

# BARGAINING POWER AND PATENT DAMAGES

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## ABSTRACT

*In patent-infringement litigation, if no established royalty for the patent in suit has emerged from multiple market transactions at a readily observable price, then the finder of fact needs to infer a reasonable royalty from the many factors identified in the Georgia-Pacific framework. The well-recognized problem with the Georgia-Pacific framework is that it poses many potentially relevant questions but does not say how the finder of fact should weight the answers. The case law offers no algorithm or decision tree for the finder of fact to follow. Courts find expert testimony inadmissible if it does not apply intellectually rigorous economic methods and principles to the facts and data of the case to produce results that are replicable and falsifiable. With modest effort, and without repudiating existing precedent, the courts can make the Georgia-Pacific framework far more coherent, predictable, and intellectually rigorous. From an economic perspective, that framework ultimately leads the finder of fact, first, to determine the gains from trade—which economists call “surplus”—arising from a hypothetical, voluntary negotiation between a willing licensor and a willing licensee just before the moment of first infringement and, second, to divide that surplus between the licensor and licensee according to their relative bargaining power. For brevity and clarity, I call these two culminating steps the surplus-division principle. This principle is more reliable than purporting to set a reasonable royalty on the basis of a mathematical theory (such as the Nash bargaining solution) that is too abstract to fit the facts and data of the case. It is also more reliable than an expert’s idiosyncratic and nonfalsifiable claim to have balanced the totality of the circumstances in light of his professional experience. In contrast to both a theoretical black box and an expert’s ipse dixit, the surplus-division principle uses elementary principles of microeconomics to give coherence to the Georgia-Pacific factors that courts have already defined and applied. The result enables the finder of fact to determine a licensor’s minimum willingness to accept and a licensee’s maximum willingness to pay for the patented technology, and thereby to define the bargaining range for a hypothetical negotiation. This method is robust across different factual scenarios and multiple defendants.*

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## INTRODUCTION

Section 284 of the Patent Act provides that damages for patent infringement shall be of an amount “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 . . . .”<sup>1</sup> Moreover, section 284 says that “[t]he court may receive expert testimony as an aid to the determination of damages or of what royalty would be reasonable under the circumstances.”<sup>2</sup> Opposing expert witnesses on damages in a given case typically both purport to apply the fifteen (or more) factors identified in *Georgia-Pacific Corp. v. U.S. Plywood Corp.* to the same set of facts.<sup>3</sup> Yet, their damage estimates often differ by an

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1. 35 U.S.C. § 284. The Supreme Court has said that damages for patent infringement “should be consistent with Congress’ overriding purpose of affording patent owners complete compensation.” *General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 655 (1983); *see also* DONALD. S. CHISUM, CRAIG ALLEN NAIRD, HERBERT F. SCHWARTZ, PAULINE NEWMAN & F. SCOTT KIEFF, *PRINCIPLES OF PATENT LAW* 1284–85 (3d ed. 2004).

2. 35 U.S.C. § 284.

3. *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *mod. and aff’d*, 446 F.2d 295 (2d Cir. 1971), *cert. denied*, 404 U.S. 870 (1971). The *Georgia-Pacific* factors are:

1. The royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty.
2. The rates paid by the licensee for the use of other patents comparable to the patent in suit.
3. The nature and scope of the license, as exclusive or non-exclusive; or as restricted or non-restricted in terms of territory or with respect to whom the manufactured product may be sold.
4. The licensor’s established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly.
5. The commercial relationship between the licensor and licensee, such as, whether they are competitors in the same territory in the same line of business; or whether they are inventor and promoter.
6. The effect of selling the patented specialty in promoting sales of other products of the licensee; the existing value of the invention to the licensor as a generator of sales of his non-patented items; and the extent of such derivative or conveyed sales.
7. The duration of the patent and the term of the license.
8. The established profitability of the product made under the patent; its commercial success; and its current popularity.
9. The utility and advantages of the patent property over the old modes or devices, if any, that had been used for working out similar results.
10. The nature of the patented invention; the character of the commercial embodiment of it as owned and produced by the licensor; and the benefits to those who have used the invention.
11. The extent to which the infringer has made use of the invention; and any evidence probative of the value of that use.

order of magnitude or more. Since the determination of a reasonable royalty is ultimately a question of fact to be decided by the jury, when the patent holder demands one,<sup>4</sup> how can the courts direct expert testimony to be more helpful to the jury?

*Georgia-Pacific* poses many potentially relevant questions, but it does not say how the finder of fact should weight the answers.<sup>5</sup> The case law offers no algorithm or decision tree for the finder of fact to follow. The Federal Circuit recognizes this problem. It has said that an expert's cursory recitation of the fifteen *Georgia-Pacific* factors gives the finder of fact little guidance.<sup>6</sup> Even jurists who disagree on patent law agree that *Georgia-Pacific* needs clarification. Before his retirement, Chief Judge Randall Rader said that the *Georgia-Pacific* factors are "just a laundry list of various things to be considered" and "were never meant to be a test or a formula for resolving damages issues."<sup>7</sup> Judge Richard Posner, who sits by designation as trial judge in patent-infringement cases, has called the *Georgia-Pacific* factors "baloney"<sup>8</sup> and has asked rhetorically, "could a judge or a jury really balance 15 or more factors and come up with anything resembling an objective assessment?"<sup>9</sup> The lack of an intellectually rigorous framework that coherently marshals the information that courts consider relevant to determining a reasonable royalty

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12. The portion of the profit or of the selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions.

13. The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.

14. The opinion testimony of qualified experts.

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

4. See, e.g., *Unisplay, S.A. v. American Elec. Sign Co.*, 69 F.3d 512, 517 (Fed. Cir. 1995).

5. See J. Gregory Sidak, *The Meaning of FRAND, Part I: Royalties*, 9 J. COMPETITION L. & ECON. 931, 941–42 (2013).

6. *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1230 (Fed. Cir. 2014) (citing *Whitserve, LLC v. Computer Packages, Inc.*, 694 F.3d 10, 31–32 (Fed. Cir. 2012)).

7. David A. Haas, John R. Bone & David N. Paris, *View from the Federal Circuit: An Interview with Chief Judge Randall R. Rader*, STOUT RISIUS ROSS (June 9, 2012), <http://www.srr.com/article/view-federal-circuit-interview-chief-judge-randall-r-rader>.

8. David A. Haas, John R. Bone & Bruce W. Burton, *An Interview of Judge Richard A. Posner on Patent Litigation*, STOUT RISIUS ROSS (July 10, 2013), <http://www.srr.com/article/interview-judge-richard-posner-patent-litigation> (“[T]he *Georgia-Pacific* test is baloney. Fifteen factors, that’s ridiculous.”).

9. *Apple Inc. v. Motorola, Inc.*, 869 F. Supp. 2d 901, 911 (N.D. Ill. 2012) (Posner, J.), *aff’d in part, rev’d in part, vacated in part, and remanded*, 757 F.3d 1286 (Fed. Cir. 2014).

has invited quackery. Much expert testimony on reasonable royalties is mere *ipse dixit*. One often observes an expert witness claiming to have balanced the totality of the facts and circumstances relevant to the *Georgia-Pacific* factors and, in light of the expert's years of professional experience, to have divined the precise point estimate for a reasonable royalty.

Apart from lacking intellectual rigor, such quack testimony on reasonable royalties is neither replicable nor falsifiable. It should therefore not be admissible. The Supreme Court in *Daubert*,<sup>10</sup> *Joiner*,<sup>11</sup> and *Kumho*<sup>12</sup> established the modern American jurisprudence on the admissibility of expert testimony. In general, all "relevant" evidence on damages is admissible,<sup>13</sup> which is evidence that "has any tendency to make a fact more or less probable than it would be without the evidence" and "is of consequence in determining the action."<sup>14</sup> Federal Rule of Evidence 702 further provides specific requirements for the admissibility of expert testimony: "(1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case."<sup>15</sup> These rules and Supreme Court precedents require expert testimony on patent damages to employ a coherent and intellectually rigorous economic methodology to evaluate and consolidate the information (if any) that each relevant *Georgia-Pacific* factor conveys.

The reasonable-royalty calculation also must be replicable. *Daubert* established four criteria for determining the scientific reliability of the methodology used by an expert witness, the first of which asks whether the methodology can be and has been tested.<sup>16</sup> If an expert witness fails to incorporate information from the *Georgia-Pacific* factors into a coherent, intellectually rigorous, and replicable methodology, the expert fails to aid the finder of fact. The expert's testimony is therefore not useful. In contrast, a useful analysis of the *Georgia-Pacific* factors identifies which factors are relevant to the case, consolidates the information gleaned from the factors into a coherent economic framework, and employs a methodology that the finder of fact can replicate.

In its 2014 decision in *VirnetX, Inc. v. Cisco Systems, Inc.*,<sup>17</sup> the Federal Circuit criticized an expert's use of the "Nash bargaining solution"<sup>18</sup> to calculate a reasonable royalty. The Federal Circuit found this theoretical contribution by the late Nobel laureate John Nash too detached from the facts

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10. *Daubert v. Merrill Dow Pharm., Inc.*, 509 U.S. 579 (1993).

11. *General Elec. Co. v. Joiner*, 522 U.S. 136 (1997).

12. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).

13. FED. R. EVID. 402.

14. *Id.* 401; see generally Richard A. Posner, *An Economic Approach to the Law of Evidence*, 51 STAN. L. REV. 1477 (1999).

15. FED. R. EVID. 702.

16. *Daubert*, 509 U.S. at 593.

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

18. John Nash, *The Bargaining Problem*, 18 ECONOMETRICA 155, 155 (1950).

of a given case to help the finder of fact in patent-infringement litigation. The Federal Circuit's rejection of the Nash bargaining solution in patent litigation cannot mean that all economic analysis of the respective bargaining power of the licensor and licensee in the hypothetical negotiation under *Georgia-Pacific* factor 15 is inadmissible under *Daubert*. That reading of *VirnetX* would work the absurd result of making it impossible for the finder of fact to have any principled basis for selecting a given reasonable royalty lying along the interval between the licensor's minimum willingness to accept and the licensee's maximum willingness to pay.

In this article, I explain how, with modest effort, and without repudiating existing precedent, the courts can make the *Georgia-Pacific* framework far more coherent, predictable, and intellectually rigorous. From an economic perspective, that framework ultimately leads the finder of fact, first, to determine the gains from trade—which economists call “surplus”—arising from a hypothetical, voluntary negotiation between a willing licensor and a willing licensee just before the moment of first infringement and, second, to divide that surplus between the licensor and licensee according to their relative bargaining power. For brevity and clarity, I call these two culminating steps the “surplus-division principle.” This principle is more reliable than purporting to set a reasonable royalty on the basis of a mathematical theory (such as the Nash bargaining solution) that is too abstract to fit the facts and data of the case. It is also more reliable than an expert's idiosyncratic and nonfalsifiable claim to have balanced the totality of the facts and circumstances in light of his professional experience. In contrast to both a theoretical black box and an expert's *ipse dixit*, the surplus-division principle uses elementary principles of microeconomics to give coherence to the *Georgia-Pacific* factors that courts have already defined and applied. The result enables the finder of fact to determine a licensor's minimum willingness to accept and a licensee's maximum willingness to pay for the patented technology, and thereby to define the bargaining range for a hypothetical negotiation. This method is robust across different factual scenarios and multiple defendants.

Part II of this article examines the Federal Circuit's rejection of the Nash bargaining solution in *VirnetX*. Part III presents a simpler methodology for using bargaining principles in microeconomics to determine a reasonable royalty for patent infringement. Part IV explains the advantages of the surplus-division principle.

#### I. THE FEDERAL CIRCUIT'S REJECTION OF THE NASH BARGAINING SOLUTION IN *VIRNETX*

Before the Federal Circuit's decision in *VirnetX* in 2014, which categorically rejected an expert's use of the Nash bargaining solution to calculate a reasonable royalty, some district courts (in California, Florida, New Jersey, New York, and Texas) had found the theoretical Nash bargaining solution to be intellectually rigorous and therefore admissible as expert

testimony on a reasonable royalty.<sup>19</sup> But other district courts (in California, Delaware, Texas, and Virginia) had found such expert testimony unreliable and inadmissible.<sup>20</sup> That split of authority—sometimes occurring within a given judicial district, such as the Eastern District of Texas or the Northern District of California—highlighted the need for clarification of whether bargaining theory could enable an expert witness to provide testimony that is useful, reliable, and admissible. The Federal Circuit’s subsequent rejection of the Nash bargaining solution is tantamount to a rejection of the admissibility of any damages calculation based on a theory of bargaining that is mathematically complex, not replicable or falsifiable by the finder of fact, and not sufficiently tied to the facts of the respective case.

### A. *The Nash Bargaining Solution*

In his 1950 article *The Bargaining Problem*, John Nash proposed a solution to what he called the “bargaining situation”—an economic game in which two parties “have the opportunity to collaborate for mutual benefit in more than one way.”<sup>21</sup> A solution to that game maximizes “the amount of satisfaction each [party] should expect to get from the situation.”<sup>22</sup> Before deriving his solution, Nash made certain assumptions about the game’s participants.<sup>23</sup> Each bargaining party is “highly rational,” “can accurately compare [its] desires for various things,” is “equal [to the other] in bargaining skill,” “has full knowledge of the tastes and preferences of the other,” and “wishes to maximize

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19. See, e.g., Order at 13–14, *Parkervision, Inc. v. Qualcomm Inc.*, No. 3:11-cv-00719-RBD-TEM (M.D. Fla. Oct. 11, 2013), ECF No. 395; *Summit 6 LLC v. Research in Motion Corp.* at 18 n.10, No. 3:11-cv-00367-O, 2013 BL 172110 (N.D. Tex. June 26, 2013), ECF No. 661; *Gen-Probe Inc. v. Becton Dickinson & Co.*, No. 3:09-cv-02319 (S.D. Cal. Nov. 26, 2012), ECF No. 517; Order Granting in Part and Denying in Part Motions to Exclude Expert Testimony; Denying Motion to Bifurcate Trial; Denying Motion for Preclusive Sanctions, *Mformation Techs., Inc. v. Research in Motion Ltd.*, No. 5:08-cv-04990, 2012 WL 1142537, at \*3 n.19 (N.D. Cal. Mar. 29, 2012); *Inventio v. Otis Elevator*, 2011 U.S. Dist. LEXIS 88965 (S.D.N.Y. June 23, 2011); *Sanofi-Aventis Deutschland GmbH v. Glenmark Pharms., Inc.*, 2011 U.S. Dist. LEXIS 10512, at \*346–47 (D.N.J. Feb. 3, 2011).

20. See, e.g., Memorandum Order, *Robocast, Inc. v. Microsoft Corp.*, No. 1:10-cv-01055-RGA (D. Del. Jan. 29, 2014), ECF No. 452; (In Chambers) Order Re Apple’s Daubert Motion to Exclude the Opinions of Joseph Gemini, *NetAirus Techs., LLC v. Apple, Inc.*, 2013 U.S. Dist. LEXIS 184514, at \*156–87 (C.D. Cal. Oct. 23, 2013), ECF No. 425 (Redacted Public Version); Order Granting Motion to Exclude Opinions and Testimony of Plaintiff’s Damages Expert at 8–9, *Dynetix Design Solutions, Inc. v. Synopsys, Inc.*, No. 5:11-cv-05973 PSG (N.D. Cal. Aug. 22, 2013), ECF No. 564; Order at 3–5, *Suffolk Techs., LLC v. AOL Inc.*, No. 1:12-cv-00625-TSE-IDD (E.D. Va. Apr. 12, 2013), ECF No. 518; Order on Pending Motions at 5–6, *Simpleair, Inc. v. AWS Convergence Techs., Inc.*, No. 2:09-cv-00289-MHS (E.D. Tex. Apr. 3, 2012), ECF No. 507; *Oracle Am. v. Google Inc.*, 798 F. Supp. 2d 1111, 1119 (N.D. Cal. 2011).

21. Nash, *supra* note 18, at 155.

22. *Id.*

23. *Id.*

the utility to [itself] of the ultimate bargain.”<sup>24</sup> Nash further assumed the independence of irrelevant alternatives—that is, if a bargainer faces a choice between *A* and *B* and prefers *A* to *B*, then that bargainer must also prefer *A* to *B* if faced with a choice between *A*, *B*, and *C*.<sup>25</sup> Nash’s solution also required defining a utility function for each bargaining party, which assigns a real number to each possible outcome for each party.<sup>26</sup> The utility function quantifies the value that each party derives from the potential outcomes of the negotiation.

Given those assumptions, Nash’s solution to the bargaining situation was that the bargaining parties would jointly maximize the product of the surpluses generated by a successful bargain.<sup>27</sup> That maximization will occur when the net payoffs to each party (given by the difference between the party’s utility from a bargain and the party’s utility if no bargain is reached) are equal.<sup>28</sup> That is, the parties will evenly split the gains from trade. Calculating the price at which two bargaining parties will agree to trade requires carefully constructed utility functions for each bargaining party.

For example, consider a scenario in which party *A* has a patent *x* and party *B* wants to license *x*. If *B* obtains a license for *x*, then it expects to increase its profits by \$100. Alternatively, *B* can also design a workaround, which will increase its profits by \$40. If *B* obtains a license for *x*, then its payoff is \$100; if it does not obtain a license for *x*, then its payoff is \$40. In that case, the surplus that results from negotiation is \$60—the \$100 dollar payoff that *B* receives if it licenses *x* from *A* minus the \$40 payoff that *B* receives if it does not license *x* from *A*. The Nash bargaining solution in this game is that *A* will agree to license *x* to *B* for \$30—an even split of the \$60 surplus. It would be an incorrect application of the Nash bargaining solution to assume that *A* will agree to license *x* to *B* for \$50 (an even split of \$100). To assume that the gain from trade is \$100 is to ignore the possibility that *A* and *B* have profitable alternatives to negotiating.

The possibility of a workaround is an example of a factor that affects the determination of surplus. The Nash bargaining solution accounts for such factors in each bargaining party’s utility function. The Nash bargaining solution holds that, when a utility function is provided for each bargaining party, and when multiple assumptions about each party hold, the bargaining parties will evenly divide the gains from trade.<sup>29</sup>

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24. *Id.* at 159.

25. *Id.*

26. *Id.* at 157.

27. *Id.* at 159.

28. *Id.*

29. For an application of the Nash bargaining solution to antitrust analysis, see Aviv Nevo, Deputy Assistant Attorney Gen. for Econ., Antitrust Div., Mergers That Increase Bargaining Leverage (Jan. 22, 2014), available at <http://www.justice.gov/atr/public/speeches/303149.pdf>.

### B. *The Federal Circuit's Decision in VirnetX*

In *VirnetX*, the Federal Circuit criticized the use of the Nash bargaining solution in the reasonable-royalty opinion of VirnetX's expert witness. VirnetX alleged that the FaceTime feature of Apple's iPad, iPod, and iPhone products (collectively called iOS devices) and Mac computers, as well as Apple's virtual private network (VPN) feature of its iOS devices, had infringed four VirnetX patents that claimed technology for providing security over a network.<sup>30</sup> In 2012, a jury in the Eastern District of Texas reached the verdict that all of VirnetX's claims were valid and infringed, and that VirnetX should be awarded damages in the amount of \$368,160,000. Apple then moved for a judgment as a matter of law or, alternatively, a new trial or remittitur. Chief Judge Leonard Davis denied Apple's motions in 2013,<sup>31</sup> and Apple appealed to the Federal Circuit.

The Federal Circuit, in an opinion by Chief Judge Sharon Prost, evaluated VirnetX's damages expert's three approaches to the damages award.<sup>32</sup> Two of those approaches used the Nash bargaining solution.<sup>33</sup> The expert calculated the licensee's incremental profits associated with the patented features and determined, using the Nash bargaining solution, that each party would receive 50 percent of those incremental profits.<sup>34</sup> The expert adjusted the even split to a 55-45 split, in favor of Apple, to account for differences in bargaining power between VirnetX and Apple.<sup>35</sup> However, he did not show that the facts of the case satisfied the assumptions of the Nash bargaining solution, nor did he explain why the differences in bargaining power of each party indicated that the surplus should have been split 55-45.

The Federal Circuit vacated the jury's damage award and remanded the case for further proceedings, emphasizing that courts have rejected use of the Nash bargaining solution without "sufficiently establishing that the premises of the theorem actually apply to the facts of the case at hand."<sup>36</sup> The Federal Circuit said that the 50-50 split proposed by the Nash bargaining solution was as arbitrary as the "25 percent heuristic" that the court rejected in *Uniloc* in 2011.<sup>37</sup> The Federal Circuit had rejected the 25 percent heuristic because it "fail[ed] to tie a reasonable royalty base to the facts of the case"<sup>38</sup> and "assumed the same 25/75 royalty split regardless of the size of the patent

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30. *VirnetX, Inc. v. Apple, Inc.*, 925 F. Supp. 2d 816, 824 (E.D. Tex. 2013).

31. *Id.*

32. *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1325 (Fed. Cir. 2014). Judge Chen also sat on the panel. Judge Rader, who retired from the position of Circuit Judge on June 30, 2014, heard oral argument but did not participate in the decision. *Id.* at 1313.

33. *Id.* at 1331.

34. *Id.*

35. *Id.*

36. *Id.* at 1332.

37. *Id.*

38. *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1315 (Fed. Cir. 2011).



portfolio in question or the value of the patented technology.”<sup>39</sup> The Federal Circuit said that, because assuming that the surplus would be divided 50-50 without demonstrating that the facts of the case satisfy the assumptions of the Nash bargaining solution is not substantially different from assuming that the surplus would be divided 25-75, the Federal Circuit’s earlier criticism of the 25 percent heuristic as arbitrary also applies to the Nash bargaining solution.<sup>40</sup>

The Federal Circuit reasoned that “[t]he Nash theorem arrives at a result that follows from a certain set of premises. It itself asserts nothing about what situations in the real world fit those premises.”<sup>41</sup> Therefore, the Federal Circuit reasoned, “[a]nyone seeking to invoke the [Nash bargaining solution] as applicable to a particular situation must establish that fit” between Nash’s premises and the facts of the case, “because the 50/50 profit split is proven by the theorem only on those premises.”<sup>42</sup> Without demonstrating that the facts of a case satisfy the premises of the Nash bargaining solution, the solution is a theoretical undertaking, is not related to the facts of the case, and is therefore not useful to the finder of fact.<sup>43</sup>

The Federal Circuit did not find any more reliable the expert’s attempt to adjust Nash’s 50-50 split to account for differences in bargaining power based on the facts of the case. The Federal Circuit observed that, in the case of the 25-percent heuristic repudiated in *Uniloc*, “factors are then cited to bring the rate up or down. [But b]eginning from a fundamentally flawed premise and adjusting it based on legitimate considerations specific to the facts of the case nevertheless results in a fundamentally flawed conclusion.”<sup>44</sup> The Federal Circuit said that similar reasoning applies to the Nash bargaining solution.<sup>45</sup> VirnetX’s expert’s adjustment of an even split to a 55-45 split—based on “the fact that Apple would have had additional bargaining power over VirnetX back in . . . 2009”<sup>46</sup>—represented too great an analytical leap. The court concluded

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39. *VirnetX*, 767 F.3d at 1332 (citing *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1317 (Fed. Cir. 2011)).

40. *Id.* (citing *Dynetix Design Solutions, Inc. v. Synopsys, Inc.*, No. C 11-05973 PSG, 2013 WL 4538210, at \*4–5 (N.D. Cal. Aug. 22, 2013) (“excluding expert testimony on royalty rate that began from a starting point of a 50/50 split [according to the Nash bargaining solution] because the expert’s methodology was ‘indistinguishable from 25% rule’”).

41. *Id.* Magistrate Judge Paul Grewal of the Northern District of California excluded that same expert’s testimony in a subsequent case in which he used the Nash bargaining solution to calculate a reasonable royalty, in part because the expert “fail[ed] to tie the 50/50 split to the specifics of this case or to explain why such a split would be reasonable—other than to invoke a boilerplate assertion about the relative bargaining powers of the parties.” Order Granting-in-Part Motion to Exclude Testimony at 13, *Good Tech. Corp. v. MobileIron, Inc.*, No. 5:12-cv-05826 (N.D. Cal. July 5, 2015) (Grewal, M.J.), ECF No. 436.

42. *VirnetX*, 767 F.3d at 1332.

43. *Id.*

44. *Id.* at 1333 (quoting *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1317 (Fed. Cir. 2011)).

45. *Id.*

46. *Id.* (citation omitted).

that including the facts of the case in the reasonable-royalty analysis is beside the point if those facts are only modifying the result of an arbitrary assumption.

*VirnetX* clarifies that bargaining theory is inadmissible expert testimony if it is not adequately related to the facts of a case. But it is important to recognize what the decision does not say. Nowhere does *VirnetX* say that bargaining theory is categorically disallowed from a reasonable-royalty calculation.

## II. A REASONABLE-ROYALTY CALCULATION THAT GROUNDS ANALYSIS OF BARGAINING POWER IN THE FACTS OF THE CASE

An economic approach to analyzing the hypothetical negotiation, implicit in the *Georgia-Pacific* factors, is to determine the lower and upper bounds of the bargaining range. Those bounds are the minimum royalty that the licensor would be willing to accept (while still being better off than without issuing a license) and the maximum royalty that the licensee would be willing to pay (while still being better off than without procuring a license). In a hypothetical negotiation, the licensor and licensee negotiate within the bargaining range, which is defined by the licensor's minimum willingness to accept and the licensee's maximum willingness to pay. Because a hypothetical voluntary transaction necessarily makes both parties better off, a negotiated royalty must fall between those lower and upper bounds. This economic principle—that voluntary exchange is mutually beneficial—is as profound as it is simple, and for that reason it is called, “The Fundamental Theorem of Exchange.”<sup>47</sup>

Each *Georgia-Pacific* factor potentially influences the ultimate point royalty. However, only comparable licenses and other direct observations, if available, provide evidence of a market-disciplined price for the patented technology. The most reliable way to establish the bounds of the bargaining range is therefore to use observations of prices stated in comparable licenses or market-disciplined prices observed elsewhere in the factual record. The finder of fact can use comparable licenses in which the licensee had bargaining power comparable to that of the would-be licensee to determine the portion of the surplus that each party (that is, the patent holder and the would-be licensee) would have received in a hypothetical negotiation.

### A. *Defining the Bargaining Range*

In any negotiation, the total surplus from a successful transaction is equivalent to the bargaining range—the distance between the licensee's maximum willingness to pay and the licensor's minimum willingness to accept. Put differently, the gains from trade (that is, the gains from voluntary exchange) consist of the sum of consumer surplus and producer surplus.<sup>48</sup> However, as

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47. See JACK HIRSHLEIFER, AMIHAI GLAZER & DAVID HIRSHLEIFER, PRICE THEORY AND APPLICATIONS: DECISIONS, MARKETS, AND INFORMATION 203 (7th ed. 2005).

48. See, e.g., *id.* at 203–04.

Jack Hirshleifer, Amihai Glazer, and David Hirshleifer observe in their classic undergraduate textbook on price theory, that terminology about consumption and production should not detract from the essential characteristic of voluntary exchange: “[T]he names of these measures are somewhat misleading. The benefits stem *from trading*, not from consuming or producing. Instead of Consumer Surplus and Producer Surplus one should, properly speaking, refer to Buyer Surplus and Seller Surplus.”<sup>49</sup>

Elsewhere within economics, auction theory uses still other terminology—the reserve price or reservation price—to identify the same concepts, respectively, of the seller’s minimum willingness to accept and the buyer’s maximum willingness to pay.<sup>50</sup> In a succinct passage from *The New Palgrave* that courts could profitably read alongside *Georgia-Pacific*’s attempt to itemize the factors that influence the quantification of a reasonable royalty, Ian Steedman has observed:

It will be clear that an agent’s reservation price for any type of commodity can be expected to depend on one or more of the following considerations: the scope for direct “own use” of the commodity; the agent’s present need for liquidity; the agent’s other resources; the perishability of the commodity and thus the various elements of storage costs (including interest costs); expectations about future prices, there being always a speculative element in the reservation price of any commodity which is not immediately perishable.<sup>51</sup>

Across this varied nomenclature the economic intuition remains the same: Voluntary exchange mutually benefits the parties to the transaction, who divide their aggregate gains from trade, commonly known by economists as surplus.

In a patent-licensing negotiation, the agreed-upon royalty represents how much better off the licensor is for licensing the patents (versus not licensing, because the minimum willingness to accept reflects the opportunity cost of licensing). Likewise, the licensee becomes better off by the value of its surplus—the difference between the maximum willingness to pay and the

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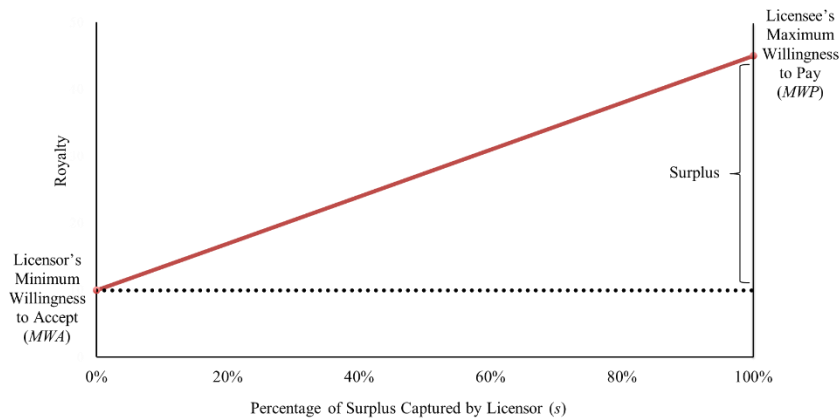
49. *Id.* at 204 n.4 (emphasis in original); *see also* ARMEN A. ALCHIAN & WILLIAM R. ALLEN, *EXCHANGE AND PRODUCTION: COMPETITION, COORDINATION, AND CONTROL* 48–49 (3d ed. 1983) (demonstrating that the total surplus in a negotiation is the sum of the *seller’s* gain from trade and the *buyer’s* gain from trade).

50. *See* Ian Steedman, *Reservation Price and Reservation Demand*, in 4 *THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS* 158 (John Eatwell, Murray Milgate & Peter Newman eds., 1987); *see also* T.R. JAIN, *MICROECONOMICS AND BASIC MATHEMATICS* 255 (2008); PAUL KLEMPERER, *AUCTIONS: THEORY AND PRACTICE* 18, 109, 112 (2004); PAUL MILGROM, *PUTTING AUCTION THEORY TO WORK* 9–11 (2004); ROBERT L. PHILLIPS, *PRICING AND REVENUE OPTIMIZATION* 46 (2005); ROBERT S. PINDYCK & DANIEL L. RUBINFELD, *MICROECONOMICS* 383, 504, 509 (6th ed. 2005); THUS TEN RAA, *MICROECONOMICS: EQUILIBRIUM AND EFFICIENCY* 320 (2013); JOHN G. RILEY, *ESSENTIAL MICROECONOMICS* 451–56 (2012); Garrett J. van Ryzin, *Models of Demand*, in *THE OXFORD HANDBOOK OF PRICING MANAGEMENT* 340, 342 (Özalp Özer & Robert Phillips eds., 2012).

51. Steedman, *supra* note 50, at 159.

royalty paid.<sup>52</sup> The total surplus from a successful patent-licensing negotiation, represented by the bargaining range, is then (by identity) the sum of the licensor's surplus and the licensee's surplus from any given license. The concept of a surplus in any agreement is fundamental to an economic analysis of negotiations. It is a fundamental principle of bargaining theory that, in a negotiation, the buyer and seller divide the surplus between themselves based upon the relative bargaining power of each party.<sup>53</sup> The buyer and seller will bargain within the range to determine the final royalty. The final agreed-upon price will fall somewhere within the bargaining range. In a patent-infringement case, the licensor is analogous to the seller, and the licensee is analogous to the buyer. Because a voluntary licensing agreement will eventuate only if it makes both parties better off, a negotiated royalty must be between the upper and lower bounds of the bargaining range.<sup>54</sup> Figure 1 illustrates the bargaining range.

Figure 1: The Bargaining Range



52. See DAVID BESANKO & RONALD BRAEUTIGAM, MICROECONOMICS 718 (4th ed. 2010) (“Owner *B* would be willing to offer owner *A* up to \$3,000 if *A* will fence in his property. (Owner *B* would offer no more than \$3,000 to *A* because *B* can fence in Farm *B* at that cost.) At the same time, owner *A* will accept no less than \$2,000 to fence in his property. There is an opportunity for both parties to be better off if they agree that *B* will pay *A* some amount between \$2,000 and \$3,000 to fence in Farm *A*.”).

53. See, e.g., PINDYCK & RUBINFELD, *supra* note 49, at 494–95.

54. See, e.g., *id.* at 584.

The equation for the line that represents all of the possible royalty outcomes along the bargaining range is:

$$\text{Royalty} = MWA + [s \times (MWP - MWA)],$$

where *MWA* is the licensor's minimum willingness to accept, *MWP* is the licensee's maximum willingness to pay, and *s* is the percentage of the surplus captured by the licensor. The vertical distance between the licensor's minimum willingness to accept and the licensee's maximum willingness to pay represents the total surplus that will be divided between the licensor and licensee when determining a royalty.

In practice, the facts and data of the case might enable the finder of fact to approximate the upper bound of the bargaining range by the licensee's actually observed willingness to pay, which I call its *demonstrated* willingness to pay. Because the licensee's demonstrated willingness to pay is, by definition, less than or equal to the licensee's true maximum willingness to pay, the bargaining range is a conservative estimate of the surplus generated by a successful bargain. Consequently, the point royalty that is eventually determined is a lower bound on a reasonable royalty. To calculate a reasonable royalty, therefore, one must determine values for three variables: *MWA*, *MWP* (or, as a conservative proxy, the licensee's demonstrated willingness to pay), and *s*.

#### 1. *The Lower Bound of the Bargaining Range*

The lower bound of the bargaining range is the licensor's minimum willingness to accept. This value is the least that the patent holder will accept while still being better off than it would have been had it not issued a license. In the absence of a compulsory-licensing regime with regulated rates, an agreement below the lower bound of the bargaining range will never eventuate between a willing licensor and a willing licensee because the licensor will not accept a price below its minimum willingness to accept.

The licensor's minimum willingness to accept depends on its opportunity cost of licensing the patent in suit to the would-be infringer at the time of the hypothetical negotiation. This opportunity cost is determined by the profits that the licensor can earn by not issuing a license and by instead pursuing alternative licensing agreements that the licensor would forgo by licensing the patent in suit to the would-be licensee. That is, even if the patent owner does not compete with the infringer (and therefore will not lose profits due to lost sales in the downstream market), the patent owner might nonetheless lose other licensing opportunities by licensing to the infringer. In those circumstances, the patent owner would demand a royalty that at least equals the profits that the forgone licensing opportunities would have generated.

Ideally, one should determine the licensor's minimum willingness to accept on the basis of real-world observations. One source of empirical evidence that can be particularly probative of the licensor's minimum willingness to accept is

comparable licenses that the licensor has executed for the patent in suit. *Georgia-Pacific* factor 1 instructs the finder of fact to consider “[t]he royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty.”<sup>55</sup> An “established royalty” is a term of art based on Supreme Court case law dating to the nineteenth century.<sup>56</sup> A royalty is “established” for a patent if enough industry participants have agreed to pay it that their acceptance constitutes “a general acquiescence” as to the royalty’s reasonableness.<sup>57</sup> The Supreme Court considers an analysis based on comparable licenses to be the best measure of patent damages<sup>58</sup> because that analysis indicates the market valuation of the licensed patent. Comparable licenses “most clearly reflect the economic value of the patented technology in the marketplace,”<sup>59</sup> and reliance on them is appropriate when “there [is] basis in fact to associate the royalty rates used in prior licenses to the . . . negotiation at issue in the case.”<sup>60</sup> If an established royalty can be proven, then analysis of the remaining *Georgia-Pacific* factors is superfluous. In many cases, however, it is uncertain whether an analysis of comparable licenses would suffice to prove the existence of an established royalty. Consequently, as a practical matter of patent-litigation strategy, the parties will still undertake an analysis of comparable licenses to inform the determination of the licensor’s minimum willingness to accept under the remaining *Georgia-Pacific* factors.

Not every comparable license necessarily indicates the licensor’s minimum willingness to accept. For example, if the licensor had greater bargaining power relative to one of its licensees, the royalty to which the licensor agreed with that licensee will exceed the licensor’s minimum willingness to accept; or, a license that is the result of a settlement of litigation may not indicate the licensor’s true minimum willingness to accept or the licensee’s true maximum willingness to pay. To determine the licensor’s minimum willingness to accept accurately from an analysis of comparable licenses, one must identify a license in which the licensor had little or no bargaining power, or in which the licensor chose not to exercise the bargaining power that it did have. For example, if the licensee in one of the comparable licenses was constrained in its *ability*, rather than *willingness*, to pay, then the negotiated royalty is likely representative of the licensor’s minimum willingness to accept (because there would be no benefit to

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55. *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *mod. and aff’d*, 446 F.2d 295 (2d Cir. 1971), *cert. denied*, 404 U.S. 870 (1971).

56. *Clark v. Wooster*, 119 U.S. 322, 326 (1886) (“It is a general rule in patent causes, that established license fees are the best measure of damages that can be used.”).

57. *See, e.g., Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1078 (Fed. Cir. 1983) (“For a royalty to be ‘established,’ it ‘must be paid by such a number of persons as to indicate a general acquiescence in its reasonableness by those who have occasion to use the invention.’”) (citing *Rude v. Westcott*, 130 U.S. 152, 165 (1889)).

58. *Clark*, 119 U.S. at 326; *see also Nickson Indus., Inc. v. Rol Mfg. Co.*, 847 F.2d 795, 798 (Fed. Cir. 1988) (“Where an established royalty exists, it will usually be the best measure of what is a ‘reasonable’ royalty.”) (citing *Alpine Valley Ski Area*, 718 F.2d at 1078).

59. *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 79 (Fed. Cir. 2012).

60. *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1317 (Fed. Cir. 2011).

the licensor from attempting to use its bargaining power to extract a higher royalty from the financially constrained licensee).

There is an important instance in which it is possible that the observed royalty in a license in which the licensor had very little or no bargaining power is *less than* the licensor's true minimum willingness to accept: Widespread infringement of the licensor's patent could systematically reduce the royalties paid for that patent.<sup>61</sup> If the facts of a case indicate widespread infringement of the licensor's patent, then the observed royalty in a license in which the licensor had very little or no bargaining power will represent a conservative estimate of the lower bound of the bargaining range.

## 2. *The Upper Bound of the Bargaining Range*

The upper bound of the bargaining range is the licensee's maximum willingness to pay. That value is the most that the licensee would willingly pay while still being better off than it would have been had it not purchased the license. An agreement with a royalty above the upper bound of the bargaining range will never happen between a willing licensor and a willing licensee because, by definition, the licensee will not pay a price above its maximum willingness to pay. The licensee's maximum willingness to pay depends on the noninfringing alternatives available to it at the time of the hypothetical negotiation. The maximum royalty that the licensee would be willing to pay equals the added increment of profit that the licensee could expect to earn by licensing the patent in suit rather than using the next-best noninfringing substitute available at the time of the hypothetical negotiation.<sup>62</sup>

The licensee's maximum willingness to pay must be at least as great as its *demonstrated* willingness to pay in actual market transactions, though the former is almost certainly larger. The only scenario in which the demonstrated willingness to pay will equal the maximum willingness to pay is when the purchaser has zero bargaining power. If the facts and data of a case indicate that the would-be licensee's maximum willingness to pay for the patented technology exceeds (rather than equals) its demonstrated willingness to pay, then (because a licensee's demonstrated willingness to pay cannot exceed its maximum willingness to pay) evidence of the licensee's demonstrated willingness to pay (as revealed by the prices that the licensee actually paid in

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61. See *Trio Process Corp. v. L. Goldstein's Sons, Inc.*, 533 F.2d 126, 129 (3d Cir. 1976) (citing *Hartford Nat'l Bank & Trust Co. v. E.F. Drew & Co.*, 188 F. Supp. 353, 362 n.50 (D. Del. 1960), *modified*, 188 F. Supp. 347 (D. Del. 1960), *aff'd per curiam*, 290 F.2d 589 (3d Cir. 1961), *cert. denied*, 368 U.S. 825 (1961)) ("As one court has accurately observed, '[i]t is a fact of economic life that an open infringement tends to reduce a patentee's fees from its subsequent licensees who must meet the infringer's competition, and such infringement deters potential licensees from taking a license.'").

62. See, e.g., *Riles v. Shell Exploration & Prod. Co.*, 298 F.3d 1302, 1312 (Fed. Cir. 2002) ("The economic relationship between the patented method and non-infringing alternative methods, of necessity, would limit the hypothetical negotiation."); Sidak, *The Meaning of FRAND, Part I: Royalties*, *supra* note 5, at 935.

comparable transactions) will yield a conservative upper bound for estimating the surplus that the hypothetical negotiation would create.

Two important considerations in establishing the demonstrated willingness to pay are (1) whether any acceptable noninfringing substitute actually existed for the infringing product at the time infringement began, and (2) the cost of using the next-best noninfringing substitute at that time, if such a substitute did exist. A reliable proxy for the licensee's valuation of the patented technology is the difference between the would-be licensee's expected profits from selling infringing products and the would-be licensee's expected profits from selling products that implement the next-best noninfringing substitute. A similarly reliable proxy for valuing the patented technology, if data are available, is the difference between what the would-be licensee actually paid for the infringing product and what the would-be licensee actually paid for the next-best noninfringing substitute. The former method identifies the portion of the infringer's expected profits that are attributable to the patented technology by determining the increase in value that the licensee gains by using the patented technology. The latter method is a more direct observation of the same valuation. These methods separate the value of the technology covered by the hypothetical licensor's patent from the technology's other features that the hypothetical licensor's patent does not cover.

It is critical that the costs of licensing the next-best substitute are included in that incremental-value analysis to ensure that the licensee has secured the lawful right to use the next-best substitute.<sup>63</sup> The failure to do so is a common methodological error one observes in expert testimony in patent litigation. The next-best noninfringing substitute may not be in the public domain. If the next-best substitute is itself a patented technology, then failing to include the would-be licensee's cost of securing a valid license means that the incremental-value analysis would incorrectly compare *using* patent *A* with *infringing* patent *B*.<sup>64</sup> The set of noninfringing substitutes must be limited to lawfully licensed substitutes, so as to assess accurately the true cost of the licensee's next-best substitute. Neglecting to consider the licensee's acquisition costs of the alternatives both understates the true incremental value of the hypothetical licensor's patent and misidentifies the next-best alternative to that patent. Because both methods that I describe above to determine the licensee's demonstrated willingness to pay—that is, direct observations of the licensee's expected profits or actual prices paid for the infringing and noninfringing products—implicitly incorporate the licensee's cost of securing a valid license, these methods do not require additional disaggregation of value.

The finder of fact must account for the existence of available and acceptable noninfringing alternatives at the time of the hypothetical

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63. Sidak, *The Meaning of FRAND, Part I: Royalties*, *supra* note 5, at 935.

64. *Id.*; see also *In re Innovatio IP Ventures, LLC Patent Litig.*, No. 11 C 9308, 2013 WL 5593609, at \*20 (N.D. Ill. Oct. 3, 2013).



negotiation.<sup>65</sup> If a noninfringing alternative was not on the market at the time of the hypothetical negotiation, an inference arises that no noninfringing alternative existed, which the infringer may overcome by showing that a noninfringing alternative could have been “commercialized readily.”<sup>66</sup> In contrast, the mere possibility of a design around does not constitute availability.<sup>67</sup> To be considered acceptable, the substitute must have the same features as the infringing product.<sup>68</sup> The failure to evaluate the acceptability and availability of noninfringing substitutes at the time of the hypothetical negotiation could cause the finder of fact mistakenly to identify the would-be licensee’s next-best alternative to infringement, which would produce an incorrect evaluation of the licensee’s maximum willingness to pay and therefore an incorrect bargaining range.

### B. *The Effect of Each Georgia-Pacific Factor on a Reasonable Royalty*

Each *Georgia-Pacific* factor affects a different aspect of the hypothetical negotiation framework. Some factors affect the determination of the bargaining range—that is, the determination of the licensor’s minimum willingness to accept or the determination of the licensee’s maximum willingness to pay. Other factors affect the determination of the point royalty within the bargaining range. I briefly explain here the effect that each factor has on the hypothetical negotiation. *Georgia-Pacific* factor 15 establishes the hypothetical negotiation framework within which surplus is divided.<sup>69</sup> Therefore, this final factor does not explicitly affect a reasonable point royalty within the bargaining range, but rather unifies the preceding factors into a bargaining framework.<sup>70</sup>

*Factor 1.* Royalties received by the licensor for licensing the patent will help determine the bounds of the bargaining range as well as the point royalty within the bargaining range. Any observed royalty in a license for the patent in suit should equal or exceed the licensor’s minimum willingness to accept, provided that the observed licensee and the hypothetical licensee are similarly situated relative to the licensor, and that adjustments are made for the explicit

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65. See, e.g., *Mars, Inc. v. Coin Acceptors, Inc.*, 527 F.3d 1359, 1372–73 (Fed. Cir. 2008).

66. *Siemens Med. Solutions USA, Inc. v. Saint-Gobain Ceramics & Plastics*, 637 F.3d 1269, 1288 (Fed. Cir. 2011); see also *Wechsler v. Macke Int’l Trade, Inc.*, 486 F.3d 1286, 1298 (Fed. Cir. 2007); *Micro Chem., Inc. v. Lextron, Inc.*, 318 F.3d 1119, 1122–23 (Fed. Cir. 2003); *Grain Processing Corp. v. Am. Maize-Products Co.*, 185 F.3d 1341, 1351–54 (Fed. Cir. 1999).

67. *Mars*, 527 F.3d at 1372–73.

68. *Stryker Corp. v. Intermedics Orthopedics, Inc.*, 96 F.3d 1409, 1418 (Fed. Cir. 1996); *Standard Havens Prods., Inc. v. Gencor Indus., Inc.*, 953 F.2d 1360, 1373 (Fed. Cir. 1991); *TWM Mfg. Co., Inc. v. Dura Corp.*, 789 F.2d 895, 901–02 (Fed. Cir. 1986).

69. *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *mod. and aff’d*, 446 F.2d 295 (2d Cir. 1971), *cert. denied*, 404 U.S. 870 (1971).

70. I omit *Georgia-Pacific* factor 14—the “opinion testimony of qualified experts,” *id.*—because it does not identify a substantive factor relevant to the analysis.

assumption in the *Georgia-Pacific* framework that the patent in suit is valid and infringed. Likewise, similarly situated observed licensees should have a maximum willingness to pay close to the hypothetical licensee. The maximum willingness to pay will generally exceed the maximum observed royalty. The observed point royalties will reveal information about the relative bargaining power of the licensor and similar licensees and help inform the determination of a point royalty within the bargaining range.

*Factor 2.* The rates paid by the licensee for the use of other similar patents will inform a conservative estimate of the licensee's maximum willingness to pay, once adjustments are made for the relative value of the patent in suit and the patents included in observed licenses.

*Factor 3.* The nature and scope of the license, such as whether it is exclusive or nonexclusive, or restricted or nonrestricted in terms of territory or customers, will help determine the bounds of the bargaining range as well as the point royalty. A licensee will typically have a higher maximum willingness to pay for a license that includes fewer restrictions or is an exclusive license. A licensor will have a greater opportunity cost of negotiating an unrestricted license or an exclusive license and will have a higher minimum willingness to accept. A licensor will have more bargaining power in a negotiation for an exclusive license, in which it can threaten to offer an exclusive license to the would-be licensee's competitors, than in a negotiation for a nonexclusive license.

*Factor 4.* The licensor's established policy with respect to maintaining its patent monopoly will help determine the licensor's minimum willingness to accept. A licensor that does not actively license its patents and maintains a monopoly over the patented product will have a higher opportunity cost of licensing and therefore a higher minimum willingness to accept.

*Factor 5.* The commercial relationship between the licensor and licensee, such as whether they are competitors, will affect the licensor's minimum willingness to accept. The licensor's minimum willingness to accept will be greater in a licensing negotiation with a horizontal competitor than with a non-competitor because granting a license to a horizontal competitor may cannibalize sales of the practicing product and induce price erosion, both of which will reduce the licensor's expected profit.

*Factor 6.* The effect that the patented technology has in generating sales of other products of the licensee and of the licensor will affect both endpoints of the bargaining range. If a patented technology promotes the sales of related products that do not practice the patent in suit, then the value of the technology increases for both parties to the hypothetical negotiation. In that case, both the minimum willingness to accept and the maximum willingness to pay will be greater than in the absence of sales of related products. The presence of a significant amount of related sales by either party can increase the relative bargaining power of the licensor.

*Factor 7.* The duration of the patent and the term of the license will help determine the licensee's maximum willingness to pay. Generally, a licensee

will have a higher expected cost of forgoing the use of a patent with a longer duration than a patent with a shorter duration. Therefore, a licensee will have a greater willingness to pay when negotiating over a patent of longer duration. A particularly short remaining patent life may increase the licensee's relative bargaining power.

*Factor 8.* The established profitability of the product made under the patent will help determine the licensee's maximum willingness to pay and, in some circumstances, the licensor's minimum willingness to accept. The greater the profitability of the patented product, the greater will be the maximum willingness to pay for a license. For a licensor that competes with the hypothetical licensee in the downstream market, greater profitability of the licensor's downstream product will indicate a higher opportunity cost of licensing and therefore a greater minimum willingness to accept.

*Factor 9.* The utility and advantages of the patented technology over substitutes helps determine the licensee's next-best noninfringing alternative. This factor affects the licensee's maximum willingness to pay. The greater the advantages of the patented technology over the next-best alternative, the more the licensee will be willing to pay for the patented technology, and so the greater will be the upper bound of the bargaining range.

*Factor 10.* The nature of the patented invention, the character of the commercial embodiment of the patent as owned and produced by the licensor, and the benefits to those who have used the invention could affect the bounds of the bargaining range as well as the determination of the point royalty. The applicability of this factor will vary depending on the facts of a specific case.

*Factor 11.* The extent to which the infringer has made use of the invention will help determine the licensee's maximum willingness to pay. The more valuable the patented invention is to the licensee, the more the licensee will be willing to pay for a license. If the infringer relies heavily on the patented invention, the licensor will have more bargaining power in the hypothetical negotiation.

*Factor 12.* The portion of the profit or of the selling price that is the customary price for the use of the invention or analogous inventions will tend to reveal the relative bargaining power of the parties in the hypothetical negotiation.

*Factor 13.* The portion of the realizable profit that should be credited to the invention (distinguished from non-patented elements or significant features or improvements added by the infringer) will determine the value to the licensee of using the patent in suit. The greater the portion of the licensee's profit that can be credited to the invention, the greater will be the licensee's maximum willingness to pay.

Table 1 summarizes how the *Georgia-Pacific* factors affect each of the three elements of the hypothetical negotiation framework—the minimum willingness to accept, the maximum willingness to pay, and the relative bargaining power of each party. To determine a reasonable royalty using the condensation of the *Georgia-Pacific* framework that I describe in Part III.A, the

finder of fact must use the information provided by each relevant *Georgia-Pacific* factor to establish the bargaining range and determine, based on each party's relative bargaining power, the location of a reasonable royalty within that bargaining range.

Table 1: The Georgia-Pacific Factors That Affect the Three Elements of the Hypothetical-Negotiation Framework

Element of the Hypothetical-Negotiation Framework	Georgia-Pacific Factors That Affect the Element of the Framework												
<i>Georgia-Pacific</i> Factor	1	2	3	4	5	6	7	8	9	10	11	12	13
Minimum willingness to accept	✓		✓	✓	✓	✓		✓		✓			
Maximum willingness to pay	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Bargaining power	✓		✓			✓	✓			✓	✓	✓	

### C. Comparison of Bargaining Power

The ultimate outcome of the *Georgia-Pacific* hypothetical negotiation will depend on the relative bargaining power of each party to the negotiation. Relative bargaining power will determine how the total surplus—the total benefit generated by the agreement—is divided between the parties to the negotiation.<sup>71</sup> The two parties will strike a bargain at a price closer to the licensee's maximum willingness to pay (a higher  $s$  in Figure 1) if the *licensor* has relatively greater bargaining power. Conversely, the two parties will strike a bargain at a price closer to the licensor's minimum willingness to accept (a lower  $s$ ) if the *licensee* has relatively greater bargaining power. In other words, the licensee will agree to give a relatively large portion of the surplus to the licensor only if the licensee has less bargaining power; and the licensee will succeed in sharing a relatively small portion of the surplus with the licensor only if the licensee has greater bargaining power.

#### 1. Analyzing Relative Bargaining Power

The finder of fact can determine the relative bargaining power of each party in a negotiation by examining each party's relative position in the market, the benefit that each would gain from reaching a successful agreement, and each party's next-best alternative if an agreement does not eventuate. The *Georgia-Pacific* factors can serve as a guide to the facts and data of a case that one must consider, such as the benefits accruing to each party from licensing a patented technology and each party's desire to come to an agreement. Even when a particular *Georgia-Pacific* factor cannot provide guidance about the actual magnitude of a reasonable royalty, it may still provide guidance about whether one party or the other has greater bargaining power. Some

71. See, e.g., PINDYCK & RUBINFELD, *supra* note 49, at 494–95.

considerations for determining relative bargaining power are the benefits to each party of reaching a deal, each party's patience, each party's need for liquidity, and ultimately each party's willingness to walk away from the negotiation.

The relative bargaining power of a party in a negotiation reflects that party's need to reach an agreement. That need depends on the benefit that the party will gain from a successful agreement. That is, a party that will profit more from a successfully completed agreement will have a stronger incentive to reach an agreement. The party that will benefit less from an agreement can use its ability to walk away from the negotiation to appropriate greater surplus from its counterparty. This ability to gain a share of the profits by threatening not to agree to a contract is what is described by the concept of bargaining power in a negotiation.

The benefits that accrue to each party in a successful negotiation should not be measured as the absolute benefit from a license, but rather as the benefits relative to the next-best alternative. It is essential to consider the "outside option" available to each party to the hypothetical negotiation, which economists define to be "the best alternative that a player can command if he withdraws unilaterally from the bargaining process."<sup>72</sup> This concept is an application to bargaining theory of Armen Alchian's classic definition of opportunity cost: "In economics, the cost of an event is the highest-valued opportunity necessarily forsaken."<sup>73</sup> The highest net benefit of all opportunities forgone is the opportunity cost of a chosen course of action. If each party has an outside option, then each still receives some value if the negotiation fails, and each party's bargaining power is affected by the strength of its alternatives. For example, a licensee that can access a noninfringing alternative that is almost as good as the patented technology has a strong available alternative. Similarly, a licensor that has received many license offers has strong alternatives to any given license negotiation. Each party must receive value from a successful negotiation that is at least as good as its next-best alternative. The benefit that the parties receive from a successful transaction beyond the benefit they obtain from their next-best alternatives forms the surplus over which the parties negotiate. That surplus is divided according to the parties' respective bargaining power. Therefore, whereas a party's alternatives to licensing affect its overall payment, the portion of the surplus that it receives depends on its willingness to leave the negotiation and merely receive the value

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72. See, e.g., Ken Binmore, Ariel Rubinstein & Asher Wolinsky, *The Nash Bargaining Solution in Economic Modelling*, 17 RAND J. ECON. 176, 185 (1986); see also MARTIN J. OSBORNE & ARIEL RUBINSTEIN, *BARGAINING AND MARKETS* 62 (1990) (discussing "when . . . the execution of the outside option is a credible threat"); Ariel Rubinstein & Asher Wolinsky, *Equilibrium in a Market With Sequential Bargaining*, 53 ECONOMETRICA 1133, 1147 (1985) (characterizing the division of surplus in a bilateral negotiation as a function of the number of outside options to reaching an agreement (the expected payoff of walking away)).

73. Armen A. Alchian, *Cost*, in 3 INTERNATIONAL ENCYCLOPEDIA OF THE SOCIAL SCIENCES 404, 404 (David L. Sills ed., 1968). For an exceptionally clear exposition of opportunity cost, see RICHARD A. IPPOLITO, *ECONOMICS FOR LAWYERS* 120–21 (2005).

of its outside option. Under this framework for calculating a reasonable royalty, one cannot examine solely the available alternatives to an agreement: those alternatives determine the *amount* of surplus (that is, the extent of the bargaining range), but relative bargaining strength determines the *division* of that surplus.

The benefits that each party gains from a contract may be dynamic. Therefore, bargaining power must be evaluated at a particular point in time. For example, if one party has great need to access a patent before the impending release of a product, then it will have little bargaining power. Relative bargaining power depends not only on the overall size of the benefit that each party expects, but also on the benefit from agreeing to a contract at a particular time (versus the possible benefit from agreeing to a contract at a later time). Therefore, the party that suffers least from delaying an agreement—that is, the party that is most patient—will have more bargaining power.<sup>74</sup> The cost that each party bears from delay is measured by its respective discount rate. The dynamic nature of bargaining power indicates that the party with the lower discount rate will have more bargaining power because it suffers less from a delay in reaching an agreement.<sup>75</sup>

The *Georgia-Pacific* factors state that the voluntary hypothetical negotiation would have occurred at the time immediately before first infringement (assuming validity, enforceability, and infringement of the patent in suit). Therefore, the finder of fact undertaking a *Georgia-Pacific* factor analysis must analyze the bargaining power that each party would have had at that time—not at the time of litigation. The *Georgia-Pacific* factors, when analyzed through the lens of economics, can aid the finder of fact in determining the benefit that each party would have gained from a successful negotiation, as well as each party's relative need to reach an agreement. Thus, the *Georgia-Pacific* factors can serve as a starting point for determining each party's bargaining power by determining each party's willingness to end the voluntary negotiation.

## 2. *Incorporating Bargaining Power into the Analysis of the Georgia-Pacific Factors*

The relative bargaining power of the patent holder and the would-be licensee should inform the point estimate of the reasonable royalty within the bargaining range. The existing case law recognizes this principle. The Federal Circuit observed in 1983 that an analysis of “the respective bargaining positions of the parties engaged in the theorized licensing negotiations” is “an eminently reasonable approach to the willing seller-willing buyer analysis.”<sup>76</sup> Over the following decades, the court has reiterated the relevance of whether a

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74. ROBERT GIBBONS, GAME THEORY FOR APPLIED ECONOMISTS 68–71 (1992).

75. *Id.*

76. *Deere & Co. v. Int'l Harvester Co.*, 710 F.2d 1551, 1559 (Fed. Cir. 1983).

party to the hypothetical negotiation had “a strong bargaining position.”<sup>77</sup> Clearly, the discussion of bargaining power in *VirnetX* in 2014 confirms that this analysis remains relevant to the hypothetical negotiation; otherwise, the Federal Circuit could simply have said that expert testimony on bargaining power is irrelevant and inadmissible, rather than asking (as it did) whether an expert’s use of a particular methodology is sufficiently tied to the facts of the case to provide a reliable inference of the relative bargaining power of the parties.<sup>78</sup> Only three months after deciding *VirnetX*, the Federal Circuit reiterated in *Aqua Shield* that, within the hypothetical negotiation, “the ultimate royalty determination must reflect the two-sided nature of the posited negotiation.”<sup>79</sup> Similarly, district courts having some of the busiest patent-infringement dockets in the United States expressly consider relative bargaining power as part of the hypothetical negotiation.<sup>80</sup>

If the patent holder had greater bargaining power in the hypothetical negotiation, it would secure a royalty above the midpoint of the bargaining range. Conversely, if the would-be infringer had more bargaining power, it would secure a royalty below the midpoint. This insight rests on common sense rather than a game-theoretic mathematical model, such as the Nash bargaining

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77. *Fujifilm Corp. v. Benun*, 605 F.3d 1366, 1372 (Fed. Cir. 2010) (noting that the patent holder “would have enjoyed a strong bargaining position” in the hypothetical negotiation); *Total Containment, Inc. v. Environ Prods., Inc.*, 106 F.3d 427, 1997 WL 16032, at \*7 (Fed. Cir. Jan. 17, 1997) (requiring a “proper evidentiary basis” for concluding that a party to the hypothetical negotiation “was in a strong bargaining position”).

78. *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1331–33 (Fed. Cir. 2014).

79. *Aqua Shield v. Inter Pool Cover Team*, 774 F.3d 766, 771 (Fed. Cir. 2014).

80. For example, the Northern District of California in February 2015 found admissible the testimony of an expert witness who calculated a reasonable royalty by “taking into account the ‘real-world’ bargaining position of the parties” and “employ[ing] a reasonable royalty methodology that postulates, as a step in the hypothetical negotiation process, that each party will assess the benefits and costs to itself of entering into, or foregoing [sic], a hypothetical license. . . .” Order Denying Plaintiff’s Motion to Exclude Testimony of Defendant’s Expert Witness; Denying Defendant’s Motion to Exclude Testimony of Plaintiff’s Expert Witness at 13, *Cave Consulting Group LLC v. OptumInsight, Inc.*, No. 5:11-cv-00469-EJD (N.D. Cal. Feb. 20, 2015). The court said that the “approach incorporates a methodology previously accepted by the court for determining the hypothetical bargaining range.” *Id.* In January 2015, the same court found admissible the portion of an expert’s testimony that, unlike the expert testimony in “*VirnetX* and *Uniloc*, where the experts relied on ‘rules of thumb[.] . . . analyzed how the various factors impacted the parties’ bargaining strengths” by “consider[ing] a non-exhaustive list of ‘[p]rinciple factors’ relating to the hypothetical negotiation.” Order Granting-in-Part Motion to Exclude at 21, *Sentius Int’l, LLC v. Microsoft Corp.*, No. 5:13-cv-00825-PSG (N.D. Cal. Jan. 27, 2015). See also *Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, No. C 09-5235 MMC, 2014 WL 4437631, at \*3 (N.D. Cal. Sept. 9, 2014) (observing that the patentee “would have been in an exceptionally strong bargaining position at the time of the hypothetical negotiation”); *Commonwealth Scientific & Indus. Research Org. v. Cisco Sys., Inc.*, No. 6:11-cv-343, 2014 WL 3805817, at \*13 (E.D. Tex. July 23, 2014) (examining whether the patent holder and the accused infringer “would have been in substantially equal bargaining positions at the hypothetical negotiations”). For a decision predating *Georgia-Pacific* that based a reasonable royalty in part upon “the changed circumstances of the bargaining positions of the parties,” see *Alford v. United States*, 179 Ct. Cl. 938, 970 (1967).

solution. To calculate a reasonable royalty, therefore, one must determine the relative bargaining power of the two parties to the hypothetical negotiation. Then the finder of fact must identify, from the pool of licensees that have willingly agreed to license the licensor's patented technology, the licensee whose bargaining power when it negotiated its license was most comparable to that of the would-be licensee at the time of the hypothetical negotiation.

Once one has determined the actual licensee with bargaining power most comparable to the would-be licensee, one plots the royalty that the real-world licensee actually paid on the bargaining range between the licensor and would-be licensee.<sup>81</sup> The surplus-division principle allows the finder of fact to calculate the division of surplus that the observed royalty represents. For example, suppose that the finder of fact has determined that the licensor's minimum willingness to accept is \$10 and the licensee's maximum willingness to pay is \$45. Suppose further that the licensee whose bargaining power at the time of its negotiation was most comparable to the bargaining power that the would-be licensee would have had at the time of the hypothetical negotiation paid a \$17 per-unit royalty for the patented technology. Figure 2 illustrates how plotting \$17 on the bargaining range between the licensor and the would-be licensee reveals the division of the surplus corresponding to the \$17 per-unit royalty.

Figure 2: Determining the Division of Surplus Between the Licensor and the Would-Be Licensee

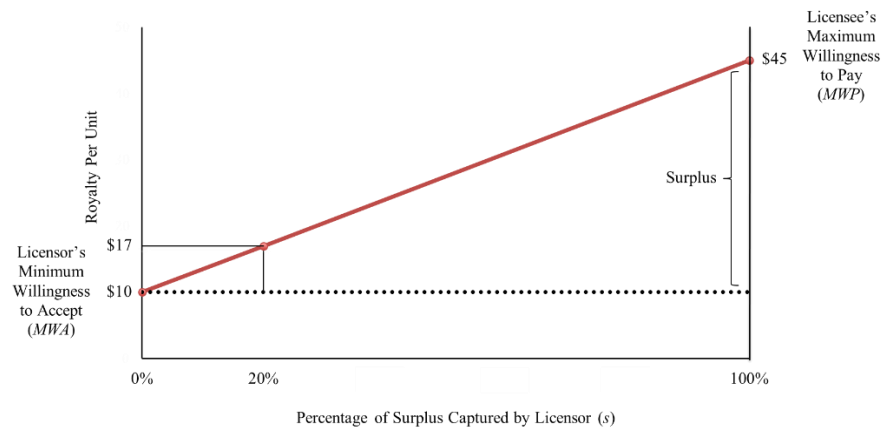


Figure 2 indicates that a \$17 per-unit royalty represents a division of surplus such that the would-be licensee would receive 80 percent of the surplus and the licensor would receive 20 percent of the surplus.

81. See, e.g., *Finjan, Inc. v. Secure Computing Corp.*, 626 F.3d 1197, 1211–12 (Fed. Cir. 2010) (“Use of past patent licenses . . . must account for differences in the . . . economic circumstances of the contracting parties.”).



This calculation uses an analysis of comparable licenses to reveal the likely division of surplus that would have resulted from a hypothetical negotiation. Having determined the likely division of surplus, one then applies that division to the surplus that results from a successful agreement between the licensor and licensee. Because the surplus is the difference between the licensee's maximum willingness to pay and the licensor's minimum willingness to accept, the surplus in the above example is \$35. Using these values, one can solve for the equation above. In this example,  $MWA = \$10$ ,  $MWP = \$45$ , and  $s = 20$  percent. Therefore,

$$\text{Royalty} = \$10 + [0.20 \times (\$45 - \$10)] = \$17,$$

such that the lower bound on a reasonable (per-unit) royalty, according to this analysis of a hypothetical negotiation, is \$17.

### III. ADVANTAGES OF THE SURPLUS-DIVISION PRINCIPLE

The surplus-division principle provides a coherent, intuitive framework for a unified analysis of the *Georgia-Pacific* factors that relies on empirically observed facts and data. Consequently, the methodology permits replication by other party experts or by the finder of fact. The approach is more scientific and more rigorous than methods that lack any unified structure for analyzing the *Georgia-Pacific* factors and whose results cannot be replicated. It relies at every step on the facts and data of a case to calculate a reasonable royalty, rather than depending critically on an individual expert's idiosyncratic witness's judgment or an abstract mathematical model. I demonstrate here how one can adapt the surplus-division principle to a variety of scenarios.

#### A. *Relating the Surplus-Division Principle to the Facts of the Case*

In the hypothetical negotiation, there is no economic reason to assume that one party has 100 percent of the bargaining power and should therefore gain 100 percent of the surplus. That is, there is no reason to assume that a reasonable royalty will eventuate at either the licensor's minimum willingness to accept or the licensee's maximum willingness to pay. Such an assumption would effectively subvert the *Georgia-Pacific* construct, whose purpose in factor 15 is to *divide* the surplus between the willing licensor and willing licensee in the hypothetical negotiation. To assign the entire surplus to one party to the negotiation would, in effect, constitute a "zero-percent" rule,<sup>82</sup>

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82. The fallacy of such a "zero-percent rule," which assumes that one party has no bargaining power and is unable to capture any value of the surplus, is tantamount to the fallacy of the 25-percent rule used by some damages experts in damages computations. The Federal Circuit eventually found the 25-percent rule inadmissible under *Daubert* and the Federal Rules of Evidence. See *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1315 (Fed. Cir. 2011) (holding that the 25-percent rule was "a fundamentally flawed tool" for

whereby one party receives none of the gains from trade from voluntarily negotiating a licensing agreement.

### 1. *Multiple Licensees*

In some cases, a single patent holder may allege infringement of its patented technology by multiple defendants. In such a scenario, it would be important to calculate a separate reasonable royalty for each defendant or for each similarly situated group of defendants. To conclude that each defendant should pay the very same reasonable royalty would require too broad a set of assumptions about all of the defendants.

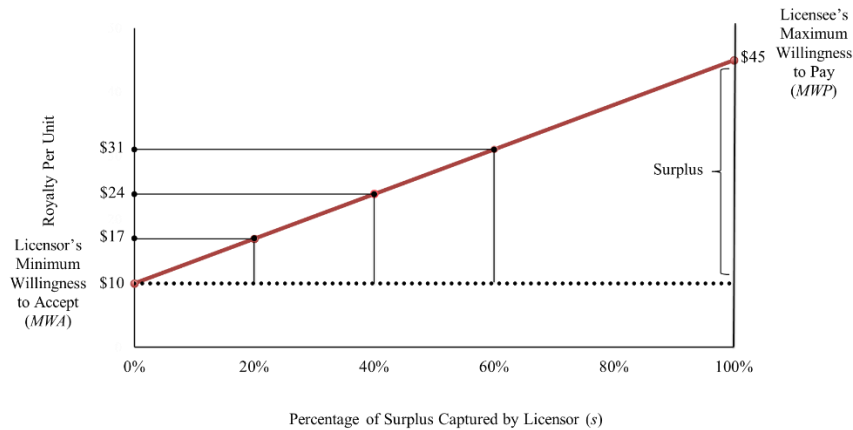
The surplus-division principle can accommodate the case in which there are multiple defendants characterized by varying economic circumstances. For example, suppose that there are three defendants in the case, and that the economic expert has determined that the bargaining ranges in each of the defendants' respective hypothetical negotiations with the patent holder are identical. In other words, suppose that the economic expert can directly observe, through a license in which the licensor had very little or no bargaining power, a price that establishes that the licensor's minimum willingness to accept is \$10. Suppose further that one can directly observe, through the value of each would-be licensee's next-best alternative, a value that establishes that the demonstrated willingness to pay of each would-be licensee is \$45. In this scenario, the lower bound of the surplus would be identical in each of the three defendants' hypothetical negotiations: \$35.

Suppose, however, that the bargaining power of each of the three defendants, relative to the bargaining power of the licensor, is not identical. There would then be no economic justification for assuming that each hypothetical negotiation would produce the same *division* of surplus, even though the amount of surplus to be divided would be identical in each case. The facts and data particular to each would-be licensee must inform the determination of the relative bargaining power of the counterparties to each hypothetical negotiation. The relative bargaining power affects the division of surplus, which in turn informs the ultimate calculation of a reasonable royalty. For example, the facts and data of a specific case might indicate that one defendant would have had very great bargaining power, the second moderate bargaining power, and the third very little bargaining power, relative to the licensor. Figure 3 depicts the outcome of each of the three hypothetical negotiations, given that the finder of fact has determined the bargaining power of each would-be licensee.

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determining the allocation of surplus between the patent holder and the infringer, "because it fail[ed] to tie a reasonable royalty base to the facts of the case at issue").

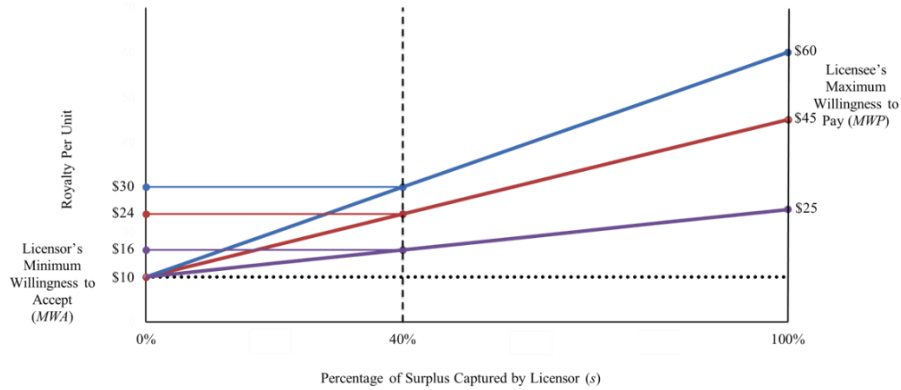
Figure 3: Three Defendants with the Same Bargaining Range but with Different Degrees of Relative Bargaining Power



In Figure 3, the defendant with very great bargaining power would capture 60 percent of the surplus; the defendant with moderate bargaining power would capture 40 percent of the surplus; and the defendant with very little bargaining power would capture 20 percent of the surplus. (I use these particular percentages strictly as numerical examples.) Although the bargaining ranges in this scenario are identical for the hypothetical negotiations between the patent holder and each of the three defendants, a reasonable royalty for each defendant differs because of the defendant's level of bargaining power, which in turn depends on the unique facts and data concerning that defendant. The surplus-division principle is therefore a generalized methodology that the finder of fact can immediately apply to the evidence unique to each would-be licensee to derive a reliable estimate of a reasonable royalty.

In other cases, there may be a different bargaining range for each defendant's hypothetical negotiation with the patent holder. For example, suppose that the licensor's minimum willingness to accept (as in the previous scenario) remains \$10 in each hypothetical negotiation, but that each of the three would-be licensees has a different maximum willingness to pay. The amount of surplus in this scenario will thus differ from one hypothetical negotiation to the next. Suppose further that, contrary to the previous scenario, each would-be licensee has the *same* bargaining power relative to the licensor. Each hypothetical negotiation will then result in the same division of surplus. However, the royalty that results will vary, because the surplus to be divided differs in each hypothetical negotiation. Figure 4 shows the result of a reasonable-royalty analysis in which each defendant has the same bargaining power but negotiates over a different bargaining range.

Figure 4: Three Defendants with Different Bargaining Ranges but the Same Relative Bargaining Power



Although each defendant has comparable bargaining power relative to the licensor, the royalty that each will pay varies because each negotiates with the licensor over a different amount of surplus.

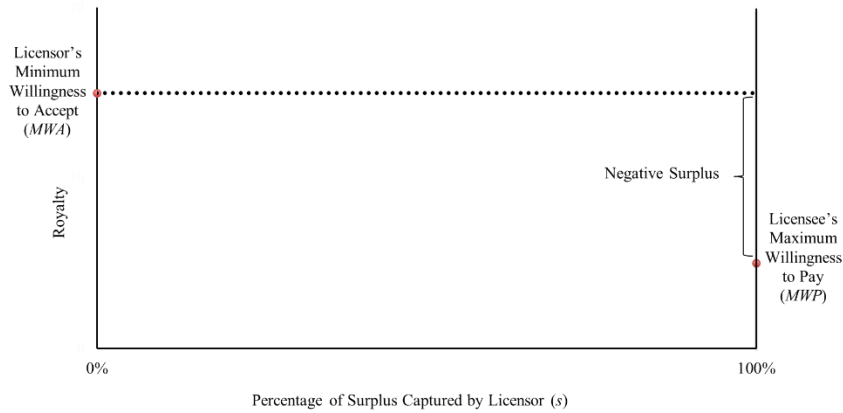
2. *What If the Licensor's Minimum Willingness to Accept Exceeds the Licensee's Maximum Willingness to Pay?*

If the licensor's minimum willingness to accept exceeds the licensee's maximum willingness to pay, there is no surplus over which to bargain. Therefore, the outcome of a hypothetical negotiation would be that no voluntary exchange occurs. In this scenario, the finder of fact should require the infringer to pay an amount not less than the patent holder's minimum willingness to accept in the hypothetical negotiation. Even though the amount would exceed the infringer's hypothetical maximum willingness to pay, that amount would be necessary to fully compensate the patent holder for its injury from patent infringement, as section 284 of the Patent Act requires.<sup>83</sup>

Figure 5 illustrates that when the licensor's minimum willingness to accept exceeds the licensee's maximum willingness to pay, there is a negative surplus. In effect, there is no bargaining range at all. As a result, a voluntary agreement will not eventuate.

83. 35 U.S.C § 284.

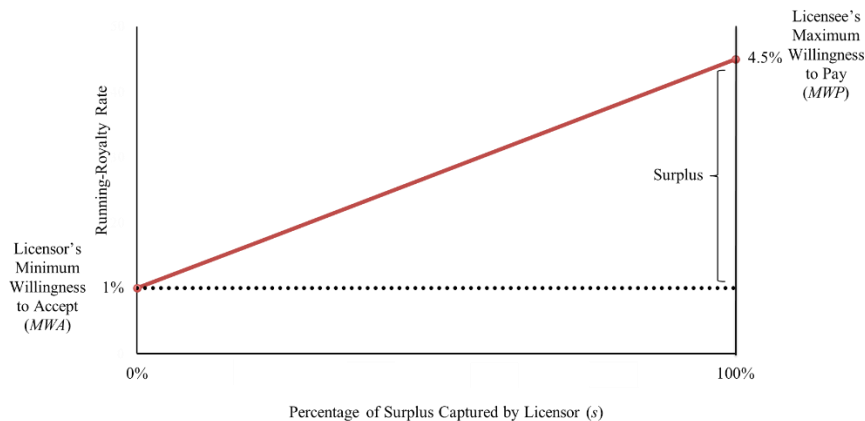
Figure 5: The Negative Bargaining Range



### 3. Multiple Licenses Having Different Royalty Structures

The examples developed so far have presupposed a per-unit royalty structure. However, the surplus-division principle can also accommodate analysis of a hypothetical negotiation in which the comparable licenses specify a running-royalty rate (typically a percentage of the net sales price of the patent-practicing product). In that case, the licensor's minimum willingness to accept and the licensee's maximum willingness to pay will simply be expressed as royalty rates rather than per-unit royalties, and the parties will negotiate within a bargaining range of running-royalty rates on a specified royalty base instead of a bargaining range of per-unit royalties. Figure 6 depicts such a bargaining range.

Figure 6: Bargaining Range of Running-Royalty Rates



If a license that specifies a lump-sum royalty is comparable, the finder of fact must convert that lump-sum royalty to either a per-unit royalty or a

running-royalty rate. To convert a lump-sum royalty to a per-unit royalty, one uses the following equation:

$$PU = LS / U,$$

where  $PU$  is the per-unit royalty,  $LS$  is the lump-sum royalty, and  $U$  is the projected unit shipments of licensed products at the time of the hypothetical negotiation. To convert a lump-sum royalty to a running-royalty rate, in simplest terms, one uses the following equation:

$$RR = LS / R,$$

where  $RR$  is the running-royalty rate,  $LS$  is the lump-sum royalty, and  $R$  is the projected net revenue from licensed products at the time of the hypothetical negotiation. Whether the finder of fact needs to convert a lump-sum royalty to a per-unit royalty or to a running-royalty rate will depend on the facts of the case.

#### B. *Replicating the Results of the Surplus-Division Principle*

The surplus-division principle for calculating a reasonable royalty employs an intuitive, coherent framework that makes use of all the pieces of information described in *Georgia-Pacific*. The determination of the bargaining range, of the parties' relative bargaining power, and of a reasonable royalty within the bargaining range, depends on the facts and data of a case. Real-world observations, such as the difference between the actual price that the would-be licensee charged for the infringing product and the actual price that the would-be licensee charged for the next-best noninfringing alternative, or a license in which the licensor had very little or no bargaining power, inform the determination of the upper and lower bounds of the bargaining range, respectively. Likewise, an analysis of the facts and data suggested by the relevant *Georgia-Pacific* factors will indicate each party's relative bargaining power, which will determine the selection of a reasonable royalty within the bargaining range. Because this methodology results in a reasonable royalty that is determined by empirical observations of relevant facts and data, the finder of fact can readily replicate its results and explore the robustness of royalty estimates across differing input values.

#### CONCLUSION

The Federal Circuit's 2014 decision in *VirnetX* reiterates that, when an established royalty cannot be proven, the calculation of a reasonable royalty for patent infringement must proceed from an analysis that weighs all the relevant facts of the case within a coherent, intuitive framework. The surplus-division principle is a simple but powerful economic framework that makes the *Georgia-Pacific* analysis more coherent and predictable. It satisfies the Federal

Circuit's requirement that the calculation of a reasonable royalty rely on the relevant facts of the case rather than a theoretical abstraction of those facts. It requires one to use real-world empirical observations to define the boundaries of the bargaining range and to select, on the basis of the parties' relative bargaining power, a reasonable royalty within that range. The surplus-division principle therefore solves the problem of how to determine a reasonable royalty according to a coherent, replicable, and intellectually rigorous methodology that is applied to the facts of the case.