The study included . . . [1,367] unique US Federal District Court [patent] cases . . . and 29 cases that included both patent and trademark issues . . . and [273] unique CAFC [patent] cases . . . 7 cases that included both patent and trademark issues."
- "Jury verdict information varied by jurisdiction and was particularly limited during the early and mid-1980s."

2. 2008 PwC Study

The 2008 PwC Study contains an updated dataset, containing data on damage awards from 1980-2007.[104] Furthermore, additional analysis is provided. Notably, the study lists nine

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97 PricewaterhouseCoopers, A Closer Look—Patent Litigation Trends and the Increasing Impact of Nonpracticing Entities (2009) [hereinafter "2009 PwC Study"].

98 Lemley & Shapiro, *supra* note 50.

99 John R. Allison, Mark A. Lemley & J.H. Walker, *Trolls on Top?*, 158 U.Penn.L.Rev. 1 (studying litigation rates of patents in specific industries). However, this study does not address the outcomes of the litigation, but notes "that is the subject of a companion piece by the authors, tentatively entitled Patent Quality and Risk Aversion Among Repeat Patent Litigants." *Id.* at 5 n. 14.

100 David W. Opderbeck, *Patent Damages Reform and the Shape of Patent Law*, 89 B.U.L.Rev. 127 (2009).

101 2007 PwC Study, *supra* note 95, at 14.

102 *Id.* at 22-25.

103 *Id.* at 29.

104 2008 PwC Study, *supra* note 96, at 1.

"landmark" awards from 2005-2007 that exceeded $100M. The study also lists six of the largest awards since 1985.[105]

The 2008 PwC Study considers the incidence of bench versus jury decisions, finding "a marked increase in jury trials since the 1980s, with the shift becoming more evident since 1995."[106] The study attributes this increase to a "stark contrast" in plaintiff success rates between bench and jury trials, and median jury awards that are "significantly larger" than median bench awards. The study finds that "[j]ury success rates have consistently outperformed their bench counterparts for every year since 1995."[107] Additionally, "[r]ecent awards by juries have been running several multiples of the amounts awarded by judges."[108]

The 2008 PwC Study further performs some initial industry-specific analysis. For instances, the study calculates the median damages award in ten industry sectors.[109] The authors do not explicitly describe their methodology for identifying the industry sectors. The study also ranks judicial districts according to median damage awards from 1995 to 2007. It finds that "[c]ertain federal district courts . . . continue to be more favorable to patent holders."[110] Finally, the 2008 PwC Study considers appeal rates and appellate outcomes (affirmance, reversal, or modification).

3. 2009 PwC Study

The 2009 PwC Study contains an updated dataset, including information on damage awards from 1980 to 2008.[111] Furthermore, new analysis is conducted on NPEs involved in patent litigation. The study defines an NPE as "an entity that does not have the capabilities to design, manufacture, or distribute products that have features protected by the patent."[112]

Among its key findings, the 2009 PwC Study determined that the median patent infringement damages award for NPE patent-holders was more than three times that of practicing entities during the period from 2002 to 2009.[113] Whereas the median during this period for practicing entities was $3.4 million, it was $12 million for NPEs (in inflation-adjusted numbers); by contrast, from 1995 to 2001, the medians were roughly equal for NPEs and practicing entities

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105 *Id.* at 3-4.
106 *Id.* at 4.
107 *Id.* at 5.
108 *Id.* at 6.
109 *Id.* at 3.
110 *Id.* at 14.
111 2009 PwC Study, *supra* note 97, at 4.
112 *Id.* at 20.
113 *Id.* at 6.

alike.[114] Also, like the 2008 PwC Study, this iteration also lists the "landmark" awards from 2005-2007 that exceeded $100M, and further indicates the entity status of the patentee.[115]

In addition, the 2009 PwC Study reports the incidence of bench versus jury decisions and median bench versus jury damage awards categorized by type of entity.[116] It further considers the composition of types of damage awards (price erosion, lost profits or reasonable royalty) from 1995 to 2001 and 2002 to 2008, respectively, though it excludes NPE data from this analysis due to the fact that NPEs are generally not entitled to lost profit damages as they do not compete with the infringing entity.[117]

In addition, the 2009 PwC Study considers the success rates at trial of NPEs versus practicing entities, and further distinguishes between success on summary judgment versus at trial.[118] The study finds that NPEs were successful 29 percent of the time overall, compared to a 41 percent success rate for practicing patent-holders. Whereas NPEs were slightly more successful than practicing entities at trial, they were successful on summary judgment only 12 percent of the time compared with a 20 percent success rate for practicing patent-holders.[119]

4. Lemley & Shapiro Study

In their 2007 study of reasonable royalty awards, Lemley & Shapiro focus on the extent to which court-awarded royalty rates properly apply apportionment for multi-component technologies.[120] Their data set covered all cases reported in Westlaw from 1982 to mid-2005 that awarded a reasonable royalty.[121]

Notably, their study was cited in the Senate Report for S. 515 for their finding that only 58 reasonable royalty awards were awarded from 1980 to 2005.[122] Lemley & Shapiro arrived at this count by including only "the subset of cases in which a court has written an opinion disclosing the royalty awarded."[123]

Lemley & Shapiro track the differences in royalty rates between different industries groups, and find variations in the average royalty rate awarded.[124] They conclude that "the

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114 *Id.*
115 *Id.* at 7.
116 *Id.* at 10.
117 *Id.* at 11.
118 *Id.* at 12.
119 *Id.*
120 Lemley & Shapiro, *supra* note 50.
121 *Id.* at 2030.
122 *Id.*
123 *Id.* at 2031.
124 *Id.* at 2034-35.

reasonable-royalty rules do in fact accommodate component products but only to a limited extent."[125] They do not appear to consider the amounts of damage awards, what royalty base was used, or track the final outcomes after appeal.

5. Allison, Lemley & Walker Study

In their study, *Extreme Value Patents*, Allison, Lemley & Walker analyzed data on patent litigation from 2000 to 2007 provided by the Stanford IP Litigation Clearinghouse (the "Clearinghouse"). The authors identified from the Clearinghouse data every patent that had been litigated eight or more times between 2000 and 2007, a total of 106.[126] They further identified a random set of 106 once-litigated patents from the Clearinghouse data. The authors collected information about entity status, industry characteristics, and indicia of patent value (such as number of claims, forward-citations, and prior art citations).[127]

The relevant findings of the Allison, Lemley & Walker study are noted as follows:

- Litigation Rates by Industry:
  - Software and telecommunications patents are far more likely to be litigated, even over mechanical and chemical patents.
  - In particular, software-implemented business method patents comprise a large portion of the most-litigated patents group at 15%, compared to only 4% of once-litigated patents.
  - Mechanical and electronics patents make up the bulk of the once-litigated patent cases at 53% and 25%, respectively. Conversely, they are of only minor significance in the most-litigated patent set at 8% for mechanical and 1% for electronics.
- Patent Owners:
  - More than one-third of all litigated patents were sold to another owner after issue and before the lawsuit was filed.
  - Small entities that keep their patents rather than selling them tend to litigate less often than either large entities or purchasers of small entity patents.
  - Among the most-litigated patents, there are significantly more non-practicing entities than among the once-litigated patents.
  - Ownership of once-litigated patents is more diverse, with no one type of company or industry representing any significant percentage.

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125 *Id.* at 2035.

126 Allison, Lemley & Walker, *supra* note 99, at 4-5.

127 *Id.* at 5.

The authors provide an extensive discussion of their classification technique, and references to other relevant work.[128] Additionally, they provide categorization of the parties' entity type to assist in identifying indicia of strategic litigation practices.[129]

6. Opderbeck Study

A recent study by David Opderbeck conducts an independent empirical analysis of patent damage awards data.[130] Data was obtained from the Administrative Office of the Courts data files for civil cases decided from 2002 to 2007.[131] His analysis finds that "damage awards are widely and stochastically distributed, which suggests that most cases are being adjudicated according to their facts rather than according to some predisposition towards large awards."[132]

Opderbeck analyzes the distribution of patent infringement damage awards, finding a mean of $4.3M, median of $0.8M, standard deviation of $9.8M, and skewness of 3.97.[133] On this basis, Opderbeck concludes that "the range of awards varied widely . . . [suggesting] a lack of any pattern in the awards."[134] He further calculates the correlations between size of award and field of art. He finds "possibly significant" correlations with field of art of 0.36 (awards >= $500k), 0.54 (awards >= $1M), and 0.63 (awards >= $10M), but cautions that the sample sizes of the upper award tiers were small.[135]

Notably, Opderbeck further studies the correlation between size of award and type of remedy (lost profits or reasonable royalty). He finds correlations of 0.12 (awards >= $500k), 0.01 (awards >= $1M), and 0.52 (awards >= $10M).[136] From this, Opderbeck concludes that the sample reveals "no overriding patterns to the awards, except for some varying degrees of correlation between the size of award and the field of art or type of remedy."[137]

Opderbeck concludes that "the manner in which courts calculate reasonable royalty rates does not fundamentally cause any holdup and royalty stacking problems."[138] Instead, he

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128 *See id.* at 6-11.

129 *See id.* at 12-14, *citing* Mark A. Lemley & Nathan Myhrvold, *The Complex Ecology of Patent Plaintiffs* (working paper 2009).

130 Opderbeck, *supra* note 100.

131 *Id.* at 145.

132 *Id.* at 130.

133 *Id.* at 146.

134 *Id.*

135 *Id.* at 148.

136 *Id.*

137 *Id.* at 149.

138 *Id.*

suggests that "some facially shocking but mostly innocuous data are being used as the point of a much longer spear, which aims to redefine what kind of right a 'patent' represents."[139]

D. Recent Patent Damages Case Law

Several recent opinions, most issued in the 18 months prior to this article, have taken strides to reshape patent damages law and redress certain prevalent concerns. In particular, these cases have arguably heightened the standards for establishing reasonable royalty damages and instituted standards for more exacting scrutiny of jury verdicts.[140]

1. *Lucent v. Gateway*

In *Lucent v. Gateway*, a Federal Circuit panel vacated the jury's reasonable royalty award of $358 million for a minor component of Microsoft Office that was found to be infringing plaintiff's patent.[141] The issue on appeal was "whether substantial evidence supports the jury's implicit finding that Microsoft would have agreed to, at the time of the hypothetical negotiation, a lump-sum, paid-in-full royalty of about $358 million."[142]

The Court began by enumerating each of the *Georgia-Pacific* factors at issue and assessing the testimony and documentary evidence pertaining to each.[143] Principally relevant was the first factor, the "established royalty" for licensing the patents in suit. There, eight licenses that were accepted into evidence and used by the jury at trial were rejected as lacking "sufficient relevance"[144] to support the verdict. The jury had awarded a lump-sum royalty

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139 *Id.*

140 *See* Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1301 (Fed. Cir. 2009); ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 860 (Fed. Cir. 2010). Two district court opinions authored by Chief Judge Rader of the Federal Circuit, sitting by designation, also reflect this view. *See* Cornell Univ. v. Hewlett-Packard Co., 609 F. Supp. 2d 279 (N.D.N.Y. 2009) (C.J. Rader sitting by designation); IP Innovation LLC v. Red Hat Inc., No. 2:07-CV-447 (RRR), 2010 WL 986620 (E.D. Tex. Mar. 2, 2010) (C.J. Rader sitting by designation). Another recent Federal Circuit opinion reiterated the principles articulated in *Lucent* and *ResQNet* in reversing the district court's denial of defendant's F.R.C.P. 59(a) motion for a new trial on grounds that the damages awarded by the jury were "'clearly not supported by the evidence' and 'based only on speculation or guesswork.'" WordTech Sys., Inc. v. Integrated Network Solutions, Inc., 609 F.3d 1308, 1319 (Fed. Cir. 2010), (quoting Del Monte Dunes at Monterey, Ltd. v. City of Monterey, 95 F.3d 1422, 1435 (9th Cir. 1996)). And, in the first week of 2011, the Federal Circuit further supported this line of cases with its decision in *Uniloc USA, Inc. v. Microsoft Corp.*, __F.3d__, 2011 WL 9738 at *43 (Fed. Cir. Jan. 4, 2011).

141 *Lucent*, 580 F.3d at 1337 ("The only reasonable conclusion that can be drawn from this evidence is that the infringing use of Outlook's date-picker feature is a minor aspect of a much larger software program and that the portion of the profit that can be credited to the infringing use of the date-picker tool is exceedingly small.").

142 *Id.* at 1309.

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

144 *Wordtech*, 609 F.3d at 1309.

amount, but four of the licenses were based on running royalties and therefore were not comparable.[145] The other four licenses provided for lump-sum royalties but included additional material and arose under different circumstances than the hypothetical negotiation assumed, and therefore were not "sufficiently comparable."[146]

Accordingly, the Court reversed and remanded, having reached the "unmistakable conclusion that the jury's damages award is not supported by substantial evidence, but is based mainly on speculation or guesswork."[147] Subsequent decisions have followed this mode of careful analysis of the "sufficiency" of evidence of prior licenses.[148]

Notably, in closing, the Court also stated that to the extent the jury has applied the EMVR, this would have constituted legal error.[149] Though writing in dicta, the Court went to lengths to explore a long history of EMVR precedent, dating back to *Garretson v. Clark* in 1884.[150] The Court stressed the necessity for the plaintiff to establish applicability of the EMVR by demonstrating that that the patented feature constitute the "basis for customer demand."[151] Subsequent cases cite *Lucent* for these EMVR principles.[152]

2. *ResQNet v. Lansa*

In *ResQNet v. Lansa*, a Federal Circuit panel vacated a bench damages award of $506,305 for infringement of a patent directed to a computer terminal emulation algorithm, which award was calculated by applying a hypothetical 12.5% royalty rate to the defendant's revenues from sales of the infringing software.[153] At the outset, the Court emphasized that the fact-finder "must carefully tie proof of damages to the claimed invention's footprint in the market place,"[154] and cited its precedent for the rule that "[t]o prevent the hypothetical [negotiation] from lapsing into pure speculation, this court requires sound economic proof of the nature of the market and likely outcomes with infringement factored out of the economic picture."[155]

In arriving at a 12.5% reasonable royalty rate, the plaintiff's expert used average royalty rates from two sets of prior licenses to the patents in suit and related technology. One set of prior licenses related to re-branding and re-bundling licenses which "furnished finished software

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145 *Lucent*, 580 F.3d at 1329-30.
146 *Id.* at 1328-29.
147 *Id.* at 1117.
148 *Wordtech*, 609 F.3d at 1309.
149 *Lucent*, 580 F.3d at 1336.
150 111 US 120, 121 (1884).
151 *Lucent*, 580 F.3d at 1336-37.
152 *See, e.g.*, Uniloc USA, Inc. v. Microsoft Corp., __F.3d__, 2011 WL 9738 at *51 (Fed. Cir. Jan. 4, 2011).
153 ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 869 (Fed. Cir. 2010).
154 *Id.*
155 *Id.* (*quoting* Grain Processing Corp. v. Am. Maize-Prods. Co., 185 F.3d 1341, 1350 (Fed. Cir. 1999)).

products and source code, as well as services,"[156] was rejected because the plaintiff had not shown that these licenses "embody or use the claimed technology" claimed by the patents in suit.[157] The other set were "straight" licenses to the patents in suit, which arose as settlements of prior litigation brought by the patentee.[158] The Court acknowledged that the settlement licenses could be admissible, but cautioned that even these must be scrutinized because settlement royalty rates may be too high (for example, "license fees negotiated in the face of a threat of high litigation costs may be strongly influenced by a desire to avoid full litigation"[159]) or too low (for example, "widespread infringement [could] artificially depress . . . past licenses"[160]), compared to what parties in an *ex ante* hypothetical negotiation would reach. Rather, the Court stressed use of prior licenses under *Georgia-Pacific* factor 1 must account for the "technological and economic differences" between the licenses and the assumptions underlying the hypothetical negotiation.[161]

3. *WordTech Systems v. Integrated Networks*

In *WordTech Systems v. Integrated Networks*, a Federal Circuit panel reversed the district court's denial of defendant's motion for a new trial in light of a jury damages award of $250,000 for infringement of a patent directed to a device for copying video files from computer memory to multiple discs.[162] The jury award calculated damages as a lump sum royalty (as opposed to a running royalty on sales),[163] based on evidence of thirteen past licenses to the patents in suit. Notably, the Court reiterated the lessons of its *Lucent* and *ResQNet* precedent that when using past licenses to calculate a reasonable royalty damages award, the licenses in the record must be "sufficiently comparable" on the basis of the circumstances and technology involved in each[164] and the comparison "must account for the technological and economic differences" to the present case.[165] Turning to the licenses in the record, the Court scrutinized each, finding that the amounts agreed to therein were substantially lower than the royalty amount (with respect to the licenses involving a lump sum royalty)[166] or effective royalty rate (with respect to the licenses involving a running royalty)[167] awarded by the jury.

4. *Cornell University v. Hewlett-Packard*

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156 *ResQNet.com*, 594 F.3d at 870.
157 *Id.* at 871.
158 *Id.*
159 *Id.* at 872 (*quoting* Hanson v. Alpine Valley Ski Area, Inc., 718 F.2d 1075, 1078-79 (Fed. Cir. 1983)).
160 *Id.* at 872 (*citing* Nickson Indus., Inc. v. Rol Mfg. Co., 847 F.2d 795, 798 (Fed. Cir. 1988)).
161 *Id.* at 873.
162 *WordTech Sys., Inc. v. Integrated Network Solutions, Inc.*, 609 F.3d 1308, 1309 (Fed. Cir. 2010).
163 *Id.* at 1310.
164 *Id., quoting Lucent Techs, Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1328-29 (Fed. Cir. 2009).
165 *Id., quoting ResQNet*, 594 F.3d at 873.
166 *Id.*
167 *Id.* at 22.

In *Cornell University v. Hewlett-Packard*, Federal Circuit Chief Judge Rader, sitting by designation, granted the defendant's motion for judgment of a matter of law, and in the alternative offered the plaintiff remittitur, in a damages amount of $58,494,282.[168] Although the final award was still substantial, it was less than one third of the jury verdict of $184,044,048.[169] Notably, Judge Rader's opinion did not address the royalty rate at all, which was an uncontested and minimal 0.8%, and focused solely on the issue of apportionment as applied to Hewlett-Packard's sales of CPU brick products containing, as a relatively small though functionally advantageous and "important component"[170] thereof, an instruction-issuing mechanism that infringed Cornell's patent.

Chief Judge Rader first articulated the requirements for applying the EMVR in a reasonable royalty analysis.[171] Further, Chief Judge Rader explained that sufficient evidentiary proof of the applicability of the EMVR is a "demand curve [or] market evidence indicating that [the patented] invention drove demand for [infringer's products]."[172] Requiring such economic evidence of market demand, Chief Judge Rader rejected the plaintiff's expert's methodology of selecting the revenue base as sales of the CPU brick without showing the connection to consumer demand for the infringed component thereof.[173] The Court rejected this evidence, holding that "manufactured revenues cannot . . . sustain expansion of the [EMVR] beyond some credible economic indicators."[174]

Another recent district court case authored by Chief Judge Rader sitting by designation took a similar approach, holding that the plaintiff "must show some plausible economic connection between the invented feature and the accused operating systems before using the market value of the entire product as the royalty base."[175]

5. *Uniloc USA, Inc. v. Microsoft Corp.*

Most recently, the Federal Circuit issued its opinion in *Uniloc USA, Inc. v. Microsoft Corp.*, in which it rejected the long-standing "25% Rule of Thumb" for establishing a starting point for a reasonable royalty calculation.[176] The Rule was a common methodology used by plaintiffs' damages experts, whereby an initial royalty rate of 25% was assumed and case-specific factors were then applied to vary from that rate to arrive at a final number. In its opinion, the Court noted that while it had never squarely addressed admissibility of the Rule, the Federal

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168 Cornell Univ. v. Hewlett-Packard Co., 609 F. Supp. 2d 279, 293 (N.D.N.Y. 2009).
169 *Id.* at 282.
170 *Id.* at 285.
171 *Id.* at 286-87.
172 *Id.* at 288.
173 *Id.* at 285.
174 *Id.* at 288.
175 IP Innovation LLC v. Red Hat, Inc., No. 2:07-cv-447(RRR), 2010 WL 986620 at *3 (E.D. Tex. Mar. 2, 2010).
176 Uniloc USA, Inc. v. Microsoft Corp., __F.3d__, 2011 WL 9738 (Fed. Cir. Jan. 4, 2011).

Circuit has "passively tolerated its use where its acceptability has not been the focus of the case."[177] In premising its holding in the *Daubert* standard for expert evidence, the Court held the Rule to be inadmissible "because it fails to tie a reasonable royalty base to the facts of the case at issue."[178]

Explicitly, the Federal Circuit heavily relied and expanded on its precedent in *Lucent*, *ResQNet* and *Wordtech* in reaching its decision. The Court cited its precedent for the principle that "a patentee could not rely on license agreements that were 'radically different from the hypothetical agreement under consideration' to determine a reasonable royalty."[179] The Court emphasized that the "meaning of these cases is clear: there must be a basis in fact to associate the royalty rates used in prior licenses to the particular hypothetical negotiation at issue in the case."[180] Because the 25% Rule is "an abstract and largely theoretical construct [that] fails to satisfy this fundamental requirement," it was inadmissible as a tool for determining damages.[181]

Notably, the Court also harkened back to recent decisions regarding the EMVR in the second part of its opinion. Addressing the issue of application of the EMVR, the Court cautioned against the "danger of admitting consideration of the entire market value of the accused [product] where the patented component does not create the basis for customer demand."[182]

E. Implications of Recent Patent Damages Case Law and Questions for Study

In sum, *Uniloc* and its predecessors appear to strike a new course regarding damage awards and their methodologies and evidentiary foundations. It remains to be seen whether this shift will be substantive as well as rhetorical in the long term. Currently, the broader impact of these decisions, both on appellate review of patent infringement damage awards and on initial admissibility decisions at trial, is not yet empirically observable. It is possible that a central cause of excessive patent damages, to the extent they existed, has been corrected by these decisions. Or, these cases may have no long-term impact.

It is clear, however, that the Federal Circuit bench is taking an active role in reviewing patent damage awards and is seeking to clarify the rules for their determination at trial. To the extent problems with damages behave idiosyncratically, case-specific correction may be the most

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177 *Id.* at *39.
178 *Id.* at *41.
179 *Id.* at *43.
180 *Id.* at *45.
181 *Id.*
182 *Id.* at *51.

effective remedy.[183] Or, the opposite might be true. Since statutory changes operate differently than the organic evolution of case-by-case precedent, legislative patent reform might be more effective at fixing current problems in patent damage awards. Which fork should be taken depends on what, in fact, these problems are. That is, the nature of the appropriate remedy depends on the diagnosis of the problem.

More precisely, if excessive patent damages are found to behave idiosyncratically, then case-by-case correction of such individual errors and establishment of precedent to prevent their recurrence under analogous circumstances may be the best approach. However, if excessive damages are a systematic problem, legislative changes that would categorically impact all patent cases may be more effective. Or, as a third alternative, if excessive damages are systematically found across a subset of patent awards with identifiable characteristics, legislative or judicial approaches (or a combination of both) may be appropriate to target the problem. In this third case, identifying the characteristics in question will be key.

[183] Burk and Lemley make this argument in their excellent book from 2009, *The Patent Crisis and How the Courts Can Solve It*. See Dan L. Burk and Mark A. Lemley, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2009).

II. RESEARCH METHODOLOGY

This study builds a comprehensive dataset of patent awards and attempts, to the extent possible given available information and statistical techniques, to systematically characterize the distribution of damage awards and analyze their composition. We principally seek to determine first whether or not damages are systematically excessive and second whether or not they behave predictably based on specific characteristics such as determination by a jury or calculation via the reasonable royalty theory.

A. Framework for Study

The economic literature on patents affords a particularly useful frame of reference for constructing the set of variables used in this study. Several prior empirical analyses have demonstrated various factors that explain or determine the likelihood of patents to be infringed and/or asserted against potential infringers and other indicia of economic value.[184] These factors give rise to observable variables for which we assemble data and proxies. For example, several authors have measured the importance of the number of times that patents are subsequently cited in other patent applications.[185] Others have noted that specific firm or industry factors may influence a patent's value.[186]

As such, to the extent that there is a connection between economically validated contributors to patent value and the level of damage awards, there would be less concern that the observed damage awards have been excessive. Conversely, outliers could represent excessive awards—for example, if a correlation is found between the economic variables and infringement awards generally, but several awards have higher amounts than what would be expected under the factors present in those cases, these awards could be excessive. Or, finding a large number of damage awards that deviate from economic variables in unpredictable ways could suggest excessiveness. Conversely, finding a high correlation between award values and the observed variables would undercut arguments that awards are systematically excessive.

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184 *See e.g.*, John Allison & Mark Lemley & Kimberly Moore & Derek Trunkey, *Valuable Patents*. 92 GEORGETOWN LAW JOURNAL. 435 (2004); John Allison and Thomas Sager, *Valuable Patents Redux: On the Enduring Merit of Using Patent Characteristics to Identify Valuable Patents*, 85 TEXAS LAW REVIEW, 1769 (2007); John Allison & Emerson Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECHNOLOGY LAW JOURNAL (2003); John Allison & Mark Lemley & J.H. Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most Litigated Patents,* 158 UNIVERSITY OF PENNSYLVANIA LAW REVIEW (2009).

185 The survey by Zvi Griliches, *Patent Statistics as Economic Indicators: A Survey*, 28 JOURNAL OF ECONOMIC LITERATURE (1990) provides a good background on these studies. More recent contributions include Bronwyn Hall, Adam Jaffe & Manuel Trajctenberg, *Market Value and Patent Citations*, 36 RAND JOURNAL OF ECONOMICS (2005) and Nicholas van Zeebroek, *The Puzzle of Patent Value Indicators*, 20 ECONOMICS OF INNOVATION AND NEW TECHNOLOGY (2011).

186 *See, e.g.,* Ian Cockburn & Zvi Griliches, *Industry Effects and Appropriability Measures in the Stock Market's Valuation of R&D and Patents*, 78 AMERICAN ECONOMIC REVIEW (1988).

Yet, we acknowledge that there may be several other empirical definitions of excessive that have merit. We initially conduct a series of statistical exercises with the data and identify evidence suggesting that awards are not excessive from the perspective of the distribution viewed as a whole. Nonetheless, this does not rule out the possibility of some excessive awards or even background factors across the distribution giving rise to systematically excessive awards. We therefore proceed by uncovering and weighing empirical facts on both sides of the ledger and search for evidence of excessive awards under a variety of possible definitions.

Notably, one methodology not undertaken herein would be to attempt an independent determination of the compensatory value of lost profits or reasonable royalties in litigated cases (*e.g.*, by commissioning expert assessments of damages based on the full evidentiary record). There are several reasons we did not proceed down this path. First, given the size of the dataset, the time and expense required were prohibitive. Second, the validity of such an independent assessment would be inherently suspect. For instance, without additional and unlimited discovery, the basis for determination would be restricted to the public record and therefore omits information that may have been erroneously excluded in limine or was restricted under protective order. Furthermore, the absence of opposing adversarial biases resolved through a neutral arbiter would eliminate an important mechanism for uncovering and reconciling reasonable differences of opinion, as for ensuring legal parameters are correctly applied. While it would be interesting to see whether litigation outcomes correlate with independent calculations, a failure of such correlation might not indicate errors in the verdicts so much as differences between litigation and mathematical calculation.

B. Dataset

Addressing the question posed above requires both comprehensive information about observed patent damage awards and detailed corresponding data on the potential economic value of the patents involved in the litigation. As part of its intellectual property (IP) dispute analysis practice, which provides IP litigation and valuation services, PricewaterhouseCoopers LLP (PwC) has collected an extensive database of information on patent case rulings and damage awards that includes party names, the industry of the potential infringer, whether the patent holder is a non-practicing entity, the presiding court at the time of the decision, the deciding body (bench or jury), the year of decision, the time to trial, and the associated damage awards with their component parts (where available). PwC updates this dataset every year and uses it to issue an annual report on statistics and trends in patent litigation and damages.[187] The PwC annual reports were often cited in the patent reform debates.[188] PwC licensed to us the proprietary dataset underlying their reports to form the foundation on which this study is built. We carefully investigated each of the damage awards identified in PwC's original database to determine the nature of the intellectual property at issue and to verify that damage awards pertaining to the

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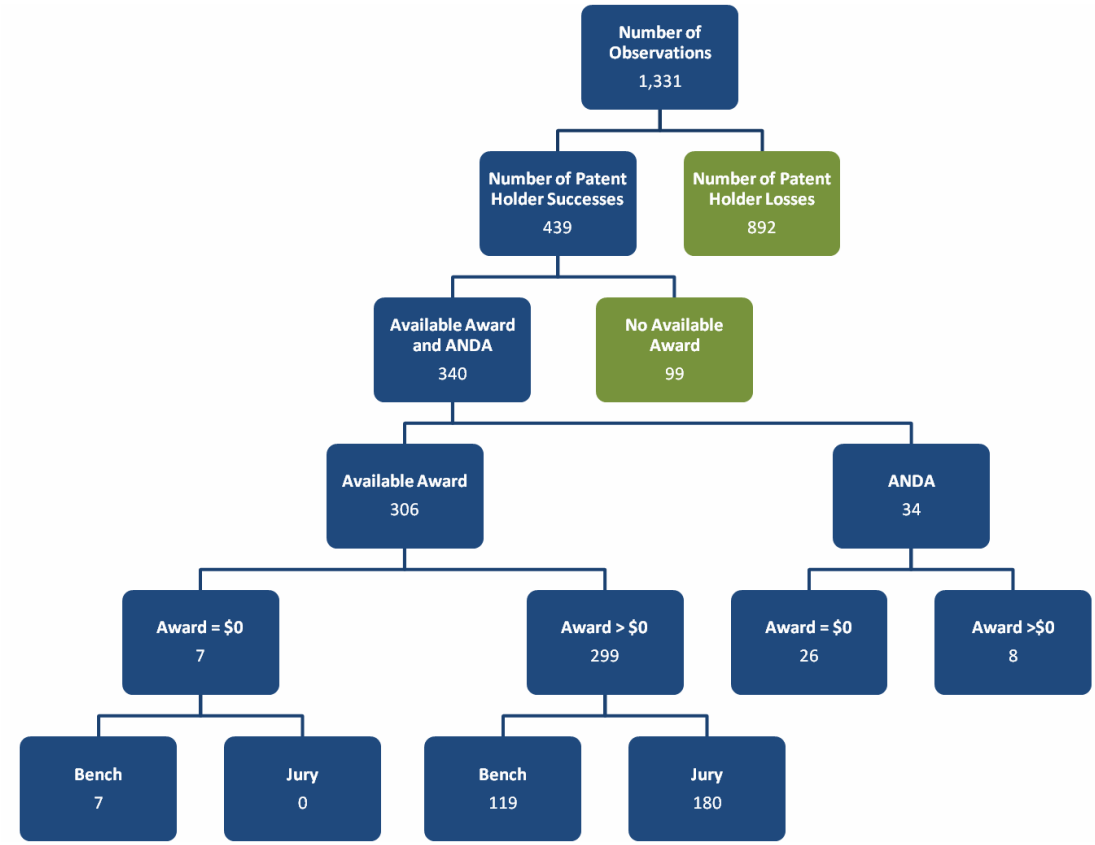
[187] The most recent PwC studies are available at: http://www.pwc.com/us/en/forensic-services/publications/patent-litigation-study.jhtml.

[188] *See*, *e.g.*, note 8 and accompanying text.

same litigated case were appropriately combined. This process yielded a final case information database that is summarized in Figure 1.

FIGURE 1
Description of the Final Case Information Database
1995 – 2008



A total of 1,331 cases were identified, of which the trial court ruled there was infringement in 439. Among these, courts awarded damages in 340 cases – with post-judgment settlement by the parties being the most common reason no award data was found. These 340 cases represent the set of observations examined in this analysis, with the identified total damages award level representing the main dependent variable of interest.[189] The level of some of these awards may well have changed on post-trial review and appeal; however, attention is

189 The 340 cases include those involving Abbreviated New Drug Applications (ANDAs) where lost profits and reasonable royalties are not available remedies. To avoid losing these cases in the regression analysis they are coded as having $0 award (if there were no costs awarded). Because some total damages amounts include costs that cannot be separated out, all total awards include costs and attorneys fees, where available. Further, seven non-ANDA cases have a true award of $0. In these cases, the trier-of-fact determined that the patent holders did not bear their burden of proof on damages.

focused only on the initial damage awards granted at the district court level.[190] In other words, the damage awards in our dataset may have been changed during the appeals process, but these changes are not reflected in our current analysis.[191] To compare across years, we used the Consumer Price Index to translate damage awards levels from their nominal amounts into 2008 dollars.

C. Explanatory Variables

To complement the damage awards information, we also assembled various series of data that could potentially explain the level of damages in each case. All the explanatory variables used are summarized in Table 1 and can be divided into three separate categories.[192] The first category is information derived from the record in each individual case, with key factors such as whether the case was decided by a judge or a jury and whether a lost profit or a reasonable royalty damages theory was utilized in determining the level of the award, if available.

The second category of variables represents information about the litigants in each case. This includes the identity of both the plaintiff and the defendant in each case—*i.e.*, if it is an individual, a firm, a government entity or a nonprofit organization. The corporate litigants are further broken down into various industry categories and by firm size.

The third category of variables draws on the economic literature of patent value mentioned above. These data include publicly available information on various characteristics of patents, including information about their assignees, number of claims, and counts of their citations in subsequent patents. Economists have argued that patents embodying more substantial intellectual property often have more claims and are cited more often by later patents.[193] By including number of claims or appending citation information to the data for each case, it can be determined whether a particular measure of a patent's value is associated with the court's determination of infringement award levels.

All of the case identification and variable coding are limited to the information that could be found in Westlaw, Lexis, PACER, and the NBER patent database, in addition to information

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190 To be clear, we define awards based on the trier of fact in the case. For cases decided by a jury, the base amounts are those awarded in the jury verdict. For cases decided by a judge, the base amounts are the those in the final judgments. Base awards are for direct infringement only (including price erosion and convoyed sales where awarded). They do not include appeals or, in the case of jury awards, remittiturs by the bench. Where available, associated interest and enhanced damages for willfulness are added to the base amounts to arrive at the total award.

191 Future analysis may study the changes in awards due to the appeals process.

192 For a list of variables, *see* Appendix 1.

193 *See* Allison et al., *Valuable Patents*, *supra* note 184.

on websites like Google, Manta, Hoover's Online, Fortune, and EDGAR (for company SEC filings).[194]

TABLE 1
Summary of Variables

Variable Groups	Description	Sources
Category 1: Case Information		
Identifiers	Variables including a unique ID assigned by the authors, the docket number of the case, and the full names of the first listed plaintiff and defendant in the case.	PwC database, Google, Westlaw, and PACER
Dates	Variables including the year of the original award in district court, date the complaint for case was filed, the earliest start date of trial on validity, infringement, or damages, and the number of days between the trial start date and the complaint date.	PwC database, Google, Westlaw, and PACER
Location	Variables including where the case was litigated, including state, circuit, and court.	PwC database, Google, Westlaw, and PACER
Other Case Information	Variables determining if the case contained a summary judgment for the patent holder on validity and/or infringement, if the case involved an invalidated patent-at-issue, and if the patent holder was successful in its patent claims.	PwC database, Google, Westlaw, and PACER
Damage Awards	If the patent holder was successful, variables for the total award amount, lost profits, reasonable royalties, prejudgment interest, enhanced damages, price erosion damages, and other damages. Also included are whether or not the case settled before damages were awarded, whether or not the case resulted in only an injunction, and whether or not the case was an ANDA filing.	PwC database, Google, Westlaw, and PACER
Category 2: Litigant Information		
General Assignee	Includes number of patent assignees associated with the patents-at-issue in the case, the names of the assignees, if one of the assignee(s) is the first named plaintiff or defendant in the case (can be both), if the plaintiff name listed is an assignee (patent holder), and if the patent holder markets or manufactures its technology covered by the patent.	PwC database, Google, Westlaw, PACER, and NBER patent database
NBER Assignee	Dummy variables from the 2002 NBER database which coded the Assignee(s) as "Unassigned," "US, Non-Government," Non-US, Non-Government,", "US, Individual," "Non-US, Individual," "US Government," or "Non-US, Government."	NBER patent database
Assignee Identifiers	Includes the variables determining whether or not the first named plaintiff or defendant are an individual, private entity, public entity, university, part of the U.S. government, a domestic entity, foreign entity, part of the 2009 Fortune 500 list, part of the 2009 Fortune 1000 list, a subsidiary of a parent company.	EDGAR, Manta, Hoover's Online, Westlaw, and Fortune 1000
Assignee Parent Identifiers	Variables for the parent companies of the plaintiff or defendant listed if it was a subsidiary that include whether or not the parent company is a private entity, public entity, domestic entity, foreign entity, part of the 2009 Fortune 500 list, part of the 2009 Fortune 1000 list, if the first named plaintiff or defendant is owned by a joint venture (2 parents or more).	EDGAR, Manta, Hoover's Online, Westlaw, and Fortune 1000
SIC Codes	Variables identifying the 2-, 3-, and 4- digit SIC codes for the potential infringers.	NBER patent database, Google, and Westlaw
Category 3: Patent(s)-at-Issue Information		
General Patent	Variables identifying the number of patent(s) at issue in the case and their type as either utility, reissue, design, or application number.	NBER patent database, Google, and Westlaw
Patent Classification	Includes variables for all patents-at-issue such as application year calculated for minimum and maximum (minimums and maxima differ for cases with multiple patents-at-issue and are the same for cases with only one patent-at-issue); grant date year calculated for minimum and maximum; grant date calculated for minimum and maximum; age of the oldest and youngest patent-at-issue in a case calculated for minimum and maximum; number of claims calculated for minimum, maximum, average and total; number of forward citations through 2002 from the NBER 2002 data, calculated for minimum, maximum and average; number of forward citations through 2010 if the 2002 forward citations were not available, calculated for minimum, maximum and average; the IPC4 classification listed first on the patent; and the PTO main classification for each patent listed in the case.	NBER patent database, Google, and Westlaw

194 The databases can be found at the following websites – Westlaw: https://lawschool.westlaw.com; Lexis: http://www.lexisnexis.com/lawschool; PACER: http://www.pacer.gov; NBER patent database: http://elsa.berkeley.edu/~bhhall/patents.html and https://sites.google.com/site/patentdataproject/Home; Google: http://www.google.com; Manta: http://www.manta.com; Hoover's Online: http://www.hoovers.com; Fortune 1000: http://money.cnn.com/magazines/fortune/fortune500/2009/full_list/; and EDGAR: http://www.sec.gov/edgar.shtml.

III. EMPIRICAL ANALYSIS

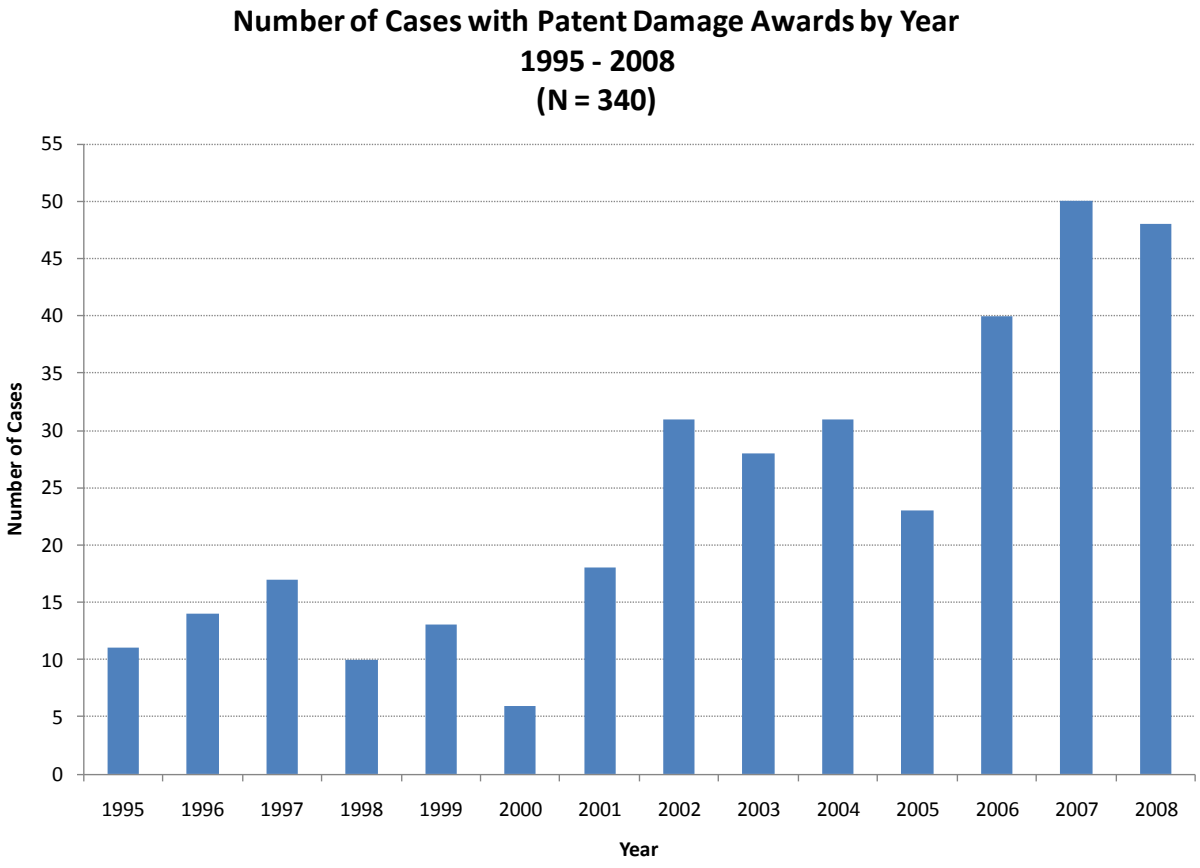
A. Descriptive Analysis

The first step of our empirical analysis is an in-depth description of the comprehensive database of available awards that we have constructed. As described above, the dataset of awards includes a total of 340 observations, each of which represents a litigated case for which infringement was found and damages were awarded by the court.

1. Characteristics of the Distribution

Figure 2 displays the count of observations in the datatset by year of decision, from 1995 through 2008.

FIGURE 2



This graphic representation underlines the fact that on a year-by-year basis, the number of patent damage awards granted is quite small. As a consequence – and particularly since one or

two large awards can skew these distributions substantially – one should be careful to not attribute too much significance to differences in observed damages from year to year.[195] When controlling for the year of the decision in the regressions below it can be shown that an independent time trend has no power in explaining damages award amounts.[196]

To facilitate comparison with previous studies, annual summaries of the distributions of awards in the dataset are presented. Table 2 provides a more complete picture of these distributions, by including the quartiles as well as medians.[197] Taking 2004 as an example, after adjusting the awards to 2008 dollars, the lowest award that year was $40,000 and the highest award that year was $175.1 million. In between those amounts though, 25% of the awards were under $540,000, 50% of the awards were under $4.3 million, and 75% of the awards were under $29.0 million. The other annual distributions behave in similar fashion.

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195 Another reason for caution in making year-to-year comparisons is because of the E-Government Act of 2002 (Pub.L. 107-347, 116 Stat. 2899, 44 U.S.C. § 101, H.R. 2458/S. 803) which applied to the federal judiciary and mandated public electronic access to all written court case opinions. This Act could account for the increase in cases starting in 2002 and going through 2008 as more courts implemented the requirements in the Act.

196 Furthermore, the small number of patent infringement cases in which damages are awarded may give reason to question the hyperbolic claims by some that patent litigation damages have significant deleterious effects on research and development activities in the United States.

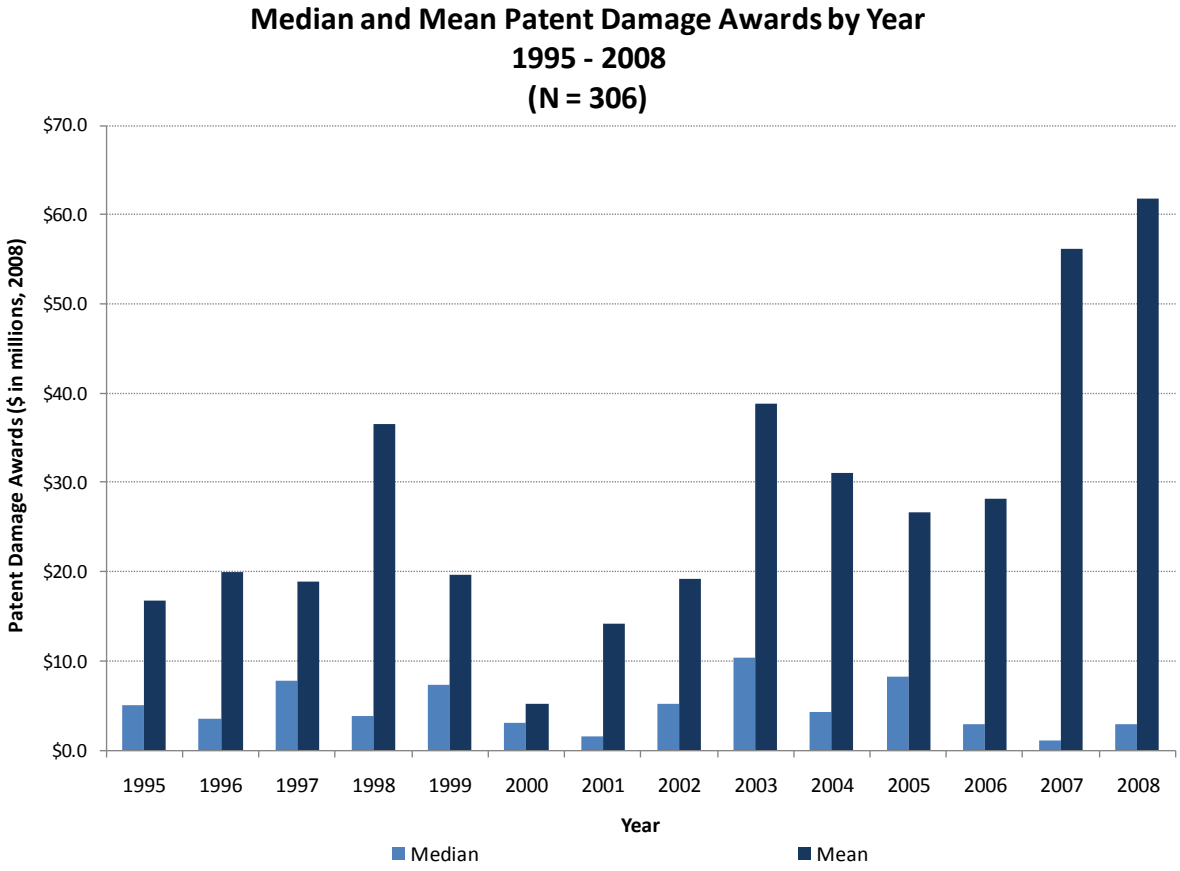
197 Since patent cases involving Abbreviated New Drug Applications (ANDAs) are structured differently from standard patent infringement cases in terms of damages, those cases were removed from Table 2 as well as from Figures 3 – 6 for descriptive purposes. The total number of cases without ANDA cases is 306 rather than 340.

TABLE 2
Distribution of Patent Damage Awards by Year ($ in millions, 2008)
1995 – 2008
(N = 306)

Year	Minimum	First Quartile	Median	Third Quartile	Maximum
1995	$0.03	$1.38	$5.07	$16.32	$87.52
1996	$0.02	$0.37	$3.57	$22.68	$130.36
1997	$0.30	$1.55	$7.70	$24.03	$97.59
1998	$0.01	$2.18	$3.81	$10.63	$225.87
1999	$0.28	$1.95	$7.35	$20.97	$125.35
2000	$0.48	$0.61	$3.02	$6.59	$16.54
2001	$0.00	$0.08	$1.58	$16.91	$94.87
2002	$0.00	$0.61	$5.15	$30.77	$117.41
2003	$0.08	$0.70	$10.41	$19.93	$609.17
2004	$0.04	$0.54	$4.27	$28.99	$175.09
2005	$0.00	$1.92	$8.23	$26.92	$141.14
2006	$0.01	$0.44	$2.94	$32.22	$327.76
2007	$0.00	$0.14	$1.11	$18.12	$1,597.11
2008	$0.00	$0.66	$2.88	$27.18	$1,223.88

Figure 3 shows the differences in the medians and averages by year.

FIGURE 3



Although there is an underlying stability of the median over time, the increasing skewness of the awards data is evident from Table 2 and Figure 3 – for example, when they occur, outliers generate large differences between the average and the median award levels in particular years. Taken together, Table 2 and Figure 3 also demonstrate an underlying stability of the distribution over time. This lack of annual variation motivates a description of the characteristics of the *entire* distribution of awards over the whole time period for which data is available.

A straightforward graphical presentation of the entire awards distribution is shown in Figure 4.

FIGURE 4

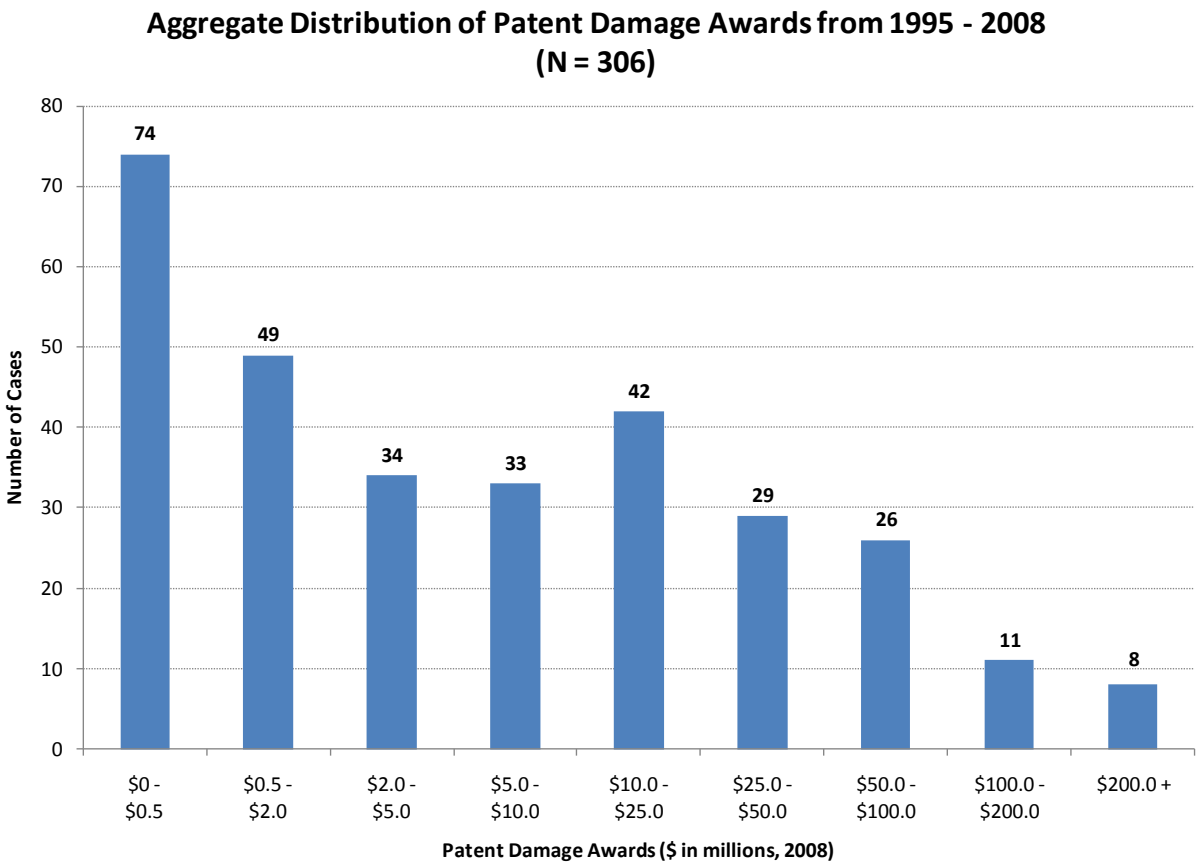


Figure 4 is a histogram of awards, broken down into increasing award-level categories. Across the dataset, 74 of the cases have damage awards of less than $500,000, representing 24.2 percent of all cases during the time period. Reading from left to right in the figure, 49 cases have award values between $500,000 and $2 million; 34 between $2 and $5 million; 33 between $5 and $10 million, 42 between $10 and $25 million, 29 between $25 and $50 million, 26 between $50 and $100 million and 11 between $100 and $200 million. Of particular note in Figure 4 is the very last bar on the right, representing damage awards of over $200 million. A total of eight cases fall into this highest category of damage awards, which represents 2.4 percent of the number of all awards during the 1995 through 2008 period.

2. Excessiveness

It is not surprising that these damage awards in the upper tail of the distribution would attract so much attention. As compared to the overall distribution, they are quite large. Indeed, we find that together, these eight cases represent 47.6 percent of the collective damages in *all* the

non-ANDA cases from 1995 until 2008. These raw data suggest that focusing on these very large values may obscure the true nature of the overall distribution of the damage awards. In contrast to the suggestion put forward by policy makers,[198] our systematic analysis of the entire distribution reveals that the largest awards are not "the tip of the iceberg" of excessive patent damage awards. Instead, these very large awards appear to be true outliers, as compared to the rest of the distribution.

While more details about the determination of awards will be discussed in the regression analysis described below, a descriptive analysis of the underlying distribution of damage awards is revealing about the question of whether the awards are systematically excessive. Cutting the data several ways shows that the distribution exhibits a great deal of skewness; a very small number of very large damage awards are not representative of what has happened across all cases. As a consequence, it may be more difficult to make an argument that damage awards are excessive by appealing to anything other than the very largest of the awards for empirical support. Yet, it is notable that such awards are indeed very large as compared with the rest of the distribution.

3. Unpredictability

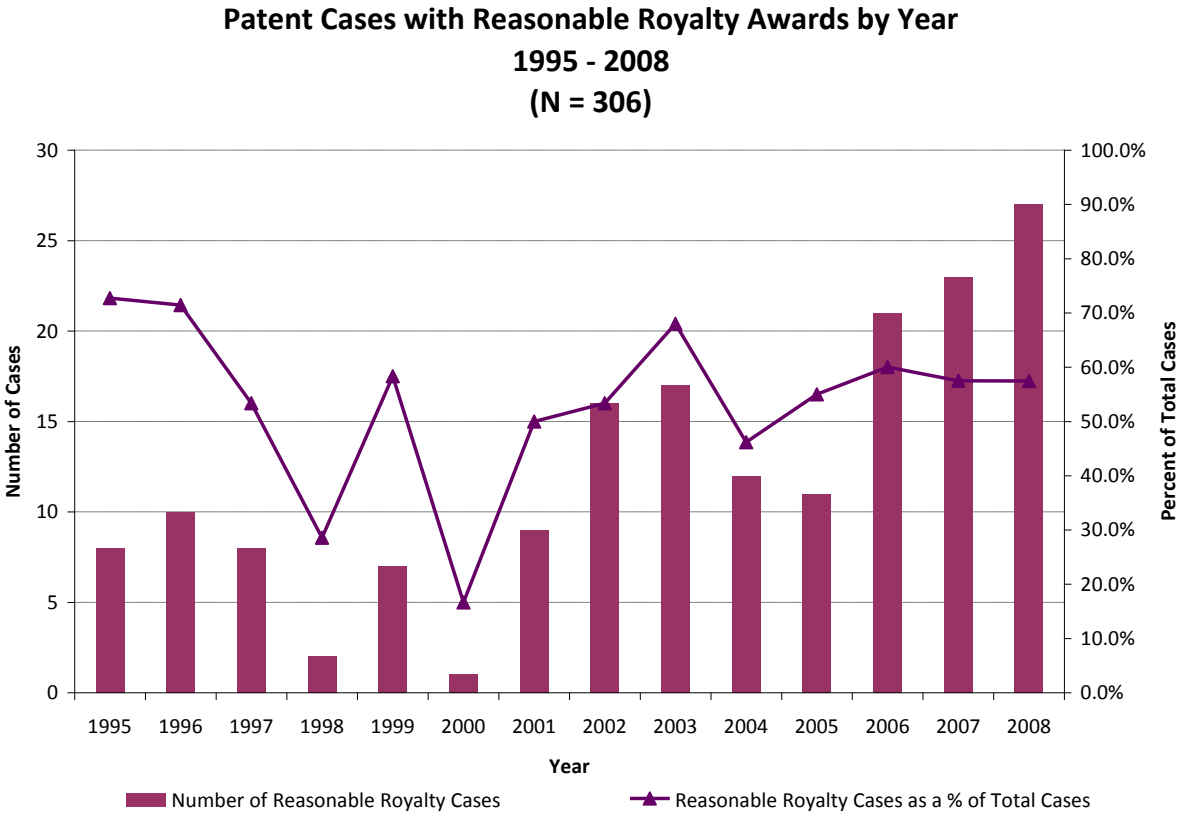
In addition to testing the concerns over whether patent damages are "excessive," the descriptive analysis herein can probe some of the key assumptions underlying concerns that awards are unpredictable. These include factors such as the prevalence of damages determined by juries, particularly given the large disparity between awards in jury versus bench trials[199] and the perceived risk of jury errors in calculating reasonable royalties.[200] As mentioned above, unpredictability can be detrimental for a number of reasons, including that it may support *ex post* exploitation of patented inventions by PAEs.[201]

As can be seen using the bars in Figure 5 below, the raw number of patent cases where it was clear that reasonable royalties had been awarded has increased over time. We considered a case as having reasonable royalty damages only if the final decision, docket sheet, or jury verdict form clearly stated that at least part of the amount was awarded as royalties. It is possible that other awards were also based on a theory of reasonable royalties, but we were unable to determine that from the information available. These cases were not classified as having a reasonable royalty award for purposes of this analysis. However, clear reasonable royalty cases as a percent of the total patent cases where damages were awarded, have an almost constant trend over the period 1995 – 2008. This can be seen in the line in Figure 5. Generally then, cases where reasonable royalties were clearly awarded do not appear to make up a larger portion of the total number of awarded cases over time. As such, patent holders are receiving royalty

198 2007 Senate Report, *supra* note 79, at 12.
199 *See* 2011 FTC Report, *supra* note 88, at 161-62.
200 *See infra*, Section I.B.
201 *See* 2011 FTC Report, *supra* note 88, at 162 n. 9 and accompanying text.

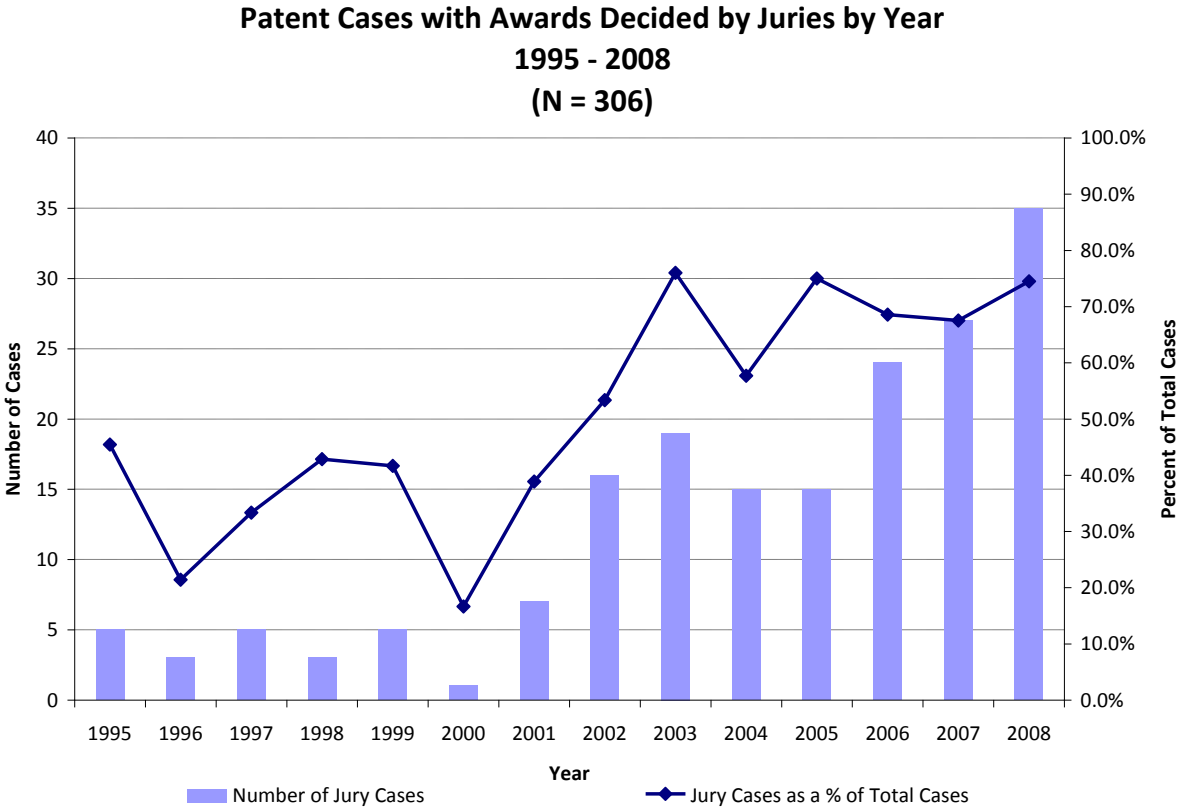
damages more frequently than before due to the increased number of patent cases with awards, but not because royalties became more common over all awarded cases.

FIGURE 5



Much like in Figure 5, Figure 6 below shows that the raw number of patent awards determined by juries has increased over time. However, unlike the trend for cases with reasonable royalty awards, the number of cases with jury awards increased as a proportion of all awarded cases. So, not only are juries deciding more patent awards due to the increasing number of patent cases with awards, but juries are deciding patent awards in an increasing proportion to judges. Thus it has become more common over time to have a patent awards decided by a jury.

FIGURE 6



Taking Figures 5 and 6 together, it is possible that although royalty cases were not necessarily more common among awarded patent cases, more of them have been decided by juries over time. To the extent that juries make errors in calculating reasonable royalties, this finding could be cause for concern; but, further analysis would be needed to determine whether juries are indeed making calculation errors. As discussed below, the regression analysis herein finds awards to be highly predictable based on *ex ante* observables. This directly addresses the concerns of a "lottery ticket mentality." Furthermore, it undercuts arguments of large proportions of erroneous outcomes, which would be expected tend towards a more idiosyncratic distribution less connected to underlying fundamentals.

B. Regression Results

The regression analysis presented below attempts to determine how much of the variation in patent damage awards can be explained by the factors we assembled regarding the cases, litigants and patents-at issue, as well as which factors in particular are associated with significantly higher or lower damages award values across the dataset. We examine outliers in this context—*i.e.*, observed damages award values that deviate from their predicted value. This allows us to test another definition of excessive awards, as those that are much higher than would otherwise be predicted based on the key identified explanatory variables. Furthermore, by

examining the fit of our regression model to the data distribution, we are able to provide a measure of the predictability of infringement awards during the target period.

1. Description of Regressors

The main goal in the regression analysis is thus to use the data series enumerated in Table 1 above to explain the variation in observed patent damage awards. In order to most effectively use the data to generate additional explanatory power, we conducted a variety of detailed manipulations on many of the variables. For example, we translated the data that identifies the circuit court in which each patent damages case was decided into a series of indicator variables representing each circuit. We also constructed interaction terms for certain key variables. As an illustration, the data contains information about who decided damages (judge or jury) in each case and the particular damages theory (lost profits or reasonable royalties) utilized. Based on these individual indicator variables, we further considered, such as interaction variables for cases decided by juries using the reasonable royalty standard. In a further effort to increase the explanatory fit of the model, we also considered nonlinear representations of some regressors.

Table 3 below highlights statistically significant results from the "best" regression, *i.e.*, the combination of variables that explain awards variation to the greatest degree.[202]

[202] The full regression can be found in Appendix 2. In order to compare all patent infringement cases, ANDA cases are included with $0 damages amounts in the regression.

TABLE 3
Summary of Significant Regression Results
Dependant = Log of Patent Damage Awards in 2008 Dollars

Number of obs	338
F(94, 243)	20.120
Prob > F	0.000
R-squared	0.756
Adj R-squared	0.662
Root MSE	2.970

Dependent = *Log of patent damage awards in 2008 dollars*	Coef.	Robust Std. Error	t	P>t	[95% Conf. Interval]	
The case was decided in the court of Federal claims	3.62033	1.39701	2.59	0.010	0.86854	6.37213
The award was decided at a jury trial	3.49765	0.88263	3.96	0.000	1.75906	5.23623
Lost profit damages were awarded	3.06881	0.73597	4.17	0.000	1.61912	4.51850
Reasonable royalty damages were awarded	2.40150	0.75302	3.19	0.002	0.91822	3.88479
Other damages were awarded	1.14349	0.51474	2.22	0.027	0.12956	2.15741
Price erosion damages were awarded	1.67677	0.97763	1.72	0.088	-0.24894	3.60247
Lost profit damages were awarded at a jury trial	-2.21232	0.94018	-2.35	0.019	-4.06426	-0.36038
The most recent patent grant year over all patents-at-issue in the case	-0.21560	0.09976	-2.16	0.032	-0.41210	-0.01910
The case involved more than 10 patents	3.63583	2.18644	1.66	0.098	-0.67096	7.94261
Number of assignees for all patents-at-issue (squared)	0.41293	0.24898	1.66	0.099	-0.07751	0.90338
Plainiff's parent company is in the Fortune 501 - 1000 rankings	2.36992	1.31649	1.80	0.073	-0.22327	4.96312
Defendant in the case is a public company	1.22817	0.59397	2.07	0.040	0.05817	2.39816
Defendant in the case is in the Fortune 501 - 1000 rankings	-2.43760	1.18366	-2.06	0.041	-4.76914	-0.10605
The potential infringer is in the construction industry	2.37488	1.35961	1.75	0.082	-0.30324	5.05300
The case involved an Abbreviated New Drug Application	-8.67051	1.33346	-6.50	0.000	-11.29711	-6.04390
Constant	362.36800	168.85260	2.15	0.033	29.76651	694.96960

2. Overall Fit

Remarkably, the statistical model that we constructed includes a set of regressors that explains over 75 percent of the variation in the observed patent damage awards, as represented by an R-squared of 0.756 (Table 3).[203] This result suggests that infringement damages are very predictable based on the dimensions represented by our data.[204] It is not clear, however, that one can conclude that damage awards are not excessive simply because they are well predicted in the regression. In particular, it is worth noting that the dependent variable in the model reported in Table 3 is the log of damage awards; a linear version using the same regressors had much less explanatory power (R-squared = 0. 393 and Adjusted R-squared = 0.158). While the better fit of the log regression is not surprising given the skewness in the underlying damages data, a well-fitting linear regression would argue even further against the excessive nature of damage awards.[205]

3. Certain Significant Factors

The regression summary statistics indicate that the variables representing characteristics of the litigants and of the patents-at-issue are significant collectively, though few—including the economic patent-value proxies—appear to individually explain much of the variation in the damages award values.[206] Table 3 also highlights the subset of explanatory variables that have a statistically significant effect on the observed damages award amounts (in logs). Also, additional interaction terms might have statistical significance; exploration of these factors has been reserved for future studies of the dataset.

Certain variables in our analysis are worth noting as they relate to particular policy proposals regarding excessive damages mitigation. First, the dummy variable indicating cases in which damage awards were decided by juries is positive and strongly significant, suggesting damage awards are approximately 350% larger in jury trials, all else equal. This lends credence to the argument that large awards are more likely in determinations made by juries instead of judges. However, the lack of evidence of systematically excessive or unpredictable awards

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203 Even after taking into account the number of regressors in the model, the Adjusted R-squared still equals 0.662.

204 These findings contrast with the suggestion in the Opderbeck study that there is no clear pattern to the observed damage awards. *See* Opderbeck, *supra* note 100, at 149.

205 It is not uncommon to use log transformations on the dependent variable in order to put the relationship between the dependent and independent variables into a linear form. The appropriateness of logging the dependent variable can also be determined by graphing the residuals of the model. Here the residuals are normally distributed, suggesting that our model is appropriate.

206 However, it is worth noting that the economic patent-value variables are jointly significant at the 10% level ($F(16, 243) = 1.55$ and p-value = 0.0847), indicating that as a group, these factors provide a useful, theoretically grounded framework for evaluating the size of damage awards.

suggests that this disproportion is not directly attributable to jury errors; an alternative possible explanation may be selection effects in infringement trials.[207]

Also, our data suggests that juries may award relatively higher damages based on reasonable royalty calculations rather than lost profits. As shown in Table 3, the interaction term of juries and lost profits is significantly negative, indicating that award amounts were about 220% lower in cases where juries clearly awarded lost profits than any other type of case.[208]

It is also true that cases in which lost profit or reasonable royalty awards were clearly indicated in the decisions tended to have higher total award amounts than cases in which a different or unstated methodology was used. Cases clearly awarding lost profit damages had damages amounts that were about 300% higher, all else equal, and cases clearly awarding reasonable royalty damages had damages amounts that were about 240% higher, all else equal. This is also true to a lesser degree for other damages, which included convoyed sales and price erosion, where amounts were about 110% and 170% higher, respectively, in cases where the methodology was clearly indicated. Other factors that seem to contribute to increases in awards include indicators for cases in which the defendant was a public company or the US government, whether the case involved more than 10 patents, the number of assignees, whether the plaintiff's parent company was in the Fortune 500-1000, and whether the potential infringer was in the construction industry.

In contrast, some factors that tended towards decreased award amounts include having a young patent-at-issue or a public defendant in the Fortune 501 – 1000. Each year later by which the youngest patent-at-issue was granted results in an approximate 20% decrease in damages. Further, defendants in the Fortune 501 – 1000 faced damages amounts of about 240% less than all other defendants, including the Fortune 500 and all other private businesses. Both of these factors are reasonably expected. Younger patents cannot be infringed upon for as long a period, resulting in fewer damages to be claimed. Public corporate defendants ranked in the Fortune 501 – 1000 have fewer revenues on which to claim damages and possibly less likely to make as many infringing units as larger public and private defendants.

4. Residuals Analysis

Building from these results, we have performed an additional empirical analysis to shed more light on the question of whether damages are excessive or unpredictable given the benchmark variables. For each damages award observation, we use the estimated parameters from the regressions to calculate a "predicted" award amount given the data on all the

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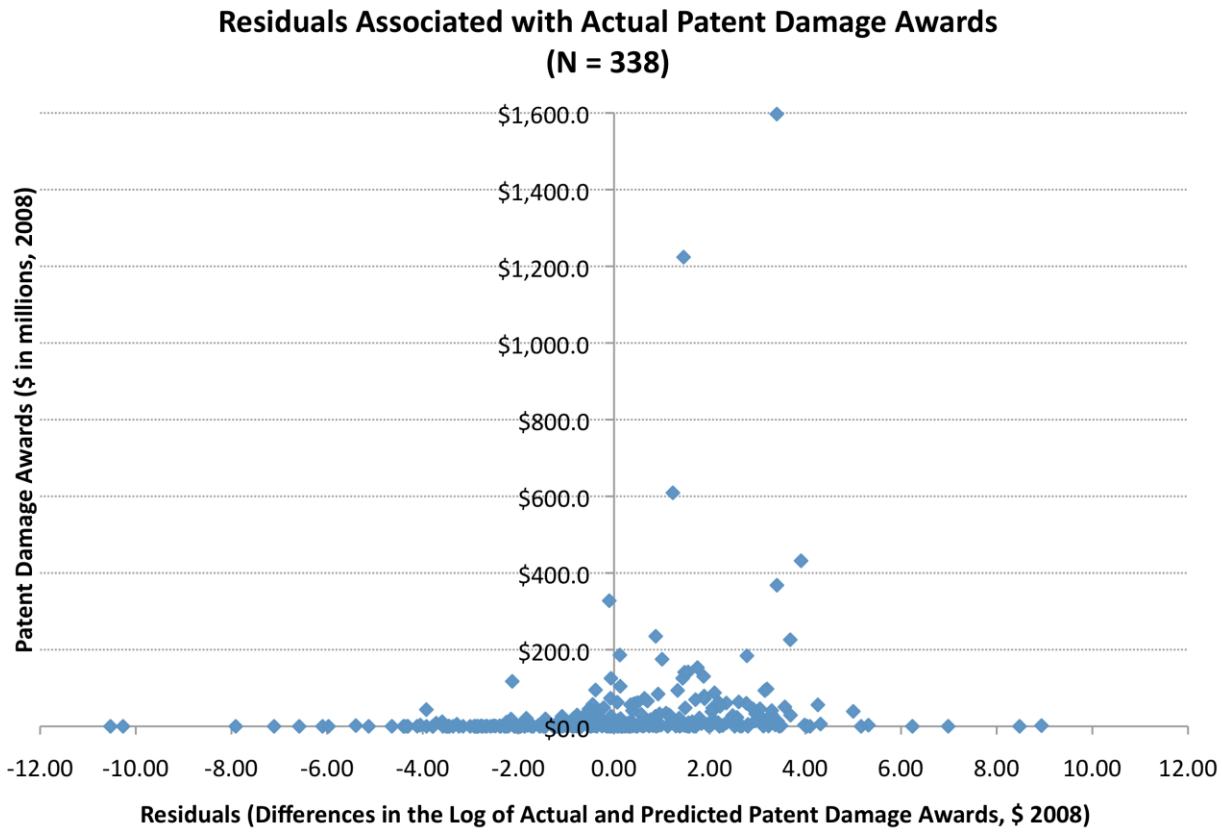
[207] Plaintiffs decide whether or not to try their case before judge or jury and may be more inclined to bring high-stakes cases before juries. The wisdom of this choice of course depends on the likelihood of a larger payout from a jury than a judge.

[208] This result should be interpreted with a degree of caution, as we were not able to identify the underlying damages theory in every case.

explanatory variables for that observation. The difference between the actual and the predicted amount (*i.e.*, the residual) represents how well the model does in terms of explaining each observation. These residual values are plotted for the entire dataset in Figure 7.

FIGURE 7



None of the cases with the largest damage awards are outliers of the residuals plot. Rather, it appears from the above that large awards, including the eight largest, are readily predictable by the model. In terms of the difference between predicted award values and observed damages, litigation outcomes again do not appear to be excessive or unpredictable.

We further investigated a possible selection effect to the extent that the database does not include a relatively large number of cases where the court found infringement but the parties settled before damages were assessed. If these cases would have had very large damage awards had they not settled, this could explain why so few cases across the dataset had very large award values. However, the predicted values for these 59 cases turned out to be quite small, with the average predicted log value equaling 10.0 (or approximately $22,000) and the maximum equaling 16.1 (or approximately $9.8 million). Had these cases not settled, it is entirely possible

then that the very large value awards would have represented an even smaller share of the overall data.[209]

5. The Eight Largest Awards

As a final query, we looked more closely at the eight largest awards to see whether these large amounts survived to the post-verdict and appellate process. Although a complete analysis of the effects of appellate and post-verdict review on patent damage awards is left to a future study, this piecemeal approach gives some appreciation for the distinction between media hype and real problems in infringement damages.

By reading through the district court and Federal Circuit dockets and opinions for these cases after damages were initially awarded, we found that none of the eight largest awards have gone unchallenged. Further, although two of the cases are still ongoing, none of the other six awards have stood. Three of these six were appealed, but the cases were dismissed (likely due to settlement) before there was a decision on appeal. The final three awards were either decreased by the district court judge following the verdict or reversed and remanded by the Federal Circuit on appeal. Based on this analysis, to the extent large awards are a concern, it appears that the post-judgment review process does mitigate the likelihood of having to actually pay these amounts.

C. Interpretation

Taken together, our empirical analysis does not reveal any evidence of a systematic or pervasive problem of excessive patent damage awards. It is quite clear that a very small number of very large awards exist; however, these very large awards are indeed rare and serve to skew the distribution immensely. Furthermore, damages award values (including the largest awards) are quite predictable using publicly available information, including data typically associated with patent value. Outliers that do exist are not particularly associated with very large value awards. Our comprehensive empirical analysis suggests that the very large awards that have garnered much public attention and scrutiny are isolated and appear not to be excessive based on the characteristics of the associated cases. Moreover, the perceived "lottery ticket mentality" associated with patent litigation does not appear to play out in the data; indeed, the surprisingly high degree of predictability of awards counsels for revised strategies towards *ex post* patent assertion and *ex ante* innovation.

These results provide empirical support for the recent abandonment of litigation reforms from the Senate and House bills. Legislative amendments addressing damages across all cases do not appear to be warranted given the absence of broad systematic problems with historic

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[209] While it would be useful to study whether the parties settled at approximately the predicted amounts, settlement data is generally unavailable.

infringement awards. To the extent systematic issues do exist, they appear to be more nuanced than wholesale excessiveness or unpredictability, and counsel for more precise corrective measures.

For example, particular factors, including juries, do appear to be associated with larger infringement awards. According to our model, larger damages come from cases in which juries determined reasonable royalties, all else being equal. To the extent that this result is cause for concern, additional work should be done to mine further into these cases and assess whether particular *Georgia-Pacific* factors correlate with higher awards, the role of apportionment in affecting award value and the extent to which these jury determinations were rescinded following judicial. The answers to these questions will help to further refine whether and what types of policy reforms might be beneficial. Additionally, the Federal Circuit has recently undertaken a more active role in reviewing patent damage awards. It is possible that post-verdict and appellate review, bolstered by these new norms, already function to correct errors on a case-by-case basis.

IV. CONCLUSION

Although concerns over excessive and unpredictable patent infringement damages have driven debates to reform damages law and overhaul the patent statutes more generally, very little work has been done to determine whether these claims are supported by the empirical record. This study finds that they are not. It addresses the question of excessive patent awards head-on, seeking to identify whether such awards systematically exist and, if so, what are their defining characteristics and contributing factors. Beginning with a proprietary dataset on patent damage awards licensed to us by PwC, we coded over 120 variables describing various aspects of the cases and awards for 340 successful patent cases over the period 1995-2008 and analyzed this data using standard statistical methods. The result was a comprehensive study evaluating the nature and characteristics of patent infringement damages for those 14 years.

The findings of our study should settle the aforementioned concerns. Moreover, they should help reshape perspectives about patent infringement damages and provide unprecedented information to policy makers, practitioners and industry participants as they respectively navigate the patent litigation and exploitation landscape. Restated in summary:

- Based on empirical analysis of the distribution of awards, it does not appear that a systematic or pervasive problem of excessive patent damage awards exists. We have constructed a statistical model that explains much of the variation in damage awards, including the largest awards, in terms of *ex ante* observable variables regarding the litigants, cases and patents-at-issue.

- The large awards garnering media attention and scrutiny from policy makers seem to be idiosyncratic. Over the 14 years of available data, there were only eight damage awards in excess of $200 million. These eight awards represented nearly half of the damages in all 300+ cases in the dataset with available damage awards from 1995 through 2008.

- The econometric model in this study does a very good job of explaining the observed patent damage awards across the dataset. Over 75 percent of the variation in observed patent award levels can be explained by the assembled information about the cases, litigants, and patents-at-issue. As a result, infringement awards can be said to be highly predictable.

- Large awards are not excessive outliers with respect to the empirical analysis in this study. Deviations from the model's predictions and actual damage awards observed are reasonably small. There appears to be little connection between the size of this deviation and the size of the award.

These empirical findings support the decision of the Senate and House to refrain from instituting sweeping damages law reforms. Since it does not appear that patent damages are systematically or pervasively "excessive," legislative reforms run the risk of over-regulating damages.

Others have suggested that courts are best equipped to handle idiosyncratic errors, and the recent shifts in patent damages case law suggests that the Federal Circuit is ready to the task. From an empirical perspective, further analysis of post-verdict and appellate data could help assess this recent precedent and guide future reforms. It is possible that appellate reversal or remittitur of patent damage awards may already be effective at correcting idiosyncratic trial errors. Understanding the results of the appeal process would also aid litigants in determining appellate strategy.

Many other open empirical questions remain. First-order investigations include further examination of litigation differences between industries, the use of apportionment, effects of key *Georgia-Pacific* factors and characteristics and effects of PAEs. Studies of greater scale include analysis of win/loss rates at trial, examination of incentives to settle pending litigation, comparison of licensing vs. litigation value and assessment of injunction value as a component of ultimate litigation awards.[210]

More generally, the results and additional questions raised herein highlight the need for increased recourse to empirical analysis in the study and practice of patent law and policy. Legal analytics (or, perhaps, "Legalytics") should be a matter of course in the formation of policy prescriptions at legislative, administrative and judicial levels. A more systematic approach to integrating systematic empirical analysis into normative processes promises increased predictability, coherence and efficacy of resulting outcomes.

We note in closing certain limitations of our study. Although the database contains a large number of patent damage awards, it may not contain every award since not every award is reported to Westlaw. Further, variable coding was limited to what was available in Westlaw, Lexis, PACER, and the NBER patent database, in addition to information on websites like Google, Manta, Hoover's Online, Fortune, and EDGAR (for company SEC filings). This study also only uses economic patent value as a benchmark for excessive damages. It is possible that other appropriate benchmarks could affect outcomes.

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[210] More generally, the 2011 FTC Report calls for "a study of the relationship between the legal rules governing damages and the economic principles that should guide damages calculations . . . ." 2011 FTC Report, *supra* note 88, at 165. We respectfully submit that the study herein takes a step in this direction.

Appendix 1

List of Variables and Descriptions

Variable	Description	Source
Category 1: Case Information		
case_ID	Unique identifier for each case	Assigned
docket_number	The docket number associate with the case	PwC database, Google, Westlaw, and PACER
P_name_1	Full name of the first plaintiff listed on the case	PwC database, Google, Westlaw, and PACER
D_name_1	Full name of the first defendant listed on the case as reported in Westlaw	PwC database, Google, Westlaw, and PACER
P_pat_owner	The plaintiff is the patent holder	PwC database, Google, Westlaw, and PACER
year_of_decision	The year associated with the leading decisions entered by PwC	PwC database, Google, Westlaw, and PACER
complaint_date	Date the complaint for the case was filed	PwC database, Google, Westlaw, and PACER
trial_start_date	The earliest start date of a trial on validity, infringement, or damages	PwC database, Google, Westlaw, and PACER
time_to_trial	The number of days between *trial_start_date* and *complaint_date*	calculated
state	The state in which the court is located	PwC database, Google, Westlaw, and PACER
circuit	The circuit to which the court belongs, if a federal court; Additionally: 0= the U.S. Court of Federal Claims and 12 = D.C. Circuit; State courts are left blank	PwC database, Google, Westlaw, and PACER
court	The court in which the decision on patent holder success was made	PwC database, Google, Westlaw, and PACER
jury	The decision on damages made by a jury	PwC database, Google, Westlaw, and PACER
SJ_flag	The case contained a summary judgment for the patent holder on validity and/or infringement	PwC database, Google, Westlaw, and PACER
invalid_pat_flag	The case involved an invalidated patent-at-issue	PwC database, Google, Westlaw, and PACER
dmg_awd_flag	The patent holder was successful in it's patent claims; i.e. the patent was found valid and/or infringed	PwC database, Google, Westlaw, and PACER
dmg_awd_amt	The total dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages (if applicable)	PwC database, Google, Westlaw, and PACER

List of Variables and Descriptions (cont.)

Variable	Description	Source
	Category 1: Case Information (con't.)	
LP_flag	The patent holder was awarded lost profits	PwC database, Google, Westlaw, and PACER
LP_amt	The lost profits dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
RR_flag	The patent holder was awarded reasonable royalties	PwC database, Google, Westlaw, and PACER
RR_amt	The reasonable royalty dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
RR_rate	The percentage rate associated with the reasonable royalty dollar award granted to the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
RR_basis	The basis to which the reasonable royalty rate will be applied in the trial case before appeal of damages; =0 if the rate is not given in the decision or there is no rate; =1 if Sales; =2 if Profit	PwC database, Google, Westlaw, and PACER
PJI_flag	The patent holder was awarded prejudgment interest	PwC database, Google, Westlaw, and PACER
PJI_amt	The prejudgment interest dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
PJI_rate	The percentage rate associated with the prejudgment interest dollar award granted to the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
PJI_basis	The basis from which the prejudgment interest rate is derived in the trial case before appeal of damages; =0 if the rate is not given in the decision or there is no rate; =1 if Prime Interest Rate; =2 if Treasury Bills; =3 if Statutory Rate; =4 if Cost of Capital; =5 if given but Other	PwC database, Google, Westlaw, and PACER
enh_dmg_flag	The patent holder was awarded enhanced damages	PwC database, Google, Westlaw, and PACER
enh_dmg_amt	The enhanced damages dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
PE_flag	The patent holder was awarded price erosion damages	PwC database, Google, Westlaw, and PACER
PE_amt	The price erosion dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
other_dmg_flag	The patent holder was awarded other damages	PwC database, Google, Westlaw, and PACER
other_dmg_amt	The other damages dollar award granted to the patent holder for the patent claims in the trial case before appeal of damages	PwC database, Google, Westlaw, and PACER
Settlement	The case settled after a finding of validity and infringement but before damages were awarded	PwC database, Google, Westlaw, and PACER
Injunction	The patent holder was awarded an injunction, but no other damages	PwC database, Google, Westlaw, and PACER
ANDA	The case involved an ANDA filing by the potential infringer (injunction and possibly costs awarded but no other damages for patent infringement)	PwC database, Google, Westlaw, and PACER

List of Variables and Descriptions (cont.)

Variable	Description	Source
	Category 2: Litigant Information	
Number_Assignees	Number of patent assignees associated with the patents-at-issue in the case	NBER patent database, Google, and Westlaw
Pat_Assignee	Name of the assignee over all patents-at-issue in the case; one variable for each assignee	NBER patent database, Google, and Westlaw
Assignee_Unassigned	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "Unassigned"	NBER patent database
Assignee_US_Non Govt	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "US, Non-government"	NBER patent database
Assignee_Non US_Non Govt	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "Non-US, Non-government"	NBER patent database
Assignee_US Indiv	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "US, Individual"	NBER patent database
Assignee_Non US Indiv	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "Non-US, Individual"	NBER patent database
Assignee_US Govt	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "US Government"	NBER patent database
Assignee_Non US Govt	At least one of the patents-at-issue in the case had an assignee in the 2002 NBER patent database coded as "Non-US Government"	NBER patent database
P_Assignee	At least one of the patent assignee(s) is the first named plaintiff in the case	calculated
D_Assignee	At least one of the patent assignee(s) is the first named defendant in the case	calculated
Patent_Manuf_Mkt_Tech	The patent holder markets or manufactures its technology covered by the patent; =1 yes; =0 no; =2 unclear	PwC database, Google, Westlaw, and PACER
P_Individual_C	The first named plaintiff is an individual	EDGAR, Manta, Hoover's Online, and Westlaw
P_Private Entity_C	The first named plaintiff is a private entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Public Entity_C	The first named plaintiff is a public entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_University_C	The first named plaintiff is a university	EDGAR, Manta, Hoover's Online, and Westlaw
P_US Government_C	The first named plaintiff is part of the U.S. government	EDGAR, Manta, Hoover's Online, and Westlaw
P_Domestic_C	The first named plaintiff is a domestic entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Foreign_C	The first named plaintiff is a foreign entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Fortune 500_2009_C	The first named plaintiff is part of the 2009 Fortune 500	Fortune 1000
P_Fortune 1000_2009_C	The first named plaintiff is part of the 2009 Fortune 1000	Fortune 1000
p_fortune_501_1K_2009_c	The first named plaintiff is listed in the Fortune 501 to 1000 in 2009	Fortune 1000
P_Subsidiary_C	The first named plaintiff is a subsidiary of a parent company	EDGAR, Manta, Hoover's Online, and Westlaw

List of Variables and Descriptions (cont.)

Variable	Description	Source
Category 2: Litigant Information (cont.)		
P_Private Entity_Par	The first named plaintiff is a subsidiary and the parent company is a private entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Public Entity_Par	The first named plaintiff is a subsidiary and the parent company is a public entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Domestic_Par	The first named plaintiff is a subsidiary and the parent company is a domestic entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Foreign_Par	The first named plaintiff is a subsidiary and the parent company is a foreign entity	EDGAR, Manta, Hoover's Online, and Westlaw
P_Fortune 500_2009_Par	The first named plaintiff is a subsidiary and the parent company is in the 2009 Fortune 500	Fortune 1000
P_Fortune 1000_2009_Par	The first named plaintiff is a subsidiary and the parent company is in the 2009 Fortune 1000	Fortune 1000
p_fortune_501_1K_2009_par	The first named plaintiff is a subsidiary and the parent company listed in the Fortune 501 to 1000 in 2009	Fortune 1000
P_Joint Venture_Par	The first named plaintiff is a subsidiary and is owned by a joint venture	EDGAR, Manta, Hoover's Online, and Westlaw
D_Individual_C	The first named defendant is an individual	EDGAR, Manta, Hoover's Online, and Westlaw
D_Private Entity_C	The first named defendant is a private entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Public Entity_C	The first named defendant is a public entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_University_C	The first named defendant is a university	EDGAR, Manta, Hoover's Online, and Westlaw
D_US Government_C	The first named defendant is part of the U.S. government	EDGAR, Manta, Hoover's Online, and Westlaw
D_Domestic_C	The first named defendant is a domestic entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Foreign_C	The first named defendant is a foreign entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Fortune 500_2009_C	The first named defendant is part of the 2009 Fortune 500	Fortune 1000
D_Fortune 1000_2009_C	The first named defendant is part of the 2009 Fortune 1000	Fortune 1000
d_fortune_501_1K_2009_c	The first named defendant is listed in the Fortune 501 to 1000 in 2009	Fortune 1000
D_Subsidiary_C	The first named defendant is a subsidiary of a parent company	EDGAR, Manta, Hoover's Online, and Westlaw

List of Variables and Descriptions (cont.)

Variable	Description	Source
Category 2: Litigant Information (cont.)		
D_Private Entity_Par	The first named defendant is a subsidiary and the parent company is a private entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Public Entity_Par	The first named defendant is a subsidiary and the parent company is a public entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Domestic_Par	The first named defendant is a subsidiary and the parent company is a domestic entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Foreign_Par	The first named defendant is a subsidiary and the parent company is a foreign entity	EDGAR, Manta, Hoover's Online, and Westlaw
D_Fortune 500_2009_Par	The first named defendant is a subsidiary and the parent company is in the 2009 Fortune 500	Fortune 1000
D_Fortune 1000_2009_Par	The first named defendant is a subsidiary and the parent company is in the 2009 Fortune 1000	Fortune 1000
d_fortune_501_1K_2009_par	The first named defendant is a subsidiary and the parent company listed in the Fortune 501 to 1000 in 2009	Fortune 1000
D_Joint Venture_Par	The first named defendant is a subsidiary and is owned by a joint venture	EDGAR, Manta, Hoover's Online, and Westlaw
ind_SIC2	The 2-digit SIC code for the potential infringer	NBER patent database, Google, and Westlaw
ind_sic_mining	Equals 1 if *ind_sic2* is between 10 and 14 inclusive	NBER patent database, Google, and Westlaw
ind_sic_cons	Equals 1 if ind_sic2 is between 15 and 17 inclusive	NBER patent database, Google, and Westlaw
ind_sic_manuf	Equals 1 if ind_sic2 is between 20 and 39 inclusive	NBER patent database, Google, and Westlaw
ind_sic_trans	Equals 1 if ind_sic2 is between 40 and 49 inclusive	NBER patent database, Google, and Westlaw
ind_sic_whole	Equals 1 if ind_sic2 is between 50 and 51 inclusive	NBER patent database, Google, and Westlaw
ind_sic_retail	Equals 1 if ind_sic2 is between 52 and 59 inclusive	NBER patent database, Google, and Westlaw
ind_sic_finance	Equals 1 if ind_sic2 is between 60 and 67 inclusive	NBER patent database, Google, and Westlaw
ind_sic_services	Equals 1 if ind_sic2 is between 70 and 89 inclusive	NBER patent database, Google, and Westlaw
ind_sic_pubadmin	Equals 1 if ind_sic2 is between 90 and 99 inclusive	NBER patent database, Google, and Westlaw
ind_SIC3	The 3-digit SIC code for the potential infringer	NBER patent database, Google, and Westlaw
ind_SIC4	The 4-digit SIC code for the potential infringer	NBER patent database, Google, and Westlaw

List of Variables and Descriptions (cont.)

Variable	Description	Source
Category 3: Patent(s)-at-Issue Information		
Number_Patents	Number of patents-at-issue in the case	Google, Westlaw, and PACER
Pat_Utility	One or more of the patents-at-issue are a utility patent	NBER patent database, Google, and Westlaw
Pat_Reissue	One or more of the patents-at-issue are a reissue patent	NBER patent database, Google, and Westlaw
Pat_Design	One or more of the patents-at-issue are a design patent	NBER patent database, Google, and Westlaw
Pat_Application	One or more of the patents-at-issue are an application number	NBER patent database, Google, and Westlaw
Pat_App_year	Application year of all patents-at-issue in the case calculated for minimum and maximum	NBER patent database, Google, and Westlaw
Pat_Gyear	Grant date year of all patents-at-issue in the case, calculated for minimum and maximum	NBER patent database, Google, and Westlaw
Pat_Gdate	Grant date of all patents-at-issue in the case, calculated for minimum and maximum	NBER patent database, Google, and Westlaw
pat_age_first	Age of the oldest patent-at-issue from date of complaint, calculated in days and years	calculated
pat_age_last	Age of the youngest patent-at-issue from date of complaint, calculated in days and years	calculated
pat_age_avg	Average age of all the patents-at-issue from date of complaint, calculated in days and years	calculated
Pat_Claims	Number of claims of all patents-at-issue in the case, calculated for minimum, maximum, average, and total	NBER patent database, Google, and Westlaw
Pat_Fwd_Cite_02	Number of forward citations of all patents-at-issue in the case from the NBER 2002 coding, calculated for minimum, maximum, and average number of forward citations through 2002	NBER patent database, Google, and Westlaw
Pat_Fwd_Cite_10	Number of forward citations of all patents-at-issue in the case not available in the NBER 2002 coding, calculated for minimum, maximum, and average number of forward citations through early 2010	Google and Westlaw
IPC4_Human_Nec	One or more of the patents-at-issue had an IPC code that began with "A" (Human Necessities)	NBER patent database, Google, and Westlaw
IPC4_Perf_Ops	One or more of the patents-at-issue had an IPC code that began with "B" (Performing Operations; Transporting)	NBER patent database, Google, and Westlaw
IPC4_Chem	One or more of the patents-at-issue had an IPC code that began with "C" (Chemistry; Metallurgy)	NBER patent database, Google, and Westlaw
IPC4_Textiles	One or more of the patents-at-issue had an IPC code that began with "D" (Textiles; Paper)	NBER patent database, Google, and Westlaw
IPC4_Construction	One or more of the patents-at-issue had an IPC code that began with "E" (Fixed Constructions)	NBER patent database, Google, and Westlaw
IPC4_Mech_Engineering	One or more of the patents-at-issue had an IPC code that began with "F" (Mechanical Engineering; Lighting; Heating; Weapons; Blasting)	NBER patent database, Google, and Westlaw
IPC4_Physics	One or more of the patents-at-issue had an IPC code that began with "G" (Physics)	NBER patent database, Google, and Westlaw
IPC4_Electricity	One or more of the patents had an IPC code that began with "H" (Electricity)	NBER patent database, Google, and Westlaw
PTO_Main_Class	PTO Main Class Code for patent-in-suit; each individual patent in the case has its own variable	NBER patent database, Google, and Westlaw

Appendix 2

Regression Results, Dependant = Log of Patent Damage Awards in 2008 Dollars

Number of obs	338
F(94, 243)	20.120
Prob > F	0.000
R-squared	0.756
Adj R-squared	0.662
Root MSE	2.970

ln_adj_dmg_awd_amt_anda_plus	Coef.	Robust Std. Error	t	P>t	[95% Conf. Interval]	
year_dum96	1.46735	1.18554	1.24	0.217	-0.86789	3.80260
year_dum97	0.86520	1.23738	0.70	0.485	-1.57215	3.30255
year_dum98	0.23660	1.37091	0.17	0.863	-2.46378	2.93698
year_dum99	0.02358	1.40030	0.02	0.987	-2.73469	2.78185
year_dum00	1.84321	1.62884	1.13	0.259	-1.36524	5.05165
year_dum01	-1.37188	1.46260	-0.94	0.349	-4.25287	1.50911
year_dum02	1.24206	1.21504	1.02	0.308	-1.15130	3.63541
year_dum03	1.82890	1.27941	1.43	0.154	-0.69126	4.34906
year_dum04	0.77706	1.27188	0.61	0.542	-1.72825	3.28237
year_dum05	1.08342	1.29445	0.84	0.403	-1.46635	3.63319
year_dum06	1.53058	1.31974	1.16	0.247	-1.06901	4.13017
year_dum07	0.88393	1.44491	0.61	0.541	-1.96222	3.73008
year_dum08	0.94803	1.54110	0.62	0.539	-2.08760	3.98365
circuit_dumFed	3.62033	1.39701	2.59	0.010	0.86854	6.37213
circuit_dum1	-0.10518	1.25825	-0.08	0.933	-2.58365	2.37329
circuit_dum2	-0.20486	1.23826	-0.17	0.869	-2.64396	2.23423
circuit_dum3	-0.95967	1.17027	-0.82	0.413	-3.26485	1.34550
circuit_dum4	-1.69495	1.29397	-1.31	0.191	-4.24379	0.85388
circuit_dum5	0.69704	1.10273	0.63	0.528	-1.47510	2.86917
circuit_dum6	0.54741	1.25070	0.44	0.662	-1.91619	3.01101
circuit_dum7	0.26437	1.20585	0.22	0.827	-2.11088	2.63963
circuit_dum8	-0.15487	1.19904	-0.13	0.897	-2.51671	2.20696
circuit_dum9	0.33900	1.13040	0.30	0.765	-1.88764	2.56564
circuit_dum10	0.35347	1.36889	0.26	0.796	-2.34293	3.04987
state_non_dom	0.19383	0.54884	0.35	0.724	-0.88726	1.27493
jury	3.49765	0.88263	3.96	0.000	1.75906	5.23623
lp_flg	3.06881	0.73597	4.17	0.000	1.61912	4.51850
rr_flag	2.40150	0.75302	3.19	0.002	0.91822	3.88479
pji_flag	0.13038	0.42158	0.31	0.757	-0.70003	0.96079
enh_flag	0.48225	0.53575	0.90	0.369	-0.57306	1.53756
other_dmg_flag	1.14349	0.51474	2.22	0.027	0.12956	2.15741
pe_flag	1.67677	0.97763	1.72	0.088	-0.24894	3.60247
jury_lp	-2.21232	0.94018	-2.35	0.019	-4.06426	-0.36038
jury_rr	-0.77877	0.85457	-0.91	0.363	-2.46207	0.90454

Regression Results, Dependant = Log of Patent Damage Awards in 2008 Dollars (cont.)

ln_adj_dmg_awd_amt_anda_plus	Coef.	Robust Std. Error	t	P>t	[95% Conf. Interval]	
pat_gyear_min	0.03837	0.10273	0.37	0.709	-0.16400	0.24073
pat_gyear_max	-0.21560	0.09976	-2.16	0.032	-0.41210	-0.01910
ipc4_human_nec	0.04106	0.77547	0.05	0.958	-1.48643	1.56856
ipc4_perf_ops	-0.79828	0.67483	-1.18	0.238	-2.12755	0.53098
ipc4_chem	0.51580	0.86586	0.60	0.552	-1.18976	2.22135
ipc4_textiles	-0.44301	1.20512	-0.37	0.713	-2.81682	1.93080
ipc4_construction	-0.30620	0.89923	-0.34	0.734	-2.07749	1.46508
ipc4_mech_engineering	-0.53106	0.81491	-0.65	0.515	-2.13625	1.07414
ipc4_phyiscs	0.00492	0.76390	0.01	0.995	-1.49978	1.50963
ipc4_electricity	0.18476	0.87596	0.21	0.833	-1.54068	1.91019
pat_claims_tot	-0.00195	0.00404	-0.48	0.629	-0.00991	0.00600
pat_claims_tot_sq	0.00000	0.00000	1.22	0.225	0.00000	0.00001
pat_age_avg_day	-0.00032	0.00045	-0.72	0.475	-0.00121	0.00056
pat_age_avg_day_sq	0.00000	0.00000	0.09	0.930	0.00000	0.00000
pat_reissue	-0.04235	1.13531	-0.04	0.970	-2.27865	2.19395
pat_design	0.09844	0.98432	0.10	0.920	-1.84045	2.03734
number_patents_2	0.07365	0.52791	0.14	0.889	-0.96621	1.11351
number_patents_3	0.54458	0.74540	0.73	0.466	-0.92368	2.01285
number_patents_4	1.24912	0.86202	1.45	0.149	-0.44886	2.94710
number_patents_5_10	1.34042	1.39969	0.96	0.339	-1.41665	4.09750
number_patents_over10	3.63583	2.18644	1.66	0.098	-0.67096	7.94261
number_assignees	-1.56972	1.26643	-1.24	0.216	-4.06429	0.92486
number_assignees_sq	0.41293	0.24898	1.66	0.099	-0.07751	0.90338
p_assignee	0.06737	0.46661	0.14	0.885	-0.85174	0.98648
d_assignee	0.80593	0.79165	1.02	0.310	-0.75344	2.36531
assignee_us_non_govt	0.59184	0.58379	1.01	0.312	-0.55809	1.74177
assignee_non_us_no_govt	0.74309	0.70333	1.06	0.292	-0.64230	2.12849
assignee_us_indiv	-0.40653	0.76799	-0.53	0.597	-1.91930	1.10624

Regression Results, Dependant = Log of Patent Damage Awards in 2008 Dollars (cont.)

ln_adj_dmg_awd_amt_anda_plus	Coef.	Robust Std. Error	t	P>t	[95% Conf. Interval]	
p_university_c	-0.87854	1.46306	-0.60	0.549	-3.76043	2.00335
p_public_e_c	-0.16730	0.54486	-0.31	0.759	-1.24054	0.90594
p_individual_c	-0.54665	0.77632	-0.70	0.482	-2.07582	0.98252
p_foreign_c	-0.50149	0.94556	-0.53	0.596	-2.36403	1.36105
p_fortune_500_2009_c	-0.60766	0.90415	-0.67	0.502	-2.38863	1.17332
p_fortune_501_1K_2009_c	0.63168	1.22103	0.52	0.605	-1.77347	3.03683
p_subsidiary_c	-0.70543	0.92648	-0.76	0.447	-2.53038	1.11952
p_public_entity_par	0.65542	1.18674	0.55	0.581	-1.68220	2.99303
p_foreign_par	0.03299	1.19568	0.03	0.978	-2.32223	2.38821
p_fortune_500_2009_par	1.76583	1.11260	1.59	0.114	-0.42573	3.95739
p_fortune_501_1K_2009_par	2.36992	1.31649	1.80	0.073	-0.22327	4.96312
d_public_entity_c	1.22817	0.59397	2.07	0.040	0.05817	2.39816
d_individual_c	0.11319	0.88366	0.13	0.898	-1.62743	1.85381
d_foreign_c	0.01674	0.58049	0.03	0.977	-1.12669	1.16018
d_fortune_500_2009_c	0.75125	0.75704	0.99	0.322	-0.73994	2.24244
d_fortune_501_1K_2009_c	-2.43760	1.18366	-2.06	0.041	-4.76914	-0.10605
d_subsidiary_c	1.01147	0.84328	1.20	0.232	-0.64960	2.67254
d_public_entity_par	0.65748	0.81160	0.81	0.419	-0.94119	2.25615
d_foreign_par	0.10954	0.80403	0.14	0.892	-1.47423	1.69330
d_fortune_500_2009_par	-0.46309	1.18069	-0.39	0.695	-2.78878	1.86260
d_fortune_501_1K_2009_par	1.73786	1.99662	0.87	0.385	-2.19503	5.67075
ind_sic_minimg	0.79352	1.01760	0.78	0.436	-1.21093	2.79797
ind_sic_cons	2.37488	1.35961	1.75	0.082	-0.30324	5.05300
ind_sic_trans	0.85068	0.93191	0.91	0.362	-0.98497	2.68633
ind_sic_whole	0.31038	0.50798	0.61	0.542	-0.69022	1.31099
ind_sic_retail	-1.05630	1.25059	-0.84	0.399	-3.51967	1.40707
ind_sic_finance	1.24822	1.33764	0.93	0.352	-1.38663	3.88306
ind_sic_services	0.28411	0.67257	0.42	0.673	-1.04070	1.60892
ind_sic_pubadmin	2.08430	1.27559	1.63	0.104	-0.42832	4.59692
p_pat-onwer	1.35085	1.07403	1.26	0.210	-0.76474	3.46644
patent_manuf_mkt_tech	-0.08972	0.59566	-0.15	0.880	-1.26304	1.08360
anda	-8.67051	1.33346	-6.50	0.000	-11.29711	-6.04390
constant	362.36800	168.85260	2.15	0.033	29.76651	694.96960