

MAKING SENSE OF “APPORTIONMENT” IN PATENT DAMAGES<sup>1</sup>

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Unreasonably large damages awards in patent litigation have been an important force in motivating the movement for patent reform. “Apportionment” has found support as a solution to problem damages awards. Under apportionment, the portion of the overall value of the product that is “attributable” to the patented technology is identified. Then, reasonable royalty damages are calculated with reference to this apportioned value of the patented technology rather than the overall value of the product. While the problems that have motivated the apportionment movement are real and serious, apportionment makes sense as a solution only under the assumption that an economically invalid approach to calculating damages is being taken in the first place. A more sensible solution is to require litigants to take an economically valid approach to damages. In addition, when there are complementarities between assets, such that the combined use of two or more assets is worth more than their individual use, no unique way exists to apportion the overall value of the product among the assets (including the patented technology at issue), rendering apportionment infeasible in many cases. We consider these and other issues that surround apportionment.

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## I. INTRODUCTION

Controversial patent damages awards have put patent damages at the center of the debate over patent reform. The award in *Lucent Technologies, Inc. v. Gateway, Inc.* (“*Lucent*”) is one such example. In a jury trial, Microsoft was found to have infringed a patent—referred to as the Day patent—that describes a method to enter information on a computer screen without using a keyboard (e.g., by using a stylus), which Microsoft was found to have used in its “date-picker” calendar tool in Microsoft Outlook. The jury awarded \$358 million in damages to Lucent. On appeal, however, the Court of Appeals for the Federal Circuit (“CAFC”) found that “the infringing use of the date-picker tool in Outlook is but a very small component of a much larger software program”<sup>2</sup> and concluded that the “damages calculation lacked sufficient evidentiary support.”<sup>3</sup> The matter was remanded to the lower court for a new trial on damages.

In recent years, Congress has considered a variety of legislative proposals designed to address the issue of unreasonably large damages awards.<sup>4</sup> Of particular concern are situations where the patented technology is but one of many technologies and assets that are incorporated into a product.<sup>5</sup> “Apportionment” has been proposed as a solution to these problems.<sup>6</sup> Under apportionment, the portion of the overall value of the product that is “attributable” to the patented technology is identified. Then, reasonable royalty damages are calculated with reference to this apportioned value of the patented technology rather than the overall value of the product.

In this article, we explore apportionment. While the problems that have motivated the apportionment movement are real and serious, apportionment makes sense as a solution only under the assumption that an economically invalid approach to calculating damages is being taken in the first place. Apportionment relieves a symptom, but not the cause, of problem damages awards. Adoption of apportionment as a damages calculation methodology may arbitrarily reduce reasonable royalty awards, even for

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<sup>2</sup> *Lucent Technologies, Inc., et al. v. Gateway, Inc., et al.*, 580 F.3d 1301, 1337 (Fed. Cir. 2009), cert. denied, 30 S. Ct. 3324 (2010).

<sup>3</sup> *Id.* at 1308.

<sup>4</sup> *See, e.g.*, The Patent Reform Act of 2009, S. 515, 111th Cong. (2009); *see also, e.g.*, S. 610, 111th Cong. (2009); H.R. 1260, 111th Cong. (2009); The Patent Reform Act of 2010, S. Managers’ Amend., 111th Cong. (2010) (Managers’ amendment to Senate Bill 515 as reported by S. Comm. on the Judiciary, March 4, 2010).

<sup>5</sup> *E.g.*, *Patent Reform in the 111th Congress: Legislation and Recent Court Decisions Before the S. Comm. On the Judiciary*, 111th Cong. 14 (2009) (statement of Mark A. Lemley, Professor of Law, Stanford Law School), available at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111\\_senate\\_hearings&docid=f:54059.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_senate_hearings&docid=f:54059.pdf) (testifying that the Georgia-Pacific factors are open to manipulation and that they do not reflect the contribution of the patented technology to the technology at issue).

<sup>6</sup> *See, e.g., id.* at 61–62. *See also*, Brian J. Love, *Patentee Overcompensation and the Entire Market Value Rule*, 60 *Stan. L. Rev.* 263, 272 (2007).

valuable new inventions—counter to the purpose of patent system. A more sensible solution is to require litigants to take an economically valid approach to damages. In that case, apportionment would not be necessary.

In addition, an attempt to implement apportionment would face serious practical problems. When there are complementarities between assets, such that the combined use of two or more assets is worth more than their individual use, no unique way exists to apportion the overall value of the product among the assets (including the patented technology at issue). Unless a particular apportionment scheme was specified in patent reform legislation, substantial legal ambiguity would be created and courts, juries, and parties would bear a heavy litigation burden. Again, the alternative of requiring litigants to take an economically valid approach to damages is a much more attractive alternative from the perspective of good public policy.

## II. APPORTIONMENT RELIEVES A SYMPTOM, NOT THE CAUSE, OF “PROBLEM” DAMAGES AWARDS

The apportionment movement has been motivated by scenarios such as the following. A damages expert provides testimony in which a reasonable royalty damages award is calculated by first determining that the average royalty rate in an industry is, say, 1%, and then applying this royalty rate to a royalty base consisting of the revenue of a product that incorporates the patented technology.<sup>7</sup> However, the patented technology covers only a “small” component of the product, and many other technologies and assets are required to produce the product. Therefore, the resulting damages award (in dollars) seems out of line with the contribution of the patented technology to the product.

This scenario played out recently in *Cornell University v. Hewlett-Packard Co.* (“*Cornell*”), presided over by Judge Rader of the CAFC, who was sitting by designation.

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<sup>7</sup> The approach of using “industry averages” and supposedly “comparable” licenses to determine the royalty rate in a given situation often fails to be economically sound in its own right. The supposedly comparable licenses are often not, in fact, comparable. License agreements can vary substantially both in terms of the patented technology being licensed and the economic conditions of the parties to the agreement. Unless the important characteristics are similar across two licenses, they will generally not be comparable. Along the same lines, the economic circumstances surrounding the “typical” or “industry average” licensing negotiation that led to the “typical” or “industry average” royalty rate are unlikely to correspond to the specific economic circumstances of the patented technology and parties at issue in the litigation. Before an existing license can be used as a benchmark, one must carefully analyze whether it is truly comparable in terms of factors such as the technology covered, the product sold by the licensee, the degree of competition between the licensor and licensee, cross licensing arrangements, and other considerations. The CAFC has pointed out this issue in recent opinions. In *Lucent*, the CAFC determined that some of the licenses that the plaintiff claimed were comparable were in fact “radically different from the hypothetical agreement under consideration for the Day patent.” As to the remainder of the licenses, the CAFC wrote that they could not “understand how the jury could have adequately evaluated the probative value of those agreements,” characterizing the evidence presented as “superficial” and “doubtful that the technology of those license agreements is in any way similar to the technology being litigated here.” *Lucent*, 580 F.3d 1301, 1328–29.

A jury had found that Hewlett-Packard infringed a patent that describes a method to read a component of a processor's instruction reorder buffer ("IRB"). The patented technology was claimed to enhance the throughput of a processor. Cornell's damages expert initially testified that the jury should compute damages using a royalty base encompassing Hewlett-Packard's earnings from its sales revenue from its entire servers and workstations.<sup>8</sup> Yet, the patented technology was "a small part of the IRB, which is a part of a processor, which is part of a CPU module, which is part of a 'brick,' which is itself only part of the larger server."<sup>9</sup> In other words, the patented technology related to only a very small component of the overall product that was being used to form the royalty base.

Judge Rader ruled in a pre-trial motion that servers were not an appropriate royalty base for calculating the reasonable royalty.<sup>10</sup> What followed was essentially application of an apportionment approach.<sup>11</sup> Cornell's expert testified that the royalty base should be reduced from servers to "CPU bricks," which yielded damages of \$184 million.<sup>12</sup> The jury awarded this amount. However, Judge Rader was troubled by the size of the damages award.<sup>13</sup> In ruling on a Hewlett-Packard post-trial motion, Judge Rader further reduced the royalty base from CPU bricks to processors, and applied the "jury's uncontroverted royalty rate of 0.8 percent"<sup>14</sup> to this reduced royalty base.<sup>15</sup> This

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<sup>8</sup> *Cornell Univ. v. Hewlett-Packard Co.*, 609 F.Supp.2d 279, 284 (N.D.N.Y. 2009).

<sup>9</sup> *Id.* at 283. The "CPU brick" is Hewlett-Packard's term for the combination of the processor, a temperature controlling thermal solution, external cache memory, and a power converter.

<sup>10</sup> *Cornell Univ. v. Hewlett-Packard Co.*, No. 01-CV-1974, 2008 WL 2222189, at \*4 (N.D.N.Y. May 27, 2008).

<sup>11</sup> This type of apportionment attempts to limit the use of the entire market value rule (where the entire value of the product is used as the royalty base) to instances where the patented feature is the basis for demand and to some smaller base otherwise. *See Love, supra* note 6, at 272 ("To prevent overcompensation and its attendant harms, the entire market value rule must be scaled back to its original role as a special case of the apportionment requirement, such that it may not be applied unless—as its name suggests—the patent at issue indeed accounts for the entire value of the infringing article.") *See also*, Eric E. Bensen & Danielle M. White, *Using Apportionment to Rein in the Georgia-Pacific Factors*, 9 Colum. Sci. & Tech. L. Rev. 1, 18–19 (2008) ("Where the patent was for an improvement or component, patentees could satisfy their apportionment burden by showing that the entire market value of the infringing product was attributable to the patented invention . . .").

<sup>12</sup> *Cornell*, 609 F.Supp.2d 279, 284.

<sup>13</sup> In particular, the court stated that "[t]he important point is not the way that Cornell derived this royalty base, but that it exceeded again this court's direction and proceeded to attempt to show economic entitlement to damages based on technology beyond the scope of the claimed invention." *Cornell*, 609 F.Supp.2d 279, 284–85.

<sup>14</sup> *Id.* at 292.

reduced damages to \$53 million. In short, Judge Rader identified the portion of the revenue of the overall product (the server) that was closely related to the patented technology, namely the processor, and then used that revenue as the royalty base.

Reducing the royalty base to which a royalty rate is applied is certainly an effective way to reduce a damages award that is overstated. However, it is also a crude approach. Typically, there are only a finite number of possible royalty bases that could be used, with discrete jumps in size between them. For example, in *Cornell*, the processor royalty base was less than one-third the size of the CPU brick royalty base. It is unlikely that the dollar royalty amount that results from multiplying a specified royalty rate by each of the small number of possible royalty bases is exactly equal to the value of the patented technology.

More fundamentally, the apportionment approach of reducing the royalty base treats the symptom (an overly large damages award), without addressing the underlying cause. The underlying cause of problem damages awards is the approach sometimes taken by damages experts of choosing the royalty rate and royalty base independently of each other, and without reference to the economic value of the patented technology. Rather than directing that apportionment be used to eliminate problem damages awards, it would be preferable for patent reform legislation or the CAFC to require damages experts to take an approach that is consistent with sound economic principles.<sup>16</sup> Then, apportionment becomes unnecessary.

Under a sound economic approach, the reasonable royalty award (in dollars) should reflect the incremental value (in dollars) of the patented technology to the defendant as compared to the next best alternative. It should not matter what royalty rate or royalty base are used, as long as the product of the two yields a result (in dollars) that is in line with the patented technology's incremental value. Put another way, the royalty rate and royalty base must be chosen together in order for the reasonable royalty (the multiplication of the two) to make economic sense. It is when the rate and base are chosen independently of each other that problem awards (i.e., awards out of line with the economic value of the patented technology) arise.

In the context of the *Cornell* case, suppose that the patented technology resulted in an increase in a server's processing speed relative to what was achievable with the next best technology. Enhanced speed may result in greater sales of, and higher prices for, servers, which in turn leads to incremental profits due to the patented technology.<sup>17</sup> These incremental profits represent the largest *dollar amount* that a rational licensee

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<sup>15</sup> Determining the royalty base for processors was not straightforward because processors were generally not sold separately from CPU bricks. *Cornell* disputed the method by which Hewlett-Packard's expert had calculated the processor royalty base.

<sup>16</sup> Indeed, without performing a proper economic analysis, it is difficult to know if a damages award is "too large" or the degree to which it is too large. As a result, an adjustment after-the-fact is likely to be ad hoc and out of line with the true economic value of the patent.

<sup>17</sup> This analysis would have to take into account any incremental costs associated with using the patented technology as well.

would pay for the right to use the patented technology.<sup>18</sup> The choice of the royalty base should be largely irrelevant as long as the royalty rate is set, *conditional on the choice of royalty base*, so as to reflect the economic value (in dollars) of the patented technology.<sup>19</sup>

The CAFC appears to be headed in the direction that we advocate. In its opinion in *Lucent*, the CAFC stated that “[t]here is nothing inherently wrong with using the market value of the entire product [as the royalty base], especially when there is no established market value for the infringing component or feature, so long as the multiplier [i.e., the royalty rate] accounts for the proportion of the base represented by the infringing component or feature.”<sup>20</sup>

### III. IN THE PRESENCE OF COMPLEMENTARITIES, NO UNIQUE APPORTIONMENT OF VALUE EXISTS

Taken in the most favorable light, advocates of apportionment argue that when calculating reasonable royalties, a royalty rate should be applied to the incremental value added by the patented technology at issue rather than to the overall value of the product.<sup>21</sup> However, the specific methodology that has been put forward to perform apportionment fails to recognize that patented technologies typically create value that is “greater than the sum of the parts,” i.e., synergies, and incorrectly attributes all of the synergies to the infringer.

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<sup>18</sup> The procedure we would typically propose is to first define the royalty base as the sales of the smallest product that (1) incorporates the patented feature and (2) can be separately priced (either through actual arm’s length transactions or a reliable approximation). Then, given that base, the royalty rate is chosen to reflect properly the economic value of the patented technology. This choice of royalty base is consistent with real world licensing practices. Licensors prefer to have a royalty base that is easily verifiable and not subject to manipulation. Licensees prefer to limit the royalty base to the smallest possible product to limit the distortionary effects of the royalty “tax” on their incentives.

<sup>19</sup> A potential practical limitation to our proposed approach is that juries may be hesitant to award a very small royalty rate, assuming a large royalty base has been chosen, even if that small royalty rate properly reflects the economic value of the patented technology. For example, a jury might be hesitant to award a royalty rate of 0.0001 percent. For this reason, as a litigation strategy, the defendant may prefer to make the case for a lower royalty base (with a correspondingly higher royalty rate). This practical problem would seem to resuscitate the need for apportionment, at least as a means of reducing the royalty base. However, it should be recognized that a symmetric problem exists for plaintiffs. If a very small royalty base was to be the rule, plaintiffs might have difficulty convincing juries to award a large royalty rate, even if that rate were economically sound given the choice of royalty base. For example, a 50 percent royalty rate may be economically appropriate given a narrow royalty base, yet the defendant might be able to persuade a jury that such a rate was out of line with “industry practice.”

<sup>20</sup> *Lucent Technologies, Inc., et al. v. Gateway, Inc., et al.*, 580 F.3d 1301, 1339 (Fed. Cir. 2009).

<sup>21</sup> See, e.g., Love, *supra* note 6.

The synergies, or additional value obtained by combining assets, are the result of complementarities among the assets. To make the concepts concrete, suppose two companies, A and B, each have an asset. Company A can use its asset to make product A and receive value  $V_A$ .<sup>22</sup> Company B can use its asset to make product B and receive value  $V_B$ . Alternatively, the two companies can join forces and make product AB, which will generate total value  $V_{AB}$ . Product AB may be an improved version of product A or B, or it may be an entirely different type of product altogether. If  $V_{AB} > V_A + V_B$ , it is said that there are (strict) “gains to trade,” i.e., the two companies would be better off joining forces than pursuing their respective alternatives. The difference  $S = V_{AB} - V_A - V_B$  represents the amount of the gains to trade, or the synergies generated by combining their assets. Neither company can access  $S$  without the other.<sup>23</sup>

The value of product AB can be rewritten as  $V_{AB} = V_A + V_B + S$ . It should be clear that there is no unique way of dividing the value of product AB between the two assets that are used to create it. This is because the value of the synergies  $S$  is “joint and common” to the two assets. Both asset owners can lay claim to  $S$ . Any mechanical rule to apportion the synergies between the assets needed to create the synergies is analogous to an accounting rule to allocate “joint and common” costs among the products that those costs support. Economists have long recognized that any such cost allocation is completely arbitrary.<sup>24</sup> Similarly, any rule to apportion the synergies between the assets is necessarily arbitrary.

To see the difficulties, suppose Company B argued that its asset should be valued by comparing the value of product AB to the value of the product that could be produced without Company B’s asset (i.e., product A). Under that argument, the value of the asset of Company B would appear to be  $V_{AB} - V_A = V_B + S$ . However, Company A could make a similar argument and claim that the value of its asset was  $V_{AB} - V_B = V_A + S$ . Yet, both companies cannot be awarded these values, or the sum would exceed the value of product AB.

In proposing a framework for apportionment, Love states that “when the patent at issue covers only a component of or improvement to the infringing item, the value of the sales or uses of that [infringing] item must be apportioned between the patented invention and the remaining unpatented components.”<sup>25</sup> According to this construct, Company B could claim that the value of the “unpatented components” (i.e., Company B’s asset) is  $V_{AB} - V_A$  and the apportioned value of Company A’s patent therefore should be limited to

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<sup>22</sup> “Value” here would be the net present discounted value of the expected profits from selling the product.

<sup>23</sup> To reiterate,  $V_A$  represents the best Company A could do by itself without access to Company B’s asset, and similarly for  $V_B$ .

<sup>24</sup> William J. Baumol, *On the Proper Cost Tests for Natural Monopoly in a Multiproduct Industry*, 67 Am. Econ. Rev. 809 (1977).

<sup>25</sup> Love, *supra* note 6, at 268.

$V_A$ . From above, however, this incorrectly attributes all of the synergies,  $S$ , to Company B's asset. The approach proposed by Love would only make economic sense in the unlikely situation in which the combination of Product A with Product B created no synergies (i.e.,  $S = 0$  such that  $V_{AB} = V_A + V_B$ ).<sup>26</sup>

As discussed above, however, combining patented technologies typically creates value that is greater than the sum of the parts. For example, patent pools often bring together various technologies that are necessary to create the product in question. The stand-alone value of any one patent in the pool may be low or close to zero unless combined with the other patents in the pool. To take another example, consider a patent related to a microprocessor incorporated into mobile phones. A chip that provided some improvement (in speed, efficiency, etc.) may enable other functionality on the phone, such as an improved touchscreen interface, software applications with greater capability, greater video functionality, or improvement of other features of the phone. While apportionment would recommend that the royalty base be limited to the chip "portion" of the phone, this delineation may miss synergies between the patent at issue and the other features of the mobile phone. It would be incorrect to attribute all such synergies to the infringing company (or, for that matter, the patented feature). Instead, we can ask the more direct question of the additional profits that the manufacturer could be expected to make by incorporating the patented feature into its product. If the patented feature provides only a small improvement over existing technology (or, equivalently, a good non-infringing alternative to the patent exists), then the royalty should be limited. The manufacturer would not be willing to pay much for access to that technology. Using this same methodology, a major innovation would result in a higher royalty. In this way, an economic approach will produce damages awards that are consistent with the purpose of patent laws such that the incentive to innovate is commensurate with the value to society of the innovation.

#### IV. A MARKET-BASED APPROACH FOR DETERMINING HOW TO DIVIDE VALUE BETWEEN TWO ASSET OWNERS

Because any mechanical apportionment "rule" is inherently arbitrary (and thus would simply lead to irresolvable disputes in litigation), a better approach to determining how value should be divided between asset owners is to analyze how the asset owners would negotiate a split of the synergies. This approach is market-based and therefore is not arbitrary.

Economic principles suggest that the negotiated payouts to the two companies must satisfy several conditions. First, the payout to company A,  $\pi_A$ , must satisfy  $\pi_A \geq V_A$  or company A would prefer to pursue its alternative (product A). The value

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<sup>26</sup> Love's model assumes that the various technologies of a product are additive, such that each additional patent adds value independent of other technologies—but with no synergies between technologies. This leads him to conclude that the value of the entire product can only be attributed to the patented technology when the value of all the other components is zero. Love, *supra* note 6, at 276. When synergies exist among the technologies, this is not true.



from product A is the opportunity cost that Company A faces (i.e., the foregone profit) in pursuing product AB. Company A must earn a payout from Product AB that exceeds its opportunity cost. Similarly, the payout to company B must satisfy  $\pi_B \geq V_B$ . The sum of the payoffs must of course satisfy  $\pi_A + \pi_B = V_{AB}$ . Under these conditions, each company's payout can be thought of as the value of its alternative (the opportunity cost) plus a fraction of the gains to trade:

$$\begin{aligned}\pi_A &= V_A + \lambda S \\ \pi_B &= V_B + (1 - \lambda)S\end{aligned}$$

where  $\lambda$  is the negotiated split of the gains to trade.

Economic models of bargaining suggest that the split of the gains to trade will be influenced by the companies' relative levels of patience (as reflected by the rate at which they discount future expected cash flows).<sup>27</sup> The more patient company is willing to let the negotiations play out longer and therefore receives a larger split of the gains to trade than the less patient company. When the two companies are sufficiently patient and are roughly equally patient, the gains to trade will be approximately equally divided.<sup>28</sup> In this case,  $\lambda = 0.5$ .<sup>29</sup>

Before applying this framework to patent licensing negotiations, we make an observation about patents as assets in this context. Unlike a physical asset, such as a manufacturing plant, the use of an intellectual property asset in one application does not necessarily preclude its simultaneous use in another application.<sup>30</sup> This can reduce the opportunity cost associated with using intellectual property in a given application. For example, suppose Company A's asset is a patented technology. By licensing Company B under its patent, Company A may not need to give up any opportunities to license the same technology to other companies that operate in different markets than Company B. We now consider several licensing examples.

*Example 1: Dividing Value Between Asset Owners When Both Companies Have Blocking Assets*

Suppose Company A holds a patent on a technology. Company A has no ability to produce any product itself, and there are no suitable licensees other than Company B.

<sup>27</sup> See Ariel Rubinstein, *Perfect Equilibrium in a Bargaining Model*, 50 *Econometrica*, Jan. 1982, at 97.

<sup>28</sup> As a technical matter, in the Rubinstein model of bargaining, the party that has the opportunity to make the first offer receives a slightly higher split of the gains to trade. This advantage goes to zero as the two parties become infinitely patient, or equivalently, as the time between offers goes to zero.

<sup>29</sup> Whether it is appropriate to apply the framework described here to a particular real world situation will depend on the specific facts of the case.

<sup>30</sup> Unless, of course, prevented by contractual obligations such as an exclusive license.

Company B has important complementary know-how to the patented technology, but cannot use this know-how to produce any product without a license to Company A's patent. If licensed, it could produce and sell product AB and generate profit  $V_{AB}$ , which accounts for all expected future economic costs associated with developing and offering product AB. Under these assumptions,  $V_A = 0$ ,  $V_B = 0$ , and  $S = V_{AB}$ . If the two companies are equally patient, they will equally split the profits from the patented product.<sup>31</sup> Essentially, each company holds a "blocking" asset that is required to produce product AB, and they have no alternative use for their assets (we call this a case of "completely blocking" assets). The resulting "Mexican standoff" yields an equal split of the profits.

In some situations it may seem counterintuitive that both companies have blocking assets. For example, suppose Company A uses its patented technology to make a product, product A, that is sold in a different market from the market in which product AB would be sold. Suppose further that product A is sold at \$500 per unit and generates profits of \$250 per unit. Company B, on the other hand, has no means by which to earn a profit on its know-how without getting a license from Company A. Product AB, which combines Company A's patented technology with Company B's know-how, would be sold at \$5,000 per unit and would generate profits of \$2,500 per unit. One might think that Company B has a blocking asset and thus Company B's know-how must be "valued" at \$2,250 (the \$2,500 profit per unit from Product AB less the \$250 profit per unit for the product that utilizes Company A's patented technology).<sup>32</sup> However, this is incorrect as a matter of economics. Company A's patent is just as blocking as Company B's know-how in making Product AB. This puts the two companies on equal footing, each able to block the other. As a result, they would negotiate an even split of the product AB profits (assuming both companies are sufficiently and equally patient).<sup>33</sup>

*Example 2: Dividing Value Between Asset Owners When Company A Has a "Partially Blocking" Asset*

Suppose Company A has a patented technology with no ability to produce a product itself, and there are no suitable licensees other than Company B. Company B has know-how, which allows it to produce a product B that generates profit  $V_B$ . Licensing Company A's patented technology would allow Company B to offer an "improved" version of its product, product AB, that adds the product feature enabled by Company

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<sup>31</sup> Again, assuming that both parties are also sufficiently patient.

<sup>32</sup> That is,  $V_{AB} - V_A$ .

<sup>33</sup> A related principle is that a company with more than one blocking asset does not get a larger piece of the pie than a company with only one blocking asset. However, in the case where the validity and infringement of patents are uncertain, so that blocking is uncertain, more than one potentially blocking patent (subject to validity and infringement) can strengthen a company's bargaining position because the probability that at least one of the patents turns out to be blocking increases with the number of patents.

A's patent. Product AB will generate profit  $V_{AB}$ . If product AB is offered, Company B would no longer offer product B. However, if product AB is not offered, Company B has the ability to continue selling non-infringing product B. In this situation, Company A has a "partially blocking" patent on a product feature. In this case,  $V_A = 0$  and  $S = V_{AB} - V_B$ . It is unclear how to implement apportionment in this case, since the value of Company A's patent can only be realized in combination with Company B's know-how. The economic approach recognizes that the two companies are negotiating only over the incremental profit  $S$  that adding Company A's patented feature would bring: if the feature is minor,  $S$  is a small fraction of  $V_{AB}$  and the royalty rate would be relatively small.<sup>34</sup>

## V. ADDRESSING "ROYALTY STACKING"

### A. Apportionment Is a Crude Solution to Royalty Stacking Problems

Many complex technology products incorporate multiple different features, each of which may be covered by a patent. For example, in *Lucent*, Microsoft Outlook was described as "an enormously complex software program comprising hundreds, if not thousands or even more, features."<sup>35</sup>

Royalty stacking refers to the potential problem that can arise from situations in which a single product may require a license from multiple patent holders. The total royalties paid by the manufacturer is the sum (or stack) of royalties paid to each individual patent holder. Some companies, particularly those manufacturers that produce complex products that incorporate multiple patents, have argued that the sum of the royalties paid to each individual patent holder may leave too little profit for the manufacturing company, reducing their own incentives to innovate. Some have even argued that royalties could exceed the total profit of a product.<sup>36</sup> In such a case, the

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<sup>34</sup> Note that in this bargaining situation, Company A does not have the ability to expropriate more than  $S$  because Company B can turn to its non-infringing alternative, valued at  $V_B$ , if the royalty were too high.

<sup>35</sup> *Lucent Technologies, Inc., et al. v. Gateway, Inc., et al.*, 580 F.3d 1301, 1332 (Fed. Cir. 2009).

<sup>36</sup> For example, in the Senate Judiciary Committee hearing on the 2009 Patent Reform Act, Steve Appleton, Chairman and CEO of Micron Technology, Inc., testified:

The difficulty is that the current patent litigation system too easily allows damages to be assessed based on the value of the whole product, rather than the contribution of the patent. If we assume thousands of patents relate to this device, the resulting damages under current law would result in an amount that would exceed the total amount of revenue derived from the product.

Patent Reform in the 111th Congress: Legislation and Recent Court Decisions Before the S. Comm. on the Judiciary, 111th Cong. 5 (2009) (statement of Steven Appleton, Chairman and

magnitude of the combined royalties would deter the introduction of the product, an economically inefficient outcome.<sup>37</sup>

The royalty stacking problem has been cited as one reason that apportionment should be applied to calculate damages in patent infringement litigation.<sup>38</sup> Specifically, it is argued that apportionment is necessary because, when a product is covered by hundreds of patents, simple arithmetic shows that each patent can receive only a small royalty or the profit of the product would be exhausted entirely. However, again apportionment treats the symptom, not the disease. While apportionment can be used to reduce the size of the base to which a royalty rate is applied, apportionment does not address the cause of the royalty stacking problem.

In contrast, the economic approach to calculating reasonable royalty damages has the potential to address royalty stacking issues directly because it explicitly can take into account multiple patent owners making claims on different synergies being generated by different combinations of technologies within the same product.

### *B. Bargaining Between a Manufacturer and More Than One Patent Owner Having a Fundamental Technology*

If a manufacturer is negotiating with multiple patent holders, the economic analysis of licensing negotiations is considerably more complex than the situation in which a single manufacturer is negotiating with a single patent holder. Apportionment is ill-equipped to deal with such complexities. While apportionment attempts to divide up the various sources of profits between the contributing assets under the assumption that the whole is equal to the sum of the parts, determining the economic value of a patented technology requires recognizing and accounting for the synergies between technologies.

We first consider a manufacturer negotiating with multiple patent owners where each of the patent owners holds a fundamental technology.<sup>39</sup> With multiple patent owners, the manufacturer may negotiate simultaneously with each patent holder or sequentially with each patent holder in turn. The equilibrium of a simultaneous

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CEO, Micron Technology, Inc.), available at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111\\_senate\\_hearings&docid=f:54059.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_senate_hearings&docid=f:54059.pdf).

See also, Mark A. Lemley & Carl Shapiro, Patent Hold-up and Royalty Stacking, 85 Tex. L. Rev. 1991, 2008–2020 (2007) (explaining that because of the threat of an injunction, negotiated royalty rates can exceed the true economic contribution of the patented technology, especially when the value of the patented technology is small relative to the product's total value).

<sup>37</sup> This outcome can result from the negative externalities that exist between owners of complementary patents, whereby each patent owner does not take into account the effects on the others of increasing its royalty. Patent pools are one remedy to this situation in that they internalize the externalities by putting royalty setting under the control of a single entity.

<sup>38</sup> Love, *supra* note 6, at 280–81.

<sup>39</sup> Whether it is appropriate to apply the framework described below to a particular real world situation will depend on the specific facts of the case.

bargaining situation in which one manufacturer and  $N$  patent owners are dividing up the profits of a product where they all hold a blocking position is, generally, an equal split of the profits among the parties.<sup>40</sup> For example, in the case of three players—one manufacturer and two patent holders—the equilibrium is that each player receives one-third of the profits.

At first glance, it may seem that the sequential bargaining game, where the manufacturer negotiates with one patent owner and then another in turn, should lead to a different outcome because the portion of the profits that any one patented technology receives would seem to depend on the order in which the manufacturer values them. To illustrate, suppose a manufacturer wants to produce product AB, which incorporates patented technology A and patented technology B. Suppose both patented technology A and patented technology B are blocking in the sense that product AB cannot exist without both technologies. Consider the situation in which the manufacturer first values patent A and then, second, values patent B. The value of patent A, conditional on not having patent B, is zero because by itself patent A does not allow for production of product AB. The value of having patent B, conditional on already having patent A, is the entire value of product AB. Now consider the situation in which the manufacturer reverses the order: first valuing patent B and then, second, valuing patent A. By reversing the roles, now patent B is valued at zero while patent A is valued at the entire value of Product AB. This apparent paradox is once again the result of synergies being created when the two patented technologies are combined.

An analysis of a sequential bargaining model again suggests how markets would resolve the apparent paradox. Suppose the manufacturer is negotiating with two patent holders, patent holder A and patent holder B, over licenses in order to produce Product AB. The outcome of a sequential move negotiation will generally be the same as the simultaneous negotiation—an equal split of profits among the three parties—as long as the players are equally and sufficiently patient.<sup>41</sup>

This outcome can be explained using the following intuition. Suppose that the manufacturer has previously agreed to a royalty payment of amount  $R$  to patent holder A and is now engaged in negotiations with patent holder B. The total available profits to split between the manufacturer and patent holder B is  $V_{AB} - R$ . Because this is a bilateral negotiation, the equilibrium of the negotiation game is that the two parties will agree on an even split of the available profits (assuming equal and sufficient patience). In other

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<sup>40</sup> While the outcome of the game depends on the bargaining procedure considered in the model, for a range of possible bargaining models, the unique solution is an equal split of profits. See, e.g., Suchan Chae & Jeong-Ae Yang, *The Unique Perfect Equilibrium of an N-Person Bargaining Game*, 28 *Econ. Letters* 221, 221–23 (1988); Suchan Chae & Jeong-Ae Yang, *An N-Person Pure Bargaining Game*, 62 *J. Econ. Theory* 86, 88–96 (1994); Vijay Krishna & Roberto Serrano, *Multilateral Bargaining*, 63 *Rev. Econ. Stud.* 61, 68–76 (1996); and Sang-Chul Suh & Quan Wen, *Multi-Agent Bilateral Bargaining and the Nash Bargaining Solution*, 42 *J. Mathematical Econ.* 61, 70–72 (2006).

<sup>41</sup> See, e.g., Chae & Yang *The Unique*, *supra* note 40, at 221–23; Chae & Yang *An N-Person*, *supra* note 40, at 88–96; Krishna & Serrano, *supra* note 40, at 68–76; Suh & Wen, *supra* note 40, at 70–72.

words, patent holder B will get a royalty of  $(V_{AB} - R)/2$  and the manufacturer will get profits of  $(V_{AB} - R)/2$ .

Now move back in time and consider the earlier negotiation between the manufacturer and patent owner A. The manufacturer will know what will happen in the later negotiation with patent owner B. Specifically, for whatever royalty  $R$  it pays patent owner A, the manufacturer knows that it will end up with  $(V_{AB} - R)/2$ . This means that the “pie” to be divided between the manufacturer and patent owner A is  $R + (V_{AB} - R)/2$ . Assuming equal and sufficient patience, the negotiated royalty  $R$  that splits this pie evenly is  $V_{AB}/3$ . Thus, the three parties each receive an even one-third split of the value of the product, the same as in the simultaneous bargain between the three parties.

*C. Bargaining Between a Manufacturer, One Patent Owner Having a Fundamental Technology, and One Patent Owner Having an Ancillary Technology*

We now compare the situation where a manufacturer is negotiating with two patent holders, one of which has a fundamental technology that is necessary to produce a product and the other of which is an ancillary feature that can be incorporated into the product.<sup>42</sup> The manufacturer has two choices. It can produce product A that only incorporates the fundamental technology, or it can produce product AB that incorporates both the fundamental and ancillary technology. Neither product A nor product AB would exist without the fundamental technology. Moreover, assume that neither product would exist without the participation of the manufacturer.

While it may be tempting to use an apportionment rule to argue that the value of the fundamental technology is  $V_A$ , the value of product A, while the value of the ancillary technology is  $V_{AB} - V_A$ , the difference between the value of product AB and the value of product A, this is incorrect as a matter of economics for two reasons. First, it fails to consider that the manufacturer is blocking for product A. In this example, neither the value of product A nor the value of product AB can be realized without the manufacturer. Second, it fails to consider that the incremental value generated by Product AB over Product A could not be obtained without first having the fundamental technology. Thus, both the manufacturer and the fundamental technology owner can lay claim both to the value of Product A and to the incremental value of Product AB over Product A. The ancillary technology owner, however, can lay claim only to the incremental value. Apportionment rules would fail to reflect the complexities of this situation, potentially understating the value of the fundamental patent as  $V_A$  and overstating the value of the ancillary technology as  $V_{AB} - V_A$ .

The economic approach, in contrast, is based on analyzing the likely outcome of a market-based negotiation among the parties. Assuming equal and sufficient patience, the manufacturer and fundamental technology owner would equally split among themselves

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<sup>42</sup> See generally, Richard J. Gilbert, *Antitrust for Patent Pools: A Century of Policy Evolution*, 3 Stan. Tech. L. Rev. 1 (2004), (discussing two-way blocking (both parties own patents with blocking positions) versus one-way blocking (a prior technology blocks the implementation of an improvement patent, but not vice-versa) in the context of patent pools).

the value of product A and would equally split the added benefit of the product AB over product A with the ancillary patent holder. In this situation, the manufacturer and the fundamental technology owner would each receive a value equal to  $\frac{1}{2}V_A + \frac{1}{3}(V_{AB} - V_A)$ , while the ancillary technology owner would receive its split of the incremental value of product AB over product A,  $\frac{1}{3}(V_{AB} - V_A)$ .

#### *D. Incomplete Information Regarding Patent Infringement*

We discussed above the intuition for how a sequential negotiation between a manufacturer and multiple fundamental patent owners could lead to the same outcome as a simultaneous negotiation among the parties. The sequential outcome, however, is predicated on the manufacturer being aware of the existence of the second fundamental patent owner B and accounting for the future royalties it would pay for patent B in its negotiation with patent owner A.<sup>43</sup>

We now consider the outcome if the manufacturer has less than complete information about the patents that might be asserted against its product. Consider the case in which the manufacturer negotiates with patent owner A, before it knows of the existence of patent owner B. As with the previous example, assume both patents are fundamental technologies. Companies that produce complex technologies may reasonably expect that there is some probability that they will face claims of infringement in the future from currently unknown patent owners. The possibility of additional royalty payments in the future is a factor that a manufacturer would take into account when negotiating with patent owner A, and would reduce the maximum royalty that the manufacturer would be willing to pay patent owner A.

Consider, however, the situation in which the manufacturer is completely “surprised” by patent owner B’s assertion of a patent infringing claim. This scenario corresponds to a situation in which apportionment might suggest that the royalty base be limited because the product incorporates many complex technologies and, therefore, royalty stacking issues must limit the royalty that the manufacturer should pay patent holder B. In other words, back when the manufacturer negotiated with patent owner A, it was under the assumption that patent A was the only patent that could be asserted against the manufacturer’s product. In that negotiation, assuming both parties were equally and sufficiently patient, the manufacturer and patent holder A would have split  $V_{AB}$  equally. When patent owner B unexpectedly sues for infringement, the manufacturer has only

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<sup>43</sup> Even if the hypothetical negotiation took place before the negotiation with other patent owners, any patents on which royalties are not currently being paid could, in theory, be taken into account based on the sequential bargaining analysis of the previous section.

$\frac{V_{AB}}{2}$  to split with patent owner B.<sup>44</sup> Thus, after the negotiation with patent owner B, the manufacturer and patent owner B each get  $\frac{V_{AB}}{4}$  while patent owner A gets  $\frac{V_{AB}}{2}$ .

The first thing to note is that the economic approach does, in fact, account for ongoing royalties already being paid on the product, in that the manufacturer pays less to patent owner B than if it was not already paying royalties to patent owner A.<sup>45</sup> Nevertheless, the manufacturer ends up paying too much in royalties relative to the complete information case. Because it is surprised, the manufacturer ends up with only one-quarter of profits, whereas if it had negotiated simultaneously or under complete information, it would have received one-third of the profits. But it should also be noted that the manufacturer does not overpay the second patent owner, since patent holder B receives also receives less than in the complete information case (again, one-quarter rather than one-third). Thus, the effect of royalty stacking in this example is not that the later patent owner is overpaid, but that the manufacturer paid more to the earlier patent owner than it would have in the absence of surprise.<sup>46</sup> Apportionment aimed at limiting plaintiffs' royalties (where the plaintiff is the later patent owner) does not address this issue.

Parties to license agreements have come up with ways to deal with the prospect of paying royalties to unexpected patent holders. For example, agreements may incorporate a royalty adjustment mechanism, whereby the royalty rate is reduced if the licensee later has to pay royalties to other licensors. In the above example, the license with patent holder A would include a provision that royalty payments to patent holder A would be reduced from 50 percent to 33 percent if another patent holder with a fundamental technology later asserts its patents against the manufacturer's product. This contingency clause restores the efficient outcome of a simultaneous negotiation since total profits would again be evenly split between the manufacturer and the blocking patent holders. Such a provision fully mitigates the risk to the manufacturer in this example.<sup>47</sup> Put

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<sup>44</sup> We assume that the manufacturer has no ability to go back and renegotiate with patent owner A.

<sup>45</sup> We assume that the manufacturer is paying ongoing running royalties to patent owner A. Royalty stacking issues can still arise in situations where the manufacturer negotiated lump sum payments with previous patent holders as opposed to running royalties.

<sup>46</sup> This raises questions about the incentives created by damages awards. If earlier patent holders receive a higher portion of the total profits, patent owners in general would have an incentive to make their patents known early, helping to mitigate royalty stacking issues.

<sup>47</sup> When licenses are for ancillary technologies, the analysis becomes more complex. Nevertheless, such contingency clauses can still be included to mitigate the risk of future unknown patent holders.



differently, patent holder A helps “pay” the royalties for the newly asserted patent by reducing the royalties for patent A.<sup>48</sup>

## VI. CONCLUSION

Proponents of apportionment have argued that excessive royalty damages awards can be curtailed by limiting the royalty base upon which royalty damages are awarded. Such apportionment rules, however, would be arbitrary and may under-compensate valuable innovations, particularly when significant synergies exist among technologies. An approach consistent with economic principles would largely eliminate damages in excess of the true economic value of a patent and align damages awards with incentives to innovate.

Even under a proper economic approach, however, other factors may still lead to what some might believe are “excessive” damages awards. Consider, for example, the issue of the time at which a patent is valued under the U.S. law. Under this legal framework, a hypothetical negotiation is assumed to take place between the patent holder and the alleged infringer at the date of first infringement. In certain cases, the infringer may have previously made large sunk cost investments that are specific to the patent at issue, making a switch to a non-infringing alternative relatively more costly. Whether or not the timing of the negotiation results in “excessive” royalty awards presents separate economic and legal questions. Rather than dealing with these factors by attempting to limit royalty awards through arbitrary rules such as apportionment, employing an economic analysis based on the specific facts of the case will provide the greatest flexibility in identifying the true economic value of a patent in infringement cases.

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<sup>48</sup> In this case, before patent holder B shows up, the manufacturer and patent holder A shared 50 percent of future profits. When B shows up, the cost of that license is paid equally by the manufacturer and patent holder A, since the amount of future profits falls from 50 percent to 33 percent for both.