

# Bargaining and the Construction of Economically Consistent Hypothetical License Negotiations

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Determining the appropriate royalty in a technology licensing negotiation requires technical inputs to an economic problem. The technical aspect arises because the "correct" royalty depends on the ways in which the technology trades off physical possibilities and constraints, the means by which it interacts with the remainder of the production process or product features, and the dimensions in which its performance is superior or inferior to alternative technologies. The fundamental problem is an economic one because, in a market setting, these technical parameters implicitly define unobserved prices (economists call them "shadow prices") corresponding to the costs and benefits of using the technology. Conducted by informed parties, an appropriate arm's length negotiation brings these component prices out of the shadows by placing an agreed-on, aggregate value on the technology, as well as creating a value-maximizing structure for the contract.

In most cases the "market" (*i.e.*, knowledgeable business people seeking to maximize profits) sets the value of a patented technology through arm's-length bargaining. But in some cases, parties cannot agree on the value of the technology, whether it is necessary for a particular purpose, or even what it is. These cases result in patent infringement litigation. We are thus interested in the special case that often arises in

such litigation: Setting a reasonable royalty for infringing sales after the fact, via a hypothetical negotiation between the parties. The purpose of this article is to explore the economics of bargaining and its relation to royalty determination for damages purposes. We argue that economic models of the bargaining process can help shed some light on the difficult problem of valuing a technology when a market-determined value does not already exist.

We acknowledge that the economics of bargaining is not as well developed as some other areas of microeconomics, and we are cautious not to draw too sharp conclusions from the economic literature as it currently stands. Nonetheless, we suggest that one can usefully apply certain lessons from economic theory in real situations, and in many cases a little structure from economics goes a long way to help solve the analytical problem. We make this argument by first reviewing some of the results from the economic literature on the subject, and then examining certain key patent decisions to guide our application of the theory. Next, we discuss some of the methods by which courts and practitioners address the negotiation of a hypothetical license, which are suggestive of a variety of approaches, not all of which are economically sound. We thus make two general points: (1) economics can help in setting out a consistent approach for use in practical problems, and (2) it can be used to illuminate some of the arguments used in prior cases.

## The Economic Treatment of Bargaining

### Bargaining Solutions

Economic models of bargaining situations typically strip away most of the idiosyncratic features that are present in any individual bargaining context, and focus only on the general factors that determine the parties' payoffs. In broad terms, these factors can be placed into two categories: those that affect the joint payoff from cooperation, and those that affect the individual payoffs if the parties fail to cooperate. The joint payoff is referred to as the "bargaining surplus," while the

latter are variously termed "threat points," "disagreement payoffs," or "outside options." Economically speaking, a bargain is nothing more than an agreed split of the bargaining surplus that is consistent with (and superior to) each party's individual disagreement payoff. Economists have recognized that in many cases bargaining problems may be hard or even impossible to solve, especially when each side has information that is not available to the other.<sup>1</sup> However, in the special case in which both sides to the transaction have "complete information,"<sup>2</sup> economists have derived some useful ways to attack the question.

To take a simple example of the type of problem we have in mind, imagine a licensing negotiation in which the licensor owns a patent and has no production facilities (nor any realistic prospects for obtaining them), and a potential licensee has the necessary capital with which to build production facilities. If the parties agree on a licensing contract the patent in question can produce a product that will generate \$10 million in profits. In the baseline case, suppose that the licensee has no alternative production plans, which we take to imply zero profits. Both sides are aware of the market value from cooperating, as well as the value to the licensee of not producing. Then, all other things equal, it is reasonable to expect the parties to split the \$10 million surplus 50/50, with the licensee paying the licensor a \$5 million royalty. The standard economic models predict this outcome as well.

Suppose instead that the potential licensee has access to an inferior (and non-infringing) "in-house" technology that will generate just \$4 million in profits. Again, both sides are aware of the value of the two options. What agreement will the parties reach? Intuitively, one expects that the availability of the alternative technology enhances the licensee's bargaining power, reduces his willingness to pay, and should result in a lower license payment.<sup>3</sup> Similarly, if the prospective licensee's alternative generated \$8 million in profits rather than \$4 million, one would expect his willingness to pay to fall further. The basic models used by economists to solve this type of bargaining "game" reproduce this intuition: An increase in the value of the disagreement outcome for one party leads to a higher payoff for that party.

The first and most commonly used model is called the Nash bargaining solution.<sup>4</sup> Under the Nash solution each party receives his disagreement payoff plus one-half of the "gains from trade," which is simply the bargaining surplus net of the disagreement payoff.<sup>5</sup> In our initial example, when the licensee possesses a low-value alternative technology, the payoffs to the licensor and licensee are easy to characterize under Nash bargaining: the licensor should receive a payoff (in the form of

a royalty payment) of  $0 + 1/2[10 - 4] = \$3$  million, while the licensee should receive a payoff (in the form of net profits) of  $4 + 1/2[10 - 4] = \$7$  million. The Nash solution embodies the intuitive property that a party's payoff from reaching an agreement should increase with the value of his outside alternative to the agreement. If the licensee's alternative technology instead produced \$8 million in profits, the payoffs would be a royalty payment of  $0 + 1/2[10 - 8] = \$1$  million to the licensor, with  $8 + 1/2[10 - 8] = \$9$  million remaining for the licensee.<sup>6</sup>

The second principal solution concept for bargaining situations is called the outside option model. Loosely speaking, while the Nash model interprets disagreement payoffs as "preserving the status quo," the outside option model treats the parties' disagreement payoffs as constraints on moving away from the status quo, in a sense that we make more precise below. For now, we note that the choice of bargaining solution has a real impact on the payoffs that the bargaining parties can be expected to receive. In our benchmark model of licensing, in which the in-house technology yields a profit of \$4 million, the outside option model predicts that the parties will simply split the total gross surplus 50/50, as the licensee's value from doing so exceeds the value of the outside option. Thus each party receives a payoff of \$5 million, which clearly is also the royalty paid by the licensee. In such a case it is sometimes said that the licensee's outside option is not binding, because, being less valuable than a simple split of the gross surplus, it does not constrain the outcome. On the other hand, when the in-house technology is more valuable (\$8 million), this constrains the payoffs that the parties will accept. Here, the outside option model predicts that the licensor and licensee will agree on a payoff that leaves the licensee as well off as if he had selected his outside option. This outcome implies a payoff to the licensee of \$8 million, and a \$2 million royalty payment to the licensor.

To summarize, we observe an important difference between the two models in the way changes in disagreement payoffs are built into the bargaining solutions. A "low" disagreement payoff (*i.e.*, less than the payoff from a 50/50 split) affects the Nash payoffs, but not the outside option payoffs. A "high" disagreement payoff constrains a party's payoff in the outside option framework and completely determines that payoff. In this latter case we observe that the royalty payment in our simple licensing example is higher when using the outside option concept than from the Nash solution; in fact, it is twice as high. The reason is that the Nash payoff is always equal to the disagreement payoff *plus* one-half of the gains from trade; under the outside option model, the licensor captures all of the remaining gains from trade. In our simple

example, the licensee is always better off, or no worse off, under the Nash model than under the outside option model.

Exhibit 1 summarizes the payoff to the licensee and the royalty paid to the licensor under the two models, in each of three cases: when the licensee has no alternative, when the alternative has relatively low value, and when the alternative has a high value.

Exhibit 1—Division of Surplus under Nash and Outside Option Models (Payoff to Licensee, Royalty to Licensor)

Gross surplus = 10		Bargaining Model	
Value of licensee's alternative technology	Nash	Outside option	
0	(5, 5)	(5, 5)	
4	(7, 3)	(5, 5)	
8	(9, 1)	(8, 2)	

### Choosing the Appropriate Solution

Having reviewed the consequences of using one bargaining solution or the other, we are left to ask: Which is most appropriate to use in practical situations? It turns out that the choice of model depends on the particulars of the situation to be analyzed. Recent research in game theory has shown that both bargaining solutions are special cases of a more general bargaining model in which parties alternate in making offers to each other, and then accept or reject these offers.<sup>7</sup> Interestingly, the Nash solution is the natural outcome of the bargaining model in which the parties can earn their disagreement payoffs before they reach an agreement, while bargaining continues in the hope of permanent agreement.<sup>8</sup> For example, during a labor dispute the owner of a sports league may threaten to use (and may use) replacement players as a temporary measure to enhance its bargaining power. In contrast, the outside option solution arises when taking up the alternative payoff ends bargaining altogether.<sup>9</sup> An example would be a one-time negotiation over the price for one batch of goods, when the buyer has alternative suppliers. The implication is that the proper solution depends on the application at hand.

These contrasting examples suggest some general observations that relate to licensing negotiations. First, in a simple situation in which a licensor and licensee are bargaining over a royalty payment for the use of a patent in a one-off production run, it may be more realistic to find the appropriate payment using the outside option solution. This is because by construction, taking up the alternative would render the patented technology irrelevant. Second in the (likely more common) situation when production and sale occur over an extended period of time, one can imag-

ine circumstances under which either model would be appropriate. The outside option model might suit cases in which taking up the alternative technology would lead to a long-term dispute over whether it is infringing or not, and thus to a cessation of meaningful licensing negotiations for a long period, or to a situation in which the licensor is choosing from among exclusive licensees. On the other hand, if the alternative can be used as a stopgap measure simply to tide the licensee over until an agreement is reached, or a better technological alternative can be developed, then the Nash solution may be more accurate. Third, although we might intuitively expect that the licensee's ability to terminate bargaining permanently by taking up an alternative technology would tend to increase its bargaining power, the opposite is true; in general, the licensee's royalty payment is higher under the outside option model than under the Nash model. Choosing the model that properly suits the situation thus has a meaningful impact.

These remarks concern actual licensing negotiations. Conversely, we ask how to characterize the hypothetical licensing negotiation contemplated in patent damages cases.

## The Hypothetical License

### Royalty Determination in Patent Damages Cases

In a successful patent infringement case, the defendant must pay "damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer."<sup>10</sup> When the patentee proves that infringement caused lost sales, forced a lower price, or increased costs, he may recover lost profits. If the patentee cannot meet the burden of proof to recover lost profits, then damages take the form of a reasonable royalty.<sup>11</sup>

In determining this hypothetical royalty, it is important to contrast the intermediate division of the gains from the use of the invention, which evidently was what Congress intended, with the more one-sided divisions that Congress has imposed in other intellectual property contexts, and that generally have been rejected by the courts in the patent context. For example, the copyright statute awards actual damages plus "any profits of the infringer that are attributable to the infringement and are not taken into account in computing the actual damages."<sup>12</sup> This procedure awards the surplus to the copyright holder. On the other hand, the courts have also held that:

The setting of a reasonable royalty after infringement cannot be treated . . . as the equivalent of ordinary royalty negotiations among truly "willing" patent owners and licensees. That view would constitute a pre-

tense that the infringement never happened. It would also make an election to infringe a handy means for competitors to impose a "compulsory license" policy upon every patent owner.<sup>13</sup>

Permitting the infringer to impose a "compulsory license" and to pay only what he might have had to pay in the course of "ordinary royalty negotiations" awards 100 percent of the gains over and above the compulsory license fee to the infringer. The patent statute thus contemplates an intermediate sharing of the surplus created by the infringer.

The key question is: In the absence of an established royalty, how are damages to be calculated? The landmark case in reasonable royalty determination contemplates a hypothetical negotiation between patentee and infringer as a method of arriving at a figure:

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.<sup>14</sup>

This framing of the problem suggests that, to the extent possible, the court should approach the hypothetical negotiation as an attempt to replicate a market situation where none existed. The opinion by the *Georgia-Pacific* court reinforces this view:

Where a willing licensor and a willing licensee are negotiating for a royalty, the hypothetical negotiations would not occur in a vacuum of pure logic. They would involve a *market place confrontation of the parties*, the outcome of which would depend upon such factors as their relative bargaining strength; the anticipated amount of profits that the prospective licensor reasonably thinks he would lose as a result of licensing the patent as compared to the anticipated royalty income; the anticipated amount of *net profits that the prospective licensee reasonably thinks he will make*; the commercial past performance of the invention in terms of public acceptance and profits; the market to be tapped; and *any other economic factor that normally prudent businessmen would, under similar circumstances, take into consideration*

in negotiating the hypothetical license.<sup>15</sup>

Certainly, this passage indicates that economic determinants of the overall bargaining surplus (such as "the anticipated amount of net profits" and "the market to be tapped") are germane. The reference to "bargaining strength" hints at the relevance of other economic alternatives, which we have previously discussed. The *Georgia-Pacific* court pointed to "the anticipated amount of profits that the prospective licensor reasonably thinks he would lose as a result of licensing the patent," which characterizes the patentee's disagreement point in analyzing the hypothetical bargain. We would argue that the court also sought to take the infringer's alternatives into account by allowing for such factors as "the net profits that the prospective licensee reasonably thinks he will make," and "the utility and advantages of the patent property over the old modes or devices."<sup>16</sup>

Building on our economic discussion, we thus find three aspects of the *Georgia-Pacific* hypothetical negotiation of interest. First, the parties *must* reach agreement on the eve of infringement, though they did not in fact. Thus, opting out of the hypothetical negotiation is not possible. Second, the patentee's alternatives, and particularly his anticipated lost profits, are to be explicitly considered in arriving at a reasonable royalty. (We return to the appropriate means of dividing compensation between lost profits and a reasonable royalty subsequently.) Third, the infringer's alternatives, and thus his disagreement payoff, are definitely relevant from an economic perspective under any plausible negotiating scenario, and are also considered among the *Georgia-Pacific* factors.<sup>17</sup> The next sections discuss these three aspects in turn.

## Mandatory Agreement and the Appropriate Bargaining Solution

With respect to mandatory agreement, we note that there is an interesting tension in the legal standard. This standard approximates the market value of the technology on the eve of infringement. The licensor and licensee are assumed to be willing to enter a "prudent" (*i.e.*, market-consistent) agreement, and moreover are not under any special compulsion to come to terms.<sup>18</sup> But by finding infringement of a valid patent, the court has imputed to the infringer an irrevocable commitment to the patented technology, and to the patentee an irrevocable commitment to license. Constraining the parties to reach agreement means neither can threaten to take up a permanent alternative. In sum, though it is appropriate to account for the parties' alternatives (because these reflect real factors that help determine the payment the parties would have arrived at), the treatment of alternatives must be consistent with the constraint to reach an agreement. The Nash bargaining solution is thus the more appropriate of our two solutions; it

allows for alternatives to affect payoffs but does not allow for a permanent breakdown in negotiations.

Applying the Nash solution is also consistent with the assumed information structure at the time of the hypothetical negotiation. Economic theory recognizes that bargaining outcomes can be indeterminate when the parties possess private information in certain dimensions.<sup>19</sup> In the context of the hypothetical negotiation we can conveniently sidestep this problem, because for practical purposes there can be no private information at the damages stage of litigation. The validity and infringement of the patent are no longer in question, and the parties involved are assumed to have access to additional information that they might not actually have known on the eve of infringement.<sup>20, 21</sup> Thus we can apply methods appropriate to the case of complete information (such as the Nash solution).

The economic significance of using the Nash solution in the hypothetical license situation is that even relatively small outside alternatives have an impact on the division of surplus. Recall from our discussion of bargaining economics that under the outside option solution, the only time a bargaining party's alternative payoff affects the split of surplus is when it acts as a constraint, *i.e.*, when it exceeds the simple 50/50 payoff. If the value of the party's outside option is less, it has no impact on the payoff. In contrast, the Nash solution accounts for even low-value outside alternatives in dividing the bargaining surplus. This can make a great deal of difference in practice. To see this, recall that when the infringer has an alternative technology available that yields profits of \$4 million, the outside option solution implies a royalty of \$5 million (*i.e.*, half of the total surplus of \$10 million), while Nash bargaining yields a royalty of \$3 million. Thus, in this simple example the royalty predicted by the Nash solution is fully 40 percent lower than the royalty from the simple split called for by the outside option solution. The reason is that, even though the outside alternative is not valuable relative to the patented technology, it still has some value, which should be accounted for in determining the appropriate royalty.

## The Patentee's Alternatives

We next incorporate the patentee's foregone profits in the disagreement payoff. These profits are clearly not an issue in the situation when the patentee does not compete with the infringer in the product market; in this case the patentee's disagreement payoff would simply be zero (as in the examples above).<sup>22</sup> When the patentee does produce, it may be appropriate to consider the profits he would have received in the absence of licensing, if the patentee can prove that he lost profits.<sup>23</sup> In *Panduit*, the Sixth Circuit held that foregone profits may be taken into account in setting a royalty rate, even when the patentee has failed to meet this burden of proof. Thus, if a producing patentee's profits

would be affected in *some* way by a licensed infringer, even if the amount is not precisely quantifiable, this effect should be taken into account in setting a royalty. We are willing to believe that there may be occasions where it is appropriate to consider a patentee's possible lost profits in determining a reasonable royalty, even when lost profits have not been proved to the required legal standard.<sup>24</sup> However, for the practical purpose of finding the disagreement point in the bargaining negotiation, a patentee that has failed to prove lost profits cannot hope to prove what he would have earned in the absence of licensing, as these are the same thing. Thus the lost profits standard does not appear to be helpful in resolving the strictly economic problem of royalty determination.

In light of this, we argue that there are at least two common cases where the patentee's "but for" profits should *not* be used to determine its bargaining power. The first concerns the situation in which lost profits are determined based on market shares. In *Mor-Flo* the Federal Circuit approved a division of infringing sales, based on a market share approach, between those that the patentee could prove it would have made (for which it recovered lost profits), and those that would have been made by other non-infringing competitors (which earned a reasonable royalty).<sup>25</sup> In itself, this approach is economically justifiable, assuming that the royalty is determined properly. Specifically, patentee profits should not be taken into account in setting this royalty, because by definition there is insufficient reason to believe that the patentee could have made these sales. It is also worth remarking that a correctly determined royalty on these sales does not overcompensate the patentee, as some have argued.<sup>26</sup> The patent statute calls for damages based on "the use made of the invention by the infringer," and thus some royalty should be assessed for sales that would have been made by other market participants in the absence of infringement.<sup>27</sup>

Patentee profits should also not be taken into account if certain sales have been explicitly excluded from the lost profits category for other reasons. For example, in *Rite-Hite* the patentee was unable to recover lost profits on 502 infringing sales because it could not prove that its sales staff was likely to have made every infringing sale.<sup>28</sup> Either the patentee's sales staff did not first contact the infringing purchaser in each of these cases, or the customer expressed some interest in products made by other manufacturers.<sup>29</sup> Further, the district court "corroborated" the division of sales between lost profits and reasonable royalties using a *Mor-Flo* type market share approach.<sup>30</sup> Both the district court and the Federal Circuit approved a "reasonable" royalty of 50 percent of patentee per-unit profits on the basis that the patentee would not have wanted to grant a license to a competitor when it earned significant profits itself.<sup>31</sup> Given that these reasonable royalty sales were explicitly carved out of the total number of infringing sales because of difficulties in proving lost profits, it seems to us that it is inappro-

appropriate to use the patentee's prospective profits as the disagreement point of this negotiation.<sup>32</sup>

## The Infringer's Alternatives

Just as it may be appropriate to consider the patentee's alternatives in the form of the profit it could have earned without licensing, it is relevant to account for the alternatives of the infringer. It is surprising that courts have only recently begun to recognize this logical symmetry in a systematic way. The dissent by Judge Nies in *Rite-Hite* sets out the argument that the district court erred by not considering other commercial alternatives available to the infringer, and instead "limited its assessment to Rite-Hite's side of the hypothetical negotiating table rather than to balance the interests of both parties."<sup>33</sup> That the infringer's alternatives matter is underscored under Nash bargaining by the bargaining power, which even a relatively unattractive alternative creates in a license negotiation.

More recently, the Federal Circuit's *Grain Processing* decision entrenched the consideration of the infringer's alternatives more firmly.<sup>34</sup> In this case the court upheld the district court's denial of lost profits on the basis of a non-infringing substitute that, while not actually on the market at the time infringement began, was for all practical purposes "available." The court noted that "a fair and accurate reconstruction of the 'but for' market also must take into account, when relevant, alternative actions the infringer foreseeably would have undertaken had he not infringed."<sup>35</sup> These alternative actions must necessarily figure into the hypothetical royalty negotiation. In this case, the availability of a slightly more costly production process acted as a cap on the amount the infringer was willing to pay for a hypothetical license.<sup>36</sup> This recognition supports the economically consistent view that the infringer's alternatives should be taken into account in finding the disagreement point for the purposes of bargaining over the license.

## Applications

### Cases

The economic framework we have outlined is helpful in interpreting a number of high-profile cases. First, the outcome of *Grain Processing* can be understood as the outcome of a bargaining process. Having rejected the patentee's lost profits argument in light of the available alternative technology, the Federal Circuit approved a royalty of 3 percent of infringing sales.<sup>37</sup> This was based on the district court's "best estimate" of the outcome of the hypothetical negotiation, in light of the fact that the alternative would have cost only 2.3 percent more to implement, and was subject to fluctuations.<sup>38</sup>

This result is very similar to what would be predicted under the outside option solution. In that solu-

tion the infringer's disagreement point acts as a constraint, so that if, for example, the infringer could earn \$100 per unit with the patent and \$97 without, the appropriate royalty is \$3 per unit. As we have remarked, we consider Nash bargaining to be more appropriate than the outside option solution in this context. Nash bargaining would tend to predict a lower royalty because the gains from trade would be shared between the patentee and infringer, over and above the value of the alternative. This may appear to make little difference under the facts of *Grain Processing*, when the value of the alternative technology was very high; but if for instance the infringer could earn only \$40 per unit, the outside option solution would predict a significantly higher royalty than Nash bargaining (i.e., \$50 per unit as opposed to \$30). Note also that a misapplication of the *Grain Processing* logic would suggest a royalty of \$60 per unit (i.e., \$100 - \$40) under this alternative set of facts, which clearly is to be avoided as it is not consistent with either of our models of bargaining. Nonetheless, the court's decision on damages is at least on its face economically consistent, if not strictly in line with our preferred method.

In contrast, the CAFC's earlier decision in *Mahurkar v. Bard* appears to endorse an economically inconsistent method of royalty determination.<sup>39</sup> Here, the court upheld a royalty rate of 25.88 percent, calculated as the infringer's net margin of 29.16 percent, plus savings of research and development expenditures that would otherwise have been made in the amount of 6.72 percent, less 10 percent to which the infringer was deemed "entitled" (as a "reasonable profit").<sup>40</sup> If we assume that the 10 percent margin represents the amount that Bard (the infringer) would have demanded as a reasonable profit, the implication is that Bard would have been willing to pay the entire amount over its disagreement point (i.e.,  $29.16\% + 6.72\% - 10\% = 25.88\%$ ) to license the patent. As we have just mentioned, this reasoning is not consistent with either the outside option or the Nash approach to a reasonable patent royalty. In any realistic negotiation, the infringer's threat must be worth something, and thus it should be able to capture at least part of the gains from trade in the form of a lower rate. The Nash solution predicts that if indeed the available gross surplus is 35.88 percent as claimed, an appropriate royalty might be in the range of 13 percent.<sup>41</sup> Taking into account the substantial difference between the rate found and the rate that is most consistent with economic logic, we suggest that the method used in this case is in error.

*Rite-Hite* illustrates another pitfall of the hypothetical negotiation framework. Recall that the *Rite-Hite* court approved a rate of approximately 50 percent of patentee profits, because the patentee would not have been willing to grant a license to a competitor.<sup>42</sup> While this outcome does not seem compatible with any of the models we have reviewed, it is important to point out that court's findings of fact violate one of the key assumptions of bargaining models, namely that the

gains from trade are positive.<sup>43</sup> Gains from trade are positive if the infringer makes sales or earns profits that the patentee would not have made. Gains from trade are negative if, for example, an infringer's entry eroded the price of the patented product so that the combined profits of the patentee and the infringer were less than those of the patentee alone. If the gains from trade are negative, then the patentee rationally would be unwilling to license at any price that is consistent with entry by the infringer.

If the patentee is truly unwilling to license, there is by definition no agreement it could reach with a licensee that would leave both parties better off.<sup>44</sup> The bargaining models do not apply in this case. The district court's 50 percent figure is therefore not justified by any economic model of bargaining. In fact, under this reasoning, it is not clear why a licensor in this situation would settle for a royalty any less than 100 percent of its profits (assuming that both firms had the same cost of production). Once one departs from an economic model of bargaining, one is confronted with a range of mostly unpalatable alternatives. One can do as the district court did (and as the Federal Circuit approved): choose a rate that is completely arbitrary; one can award lost profits, despite the plaintiff's failure of proof; or one can award a royalty that does not reflect the patentee's profits. As we have argued, we believe the third approach is preferable in many cases like this.

The apparently arbitrary nature of the award in *Rite-Hite* brings up an additional, non-statutory motive for damages, which is the appropriate level of deterrence. The Federal Circuit has affirmed the Panduit argument that damages must be high enough to ensure that the infringer does not receive a "compulsory license" when the patentee would not otherwise wish to grant a license to a competitor.<sup>45</sup> Lost profits are the preferable remedy from the perspective of adequately compensating the patentee (and deterring the infringer). If lost profits are not available, alternative measures to increase the reasonable royalty have sometimes been proposed.<sup>46</sup> However, courts seem to recognize that such measures are by their nature "discretionary," and not firmly grounded in sound economics.<sup>47</sup> This is a thorny policy problem, so we are reluctant to make a strong case that any single approach can satisfy all of the goals of compensation, deterrence, and economic consistency.

### Ad Hoc Approaches

Considering many of the difficult problems that we have reviewed to this point, practitioners and courts have sometimes foregone a more in-depth eco-

nomics analysis and settled for various *ad hoc* approaches to royalty determination.

Under the "analytical approach," a "normal" rate of profit is subtracted from the infringer's operating profit, with the balance going to the patentee in the form of a royalty. Given our discussion of the method used in *Mahurkar v. Bard*, which is exactly the same, this is not a method supported by an economic model of bargaining. It may well be supported by "the merit of relative simplicity," but this should not make it attractive.<sup>48</sup> Moreover, it assumes that the entire excess profit is due to the patents in question in the litigation, which is very rarely the case.

Likewise, the so-called 25 Percent Rule, under which 25 percent of the infringer's operating profit is attributed to the infringed patents, is too simplistic to capture most realistic situations.<sup>49</sup> Certainly, it does not account for differences in disagreement points across different situations. In the Nash bargaining context, this rule implies that the infringer's disagreement point is invariably higher than the patentee's disagreement point by the exact amount of 50 percent of the gross surplus available. This assumption does not allow either for the possibility that the infringer might have few or no alternatives, or that the patentee might have significant alternatives. One can argue that this is merely a starting point and that a number of the *Georgia-Pacific* factors could be introduced to add realism.<sup>50</sup> However, it is not clear why a practitioner would not start with a more realistic assessment of the outcome of the hypothetical negotiation, thus necessitating fewer *ad hoc* adjustments.

### Conclusion

We have suggested in this paper that economic models of bargaining can be useful in understanding the hypothetical negotiation that is contemplated in patent damages cases. We do not suggest that this is the right approach to follow in each case, and we admit that there are numerous relevant factors that are not considered in our simple economic models. Nonetheless, there is merit to starting with an economically consistent split of the bargaining surplus, and then taking into account some of the additional contextual richness by applying several of the *Georgia-Pacific* factors as necessary. To us, this seems a more reasonable approach than starting with an admittedly arbitrary benchmark such as those espoused by some practitioners or courts, and then making a plethora of adjustments.

1. See Paul Milgrom and John Roberts, "Economics, Organization and Management," (Englewood Cliffs, NJ, Prentice Hall: 1992) at 140.  
2. The requirement of "complete information" does not imply that each side must know the future in order to find a solution. Complete information means that each side has access to all available information on which to

base a forecast, which given the assumed rationality of the parties implies that expected payoffs will be known by both. If the parties place different valuations on future risk, then these valuations may enter into the structure and payoffs of the contract. For example, other things equal, a more risk-averse party would be willing to accept a reduction in its expected

- payoff in exchange for reduced variability in the payoff. This reduction might in practice take the form of a fixed annual payment plus a relatively low running royalty, for example.
3. While we focus here on the implications of the licensee's threat point, it should be emphasized that analogous conclusions would follow from a consideration of the licensor's threat point.
  4. The original solution is due to John Nash, Jr., "The Bargaining Problem," *Econometrica*, Vol. 18, (1950). The Nash solution has subsequently been used in a wide range of economic applications, particularly in the field of law and economics, from determining the incentive effects of different allocations of ownership rights over physical assets (see generally Oliver Hart, "Firms, Contracts, and Financial Structure" (Clarendon Press, Oxford: 1995)), to modeling the efficiency properties of liquidated damages clauses in commercial contracts (see Kathryn E. Spier and Michael D. Whinston, "On the Efficiency of Privately Stipulated Damages for Breach of Contract: Entry Barriers, Reliance, and Renegotiation," *RAND Journal of Economics*, Vol. 26, No. 2 (1995)).
  5. We note that both here and in our discussion of the alternative bargaining model we abstract away from issues such as "impatience" that may generally affect the distribution of the gains from trade. The economic literature has shown that the extent to which parties discount future payoffs can affect the bargaining outcome (see generally references cited *infra* n.8). Because in our application of these models there is usually no reason to believe one party has a greater general degree of patience-related "bargaining power" than the other, the assumption that the parties are symmetric is likely to be appropriate. However because of the inevitable oversimplifications in these models, in real situations there is scope for applying other qualitative factors that may affect payoffs. See text accompanying ns.15 and 16.
  6. One can show more generally that under Nash bargaining a party's bargaining payoff increases at one-half the rate of his disagreement point.
  7. See Y. Stephen Chiu and B. Rachel Yang, "The Outside Option, Threat Point, and Nash Bargaining Solution," *Economics Letters*, Vol. 62, (1999).
  8. See Y. Stephen Chiu, "Noncooperative Bargaining, Hostages, and Optimal Asset Ownership," *American Economic Review*, Vol. 88, No. 4, (1998); Chiu and Yang, *supra* n.7 at 182.
  9. *Id.*
  10. 35 U.S.C. § 284.
  11. See *infra* n.23.
  12. 17 U.S.C. § 504(a), (b).
  13. *Panduit Corp. v. Stahl Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1158 (6th Cir. 1978).
  14. *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116, 1120.
  15. *Id.*, at 1121 (emphasis supplied).
  16. *Id.*, at 1120 (emphasis supplied).
  17. Under current jurisprudence, the court does not consider what price the infringer would have charged, and what profits he would have received, had the proposed royalty been implemented. In other words, the infringer's profits are treated as fixed. Under many competitive conditions, the impact of a running royalty on the infringer's marginal cost would have induced the infringer to raise its prices, partially offsetting the cost of the royalty. This procedure understates the infringer's capacity to absorb a reasonable royalty and yet "make a reasonable profit," and so penalizes the patentee for the infringer's failure to negotiate a royalty.
  18. *Susan M. Maxwell v. J. Baker, Inc.*, 86 F.3d 1098, 1108-1109 (Fed. Cir. 1996).
  19. See *supra* n.1.
  20. "The methodology encompasses fantasy and flexibility; fantasy because it requires a court to imagine what warring parties would have agreed to as willing negotiators; flexibility because it speaks of negotiations as of the time infringement began, yet permits and often requires a court to look to events and facts that occurred thereafter and that could not have been known to or predicted by the hypothesized negotiators." *Fromson v. Western Lithoplate and Supply Co. and Bemis Co., Inc.*, 853 F.2d 1568, 1575 (Fed. Cir. 1988).
  21. "A hypothetical negotiation should take into account the actual facts as they occurred in the matter both before and after the hypothetical negotiations would occur. *Sinclair Ref. Co. v. Jenkins Petroleum Process Co.*, 289 U.S. 689, 698-699 (1933) (referring to later experiences as a "book of wisdom" which can correct uncertainties present at the time of hypothetical negotiation)." *University of Colorado Found. v. American Cyanamid Co.*, 216 F. Supp. 2d 1188, 1197 (D. Col. 2002). We observe that this *ex post* construction of the hypothetical negotiation does not conform to a pure economic forecasting model, in which parties make *ex ante* forecasts of the value of the prospective bargain based only on information available at the time of the bargain. We also observe that courts have generally adopted a hybrid of the *ex ante* and *ex post* approaches in constructing hypothetical negotiations. For example, in assessing reasonable royalty damages, the court usually mandates that the parties bargain over the royalty rate based on the expected (not actual) profitability of the use of the invention to the infringer; this royalty rate is then multiplied by the infringer's actual (not expected) sales. These sales reflect the infringer's actual infringing acts, for which it must pay compensation. Similarly, the court generally does not take into account subsequent technological developments that might have enabled the licensee to invent around the patent. And, as we have noted, the court does not attempt to determine how the imposition of the royalty would have altered the licensee's price, output and profit.
  22. If the patentee could have licensed exclusively, and infringement destroyed that possibility, then his disagreement payoff would be greater than zero.
  23. The patentee must show each of four things: (1) demand for the patented product; (2) absence of acceptable non-infringing substitutes; (3) sufficient manufacturing and marketing capability; and (4) the amount of profit lost. *Panduit* at 1156, 1163.
  24. For instance, lost profits may have been rejected because of difficulties in quantification (*i.e.*, *Panduit* factor (4)).
  25. *State Industries, Inc. v. Mor-Flo Indus., Inc. and Am. Appliance Mfg. Corp.*, 883 F.2d 1573 (Fed. Cir. 1989).
  26. "While the CAFC in *State Industries* greatly improved its economic analysis by adopting a market share approach, it made a new and serious error by simultaneously awarding lost profits on the patent owner's lost sales and a reasonable royalty on the remaining sales. This could never have happened in the real world and is another example of the patentee being far better off in court." Vincent E. O'Brien, "Economics and Key Patent Damages Cases," *University of Baltimore Intellectual Property Law Journal*, Vol. 9, No. 1 (2000), at 21.
  27. In general, the patentee's compensation should take into account the effect of the infringing sales on the market price. If the but-for price would have been higher, the but-for quantity (including sales that command a reasonable royalty) would have been lower. This is an application of the "law of demand" which both courts and economic theory say must be taken into account. *Crystal Semiconductor Corporation v. Tritech Microelectronics Int'l et al.*, Nos. 99-1558, -1559, 00-1006, Fed. Cir. (2001). See also Gregory J. Werden, *et al.*, "Quantity Accretion: Mirror Image of Price Erosion from Patent Infringement," *Journal of the Patent and Trademark Office Society*, Vol. 81 (1999).
  28. *Rite-Hite Corp., et al. v. Kelley Company, Inc.*, 774 F. Supp. 1514, 1534 (E.D. Wis. 1991), 56 F.3d 1538, 1554 (Fed. Cir. 1995).
  29. *Rite-Hite*, 774 F. Supp. 1514, 1526.
  30. *Id.*, at 1527-1528.
  31. *Id.*, 774 F. Supp. 1514, 1535, 56 F.3d 1538, 1554.
  32. This conclusion is, however, sensitive to the facts. In addition to losing a sale, the patentee may also lose the option to try to make the sale. For example, a faster, more experienced or larger infringer might contact customers before the patentee was able to do so, though eventually the patentee might also have contacted these customers. In general, the loss of a "sales option," as opposed to an actual sale, is insufficient to prove lost profits. By choosing a high royalty rate for such sales, the court may have valued this option more highly than would be justified if the patentee truly had no prospect of making the sale.
  33. *Id.*, 56 F.3d 1538, 1576-1577.
  34. *Grain Processing Corp. v. American Maize Prods. Co.*, 185 F.3d 1341 (Fed. Cir. 1999).
  35. *Id.*, at 1350-1351.
  36. *Id.*, at 1347, 1353.
  37. *Id.* at 1353.
  38. *Id.*, at 1347.
  39. *Dr. Sakharam D. Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572 (Fed. Cir. 1996).
  40. *Id.*, at 1580.
  41. To see this, note that if the patentee's disagreement point is zero by assumption, then the gains from trade are  $29.16\% + 6.72\% - 10\% = 25.88\%$ , and the patentee's payoff (and thus the royalty) is  $0 + 1/2 \times 25.88\% =$  approximately 13%.
  42. See *supra*, text accompanying n.31.
  43. Strictly speaking, we would argue that it is correct to view the gains from trade as positive in this case, because it is not appropriate to consider the patentee's foregone profits for these sales. Thus the gains from trade are only negative here to the extent that one accepts the court's premise, which is that these foregone profits are relevant. More generally, gains from trade will be negative in many competitive situations when the licensee or infringer is destroying industry profit through competing with the patentee.
  44. *Rite-Hite*, 56 F.3d 1538, 1554.
  45. *King Instruments Corp. v. Luciano Peregó and Tapematic*, 65 F.3d 941, 951 (Fed. Cir. 1995).
  46. See, *e.g.*, *Mahurkar* at 1580.
  47. *King Instruments* at 951.
  48. Robert Goldscheider, "The Employment of Licensing Expertise in the Arena of Intellectual Property Litigation," *IDEA: The Journal of Law and Technology* (1996), at 182.
  49. See *id.*, at 183; Robert Goldscheider, John Jarosz and Carla Mulhern, "Use of the 25 Per Cent Rule in Valuing IP," *les Nouvelles* (2002).
  50. See Goldscheider *et al.* at 129.