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Article

**RETHINKING PATENT DAMAGES**

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**Table of Contents**

	Introduction	2
I.	Lost Profits and Reasonable Royalties in Patent Law	5
	A. The Historical Context	5
	B. Lost Profits: The Traditional Approach	10
	1. Substitutability	13
	2. Apportionment and the Entire Market Value Rule	14
	3. The Panduit Factors	17
	C. Lost Profits: Toward Adoption of a “But For” Standard	22
	1. Market-Share Damages and the Death of Apportionment	25
	2. Lost Profits on Sales of Unpatented Goods	29
	D. Reasonable Royalties	37
II.	Cause-in-Fact	44
	A. The Goals of the Patent System	45
	B. But-for Compensation	49
	C. Lost Profits Revisited	51
	1. Infringement: The Cournot Case	52
	2. Bertrand Behavior	57
	3. Chamberlinian Behavior	57
	4. Summary	58

	D. Reasonable Royalties Revisited	59
	E. The Importance of Notice or Search	59
	F. Challenging the But-for Causation Standard	66
III.	Proximate Cause	70
	A. Some General Considerations	70
	B. The Case of the Idle Patent	74
	C. Complementary Goods	85
	1. The Economics of Complementarity	85
	2. Recovery of Lost Profits on Sales of Complementary Goods	86
	3. Tying	89
	Conclusion	93

## \*2 Introduction

Determining the appropriate monetary remedy for patent infringement has always been a complicated and confusing task, for two principal reasons. The first is that the rules courts have developed for estimating patent damages have been, all too often, both complex and contradictory. This observation continues to be true even after the creation of the United States Court of Appeals for the Federal Circuit, which since 1982 has heard all appeals in patent infringement suits.<sup>1</sup> The second reason is that the proper application of even relatively simple rules to real cases can be surprisingly difficult. In recent years, courts have begun to abandon the formalism that once characterized their approach to patent damages in favor of an analysis more solidly grounded in the economics of market structure, but much work remains to be done to set the law of patent damages on a rational footing. An analogy might be that the application of economic analysis to patent infringement suits stands today at a similar stage of development as the parallel application of economics to antitrust circa 1970.

Our goal in this article is to provide a comprehensive economic framework for analyzing and estimating patent damages in the form of either lost profits or reasonable royalties. A hypothetical case may serve to illustrate some of the complexities that can arise and that have often misled courts into over or underestimating the patentee's actual damages. An intriguing current problem in the field of computer science is the development of speaker-independent voice recognition technology.<sup>2</sup> At present, this technology is, in general, only about 80% **\*3** accurate, and scientists expect that it will not materially improve in the absence of a major breakthrough, perhaps in our understanding of how the mind processes sound.<sup>3</sup> Suppose, however, that a few years down the road a scientist (call her Alice) makes such a discovery and embodies it in a computer programmed to understand and transcribe English speech;<sup>4</sup> she then markets her invention to, among others, television networks that provide closed-caption programming for the hearing impaired. A competitor, Bruce, markets a rival system that infringes Alice's device. Alice normally will be entitled to an injunction forbidding Bruce from making, using, or selling Alice's patented invention, but what damages should a court award for the period from the beginning of the infringement to the entry of the injunction?

Although a facile analysis might suggest that Alice has lost a sale for every sale made by Bruce, and that she should be awarded her normal profit margin on those sales, or, in the alternative, the customary royalty she charges others who wish to license and market her technology, courts have come to see that neither standard necessarily provides an accurate measure of Alice's economic loss. With respect to lost profits, it is not at all clear that Alice would have made a sale for every infringing sale made by Bruce. One party may produce the product at higher or lower cost than the other, or may serve different markets; and whether the parties will compete, during the infringement phase, on the basis of price, quantity, or both is a

matter that cannot be assumed a priori. Moreover, a complete analysis must take into account that a variety of nonpatented technologies may be substitutable, if only imperfectly so, for Alice's new machine. If Bruce priced his infringing product below the price charged by Alice, some customers who bought machines from Bruce might have preferred a less advanced but lower-priced nonpatented technology to the higher-priced patented machine, in the absence of infringement. Alice's lost profit therefore will be a function of the likely reaction of consumers in light of these nonpatented alternatives. Estimating the precise state of the world sans infringement can be a difficult task, albeit one that can be aided by the tools of economic analysis.

Further complications arise if we conclude that Alice would have licensed the technology to Bruce for a price, rather than marketing it herself, so she is entitled to recover lost royalties rather than lost profits. If Alice does not have a standard royalty she charges all potential licensees, a court might try to estimate the royalty the parties would have agreed to (if any) in the absence of infringement. But this task is not easy either, given that the parties likely would have negotiated a royalty in light of factors similar to those that are relevant to the lost profits analysis, including the profit one could expect to earn from alternative, unpatented \*4 technologies. Yet more difficulties will ensue if Alice seeks damages for other losses allegedly caused by the infringement. Should she be able to recover lost profits on lost sales of unpatented goods that she normally would have sold along with the patented product? What if Alice makes more money selling or licensing a less advanced technology, and therefore lets her patent remain idle for some time? If the infringement causes her to lose sales on unpatented products that compete with infringing products, should she recover her lost profits on those sales, or should the patentee's own marketing of the patented product be a precondition to lost profits damages? Or what if Alice's patent is instead for a component that constitutes only a small part of a final product that Alice markets (say, a new device that marginally improves the quality of television reception)? Should Alice recover lost profits on lost sales of television sets generally, or should her recovery be apportioned so as to avoid conferring a windfall recovery?

We shall argue that the correct answers to these questions are both simpler and more difficult than is often assumed: simpler, in the sense that we recommend the application of traditional tort-law doctrines of cause-in-fact and proximate cause to patent questions, and generally reject the idea that patent infringement is materially different, and therefore requires different legal standards, from other torts; more difficult, in that the careful application of economic analysis to these questions is not easy, and sometimes leads to counterintuitive results. We begin, in Part I, with an overview of the law of patent damages, paying particular attention to the development of legal standards for estimating lost profits and reasonable royalties over the past thirty years. As we show, the courts have been moving by fits and starts towards adopting the tort-law framework, though without completely giving up the idea that the law of patent damages should remain materially different from the law of damages as applied to other torts. In Part II, we provide a rationale for a general but-for causation standard and demonstrate how this standard might apply to a variety of market arrangements. We also discuss, though ultimately reject, an argument that patent owners should systematically recover less than the amount of their but-for loss, in order to encourage some efficient infringement. In Part III, we discuss the concept of proximate cause and what it might mean in the context of patent infringement. We suggest that, when cause-in-fact is proven, a patent owner's lost profits on sales of complementary products, or on sales of unpatented products that compete with the infringing goods, should (sometimes) be viewed as proximately caused by the infringement as well. Although our results are largely supportive of some of the legal standards the Federal Circuit has adopted over the past ten years, we shall argue that the court itself has ignored some potent counterarguments, and that these counterarguments must be resolved before one can have any confidence in the standards chosen. In reaching our results, we therefore address, though ultimately reject, arguments that allowing patent owners to recover these damages might facilitate anticompetitive schemes of preemptive patenting, tying, or bundling.

## **\*5 I. Lost Profits and Reasonable Royalties in Patent Law**

### **A. The Historical Context**

An overview of the development of the law of patent damages may be helpful for understanding some of the peculiarities that surround this body of law today, and for putting some of the current controversies in historical context. Although the earliest U.S. Patent Act provided little guidance with respect to remedies,<sup>5</sup> by 1793 Congress had decided that the prevailing plaintiff in an "action on the case" (a type of action at law) was entitled to a sum "at least equal to three times the price, for which the patentee has usually sold or licensed to other persons, the use of the said invention."<sup>6</sup> In recognition of the fact "that some inventions or discoveries had their chief value in a monopoly of use by the inventor, and not in a sale of licenses,"<sup>7</sup> Congress in 1800 deleted the reference to "the price, for which the patentee has usually sold or licensed to other persons, the use of the

said invention” and replaced it with language calling for the recovery of at least “three times the actual damage sustained by the patentee.”<sup>8</sup> In 1819, the act was further amended so as to confer upon the federal courts the power to entertain suits in equity as well as actions at law,<sup>9</sup> although both federal and state courts had been exercising their equity powers in appropriate cases prior to this time without express statutory authorization.<sup>10</sup> Further unease over requiring damages of at least three times the actual injury sustained, even in cases of innocent infringement,<sup>11</sup> led to an amendment, found in the next major revision of the Patent Act in 1836, limiting recovery to no more than treble damages and making any damages enhancement discretionary.<sup>12</sup>

\*6 The next significant amendment relating to damages took place in 1861, when Congress enacted the predecessor to Patent Act § 287.<sup>13</sup> In relevant part § 287, which for present purposes is not materially different from the text of 1861, states that patentees who are making, selling, or importing patented articles may give notice to the public that these articles are patented, by affixing to them the word “patent” (or “pat.”) together with the patent number.<sup>14</sup> A patentee who fails to mark the articles may not recover damages, “except on proof that the infringer was notified of the infringement and continued to infringe thereafter, in which event damages may be recovered only for infringement occurring after such notice.”<sup>15</sup> In effect, the Patent Act requires the plaintiff who markets patented articles to put the defendant on either actual notice or constructive notice (by marking) before an infringer will incur any damages liability.<sup>16</sup>

Further relevant changes occurred in 1870 and again in 1946, six years before the last major revision of the Patent Act in 1952. The 1870 Patent Act retained the “actual damages” provision of the earlier legislation<sup>17</sup> and also expressly entitled the prevailing plaintiff in a suit in equity “to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby.”<sup>18</sup> This change as well largely codified existing practice, in accordance with which a court sitting in equity could order the infringer to disgorge any profit attributable to the infringement on the fiction that the infringer held this profit in trust for the patentee.<sup>19</sup> Concerns over the time, expense, and complexity surrounding the accounting of the profits remedy, however, led Congress to delete any reference to it in 1946, and the courts have interpreted this omission as \*7 stripping them of any residual authority to order restitutionary relief.<sup>20</sup> With respect to monetary relief, then, the current Patent Act authorizes the recovery of “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, together with interest and costs as fixed by the court,”<sup>21</sup> and it continues to permit the court “to increase the damages up to three times the amount found or assessed.”<sup>22</sup> Our principal focus in this article therefore will be upon compensatory damages.

Because no version of the Patent Act has ever specified exactly how to calculate the compensatory or restitutionary damages called for in the statutory text, the task of formulating workable standards has always rested with the courts. Ostensibly, the easiest case would be one in which the patent owner already licenses the patent to others for a standard or “established” royalty, because in such instances (as the 1793 Patent Act explicitly recognized) it may be appropriate to conclude that the infringement deprived the patent owner of that fee.<sup>23</sup> For a royalty to qualify as “established,” however, courts have stated that it “must be paid or secured before the infringement complained of;”<sup>24</sup> that it “must be paid by such a \*8 number of persons as to indicate a general acquiescence in its reasonableness by those who have occasion to use the invention;”<sup>25</sup> that it “must be uniform at the places where the licenses are issued;”<sup>26</sup> and that it should not be paid in settlement of another infringement claim.<sup>27</sup> Courts also have long perceived that, even when an established royalty exists, it may not accurately reflect the fee the patent owner would have charged the defendant, whose use of the invention may differ in some material respect from that of the established licensees<sup>28</sup> or may itself have reduced the established royalty below what it otherwise would have been.<sup>29</sup> Thus, in cases in which the established royalty either does not exist or would not be an appropriate measure of the patent owner’s actual damages-- including the case in which the patent owner does not license others at all, but rather uses the patent herself--the court must engage in the more difficult task of estimating the patent owner’s lost profits or the amount of a reasonable royalty.<sup>30</sup>

That a court should be required to award either lost profits or lost royalties is, in our view, a sound rule. As we have demonstrated in previous work, when the patent owner and infringer compete against one another in the sale of products embodying the patented invention, and the patent owner is a more efficient producer of that good than is the infringer, the profit the patent owner would have earned on sales of that good in the absence of infringement will exceed the \*9 defendant’s profits attributable to the infringement (all other things being equal) and, by necessity, any license fee to which the parties are likely to have agreed.<sup>31</sup> When, on the other hand, the infringer is more efficient than the patentee, the infringer’s profit, as well as any license fee to which the parties are likely to have agreed in advance, necessarily exceed the patent owner’s lost profit.<sup>32</sup> A policymaker who wishes to ensure that infringement leaves patent owners no worse off and infringers no better off as a result of infringement--in order to preserve the former’s incentive to innovate, and to encourage the latter to negotiate for permission to use<sup>33</sup>--should award, as a minimum, the greater of either the patent owner’s lost profit or the royalty the parties

would have agreed to in advance.<sup>34</sup> Given the inherently counterfactual nature of determining what would have happened if the infringement had never occurred, it is not surprising that the methods used for estimating damages have given rise to so much difficulty, and so much controversy, over the years. In the next three sections, we will examine those methodologies before proceeding in the following parts to present our own refinements of the analysis.

## **\*10 B. Lost Profits: The Traditional Approach**

Over the years, courts and commentators have come to recognize that infringement can reduce the patent owner's profits in a number of ways. First, and most obviously, the infringer may divert sales from the patent owner.<sup>35</sup> Second, competition from the infringer may cause the patent owner to reduce her own price (or to forgo an increase), and thus earn lower profits on those goods she continues to sell.<sup>36</sup> (Note, however, that if the price goes down, the quantity sold normally will increase, albeit at a lower profit margin. Accurate price erosion damages, therefore, should account not only for the reduction in price, but also for the increase in quantity caused by the reduction in price.)<sup>37</sup> A third possible effect is that the infringement causes the patentee to suffer additional costs, such as increased advertising and marketing expenditures.<sup>38</sup> Courts also on occasion have awarded or considered awarding damages for such asserted harms as lost future profits,<sup>39</sup> injury to the patent owner's reputation resulting from the sale of poor-quality infringing goods,<sup>40</sup> and the infringer's accelerated entry into the **\*11** marketplace once the patent expires.<sup>41</sup> These latter injuries, nevertheless, are more commonly perceived either as being subsumed in one or more of the other categories,<sup>42</sup> or as being too remote or speculative.<sup>43</sup> Finally, patent owners have sometimes claimed damages for lost sales of other goods, not covered by the patent in question, that typically would have been sold in connection with the patented product, or that were sold in competition with the infringing product.<sup>44</sup> We take up the issue of whether these latter harms should be compensable in subsequent sections. For the remainder of this section, we shall focus exclusively on the many complications that arise from estimating lost sales of products that embody, or were made by use of, the patented invention.

Two methods the courts have sometimes used for estimating the patent owner's lost sales are highly problematic. The first is simply to subtract the number of units the patent owner sold after the infringement from the number she sold before, and to infer that the infringement caused whatever difference may exist.<sup>45</sup> As others before us have pointed out, however, this post hoc, ergo propter hoc reasoning is valid only if demand and cost conditions have remained stable during **\*12** the period of infringement, which is often unlikely.<sup>46</sup> The second method is to use the defendant's actual sales of the infringing products as a surrogate for the sales the plaintiff would have made absent the infringement. Courts sometimes make this assumption today, though typically only when the plaintiff and defendant are the only suppliers of the product at issue (the so-called "two-supplier market" scenario).<sup>47</sup> This methodology was much more common in the nineteenth century, however--and indeed courts frequently took the analysis one step further, not only considering the defendant's actual sales but also using the defendant's actual profits as a surrogate for the profits the plaintiff would have earned but for the defendant's improper use.<sup>48</sup> (Note that this use of defendant's profits as an estimate of the plaintiff's actual damages was different in purpose from awarding the defendant's profits in their own right, as restitution. Until 1870, a court of equity could award restitutionary but not compensatory damages, and somewhat different procedures governed the estimation methods used at law and in equity.<sup>49</sup>) To be sure, the better reasoned decisions cautioned against presuming that the defendant's profits were identical to the plaintiff's lost profits; at the very least, the plaintiff would have to prove that it was ready and able to supply the defendant's customers.<sup>50</sup> Moreover, either party could try to show that the plaintiff's and defendant's profit margins differed, though normally a different profit margin worked in favor of the plaintiff.<sup>51</sup> Efforts to calculate the defendant's profit attributable to the infringement, whether used as a surrogate for actual damages or as an end in itself, **\*13** tended to focus the courts' attention on two problems that continue to cause difficulties today: substitutability and apportionment.<sup>52</sup>

### **1. Substitutability**

The substitutability problem centers upon whether there are noninfringing substitutes that the defendant could have used instead of the patented invention. When the infringer has access to such substitute technologies, the inference that he caused the patent owner to lose any profits may be false. A reasonable royalty may then be a more appropriate form of compensation, because the infringer could have made comparable sales and profits, and thereby deprived the patent owner of comparable sales and profits, by using those substitutes.<sup>53</sup> Determining whether one product is a substitute for another can be difficult, however, for several reasons. First, as others have noted, whether one product substitutes for another depends not only upon the function of the two products, but also upon the prices at which they are offered to the public.<sup>54</sup> Under the cost and demand conditions that prevail in the **\*14** United States today, for example, most people would not view automobiles and

horse-drawn carriages as adequate substitutes, but if the price of automobiles were to increase one-million fold relative to carriages, the demand for carriages would undoubtedly rise significantly. Second, as this example suggests, substitutability is not necessarily an all-or-nothing phenomenon: given an increase of \$x in the price of Good 1, some consumers may switch to Good 2, while others remain loyal to Good 1.<sup>55</sup> Thus, an infringer who could have used an alternative that some (though not necessarily all) consumers would have viewed as an adequate substitute for the patented invention would have siphoned off some sales from the patent owner, even in the absence of infringement, and courts should take this fact into account in estimating the latter's lost profits damages. As we shall see, however, this understanding of the economics of substitution has only occasionally taken hold.

## 2. Apportionment and the Entire Market Value Rule

The apportionment problem arises from the recognition that not all of the infringer's actual profit or the patent owner's lost profit is necessarily attributable to the use of the patented invention. To illustrate, suppose that a television manufacturer owns a patent for a component that, when incorporated into television sets, improves the picture quality of television broadcasts; that a rival manufacturer infringes this patent by incorporating an identical component into its (otherwise noninfringing) sets, without permission of the patent owner; and that the patent owner then sues the rival manufacturer for infringement. The intuition that not all of the plaintiff's or defendant's profit is attributable to the patented component—and that the plaintiff therefore should recover only for the incremental gain attributable to the patent—is compelling, although in searching for an explanation for this intuition the courts have succeeded largely in only further muddying the waters. Historically, the courts' principal concern seems to have been that awarding the plaintiff any more than the lost profit attributable to the component (or, under a restitutionary theory, any more than the defendant's profit attributable to the component) would in effect expand the scope of the plaintiff's patent to encompass the entire final product.<sup>56</sup> Consistent with their often-expressed concern over the \*15 “monopolistic” nature of patents, sometimes expressed in maxims calling for narrow patent construction,<sup>57</sup> courts strove to avoid this result, but with the consequence of requiring them to apportion the profits attributable to the patented and unpatented components of a unitary invention.<sup>58</sup> (Congress expressly eliminated the apportionment rule with respect to design patents, however.<sup>59</sup>) From an economic standpoint, though, trying to determine what portion of the profits earned from a multicomponent product are attributable to any one component, or combination of components, is often a meaningless inquiry.<sup>60</sup>

A more sophisticated analysis might assume that, in the typical case, the defendant would have sold some television sets, and earned some profit, even if it had avoided using the infringing component. (In fact, this would simply be another way of saying that a set without the picture-enhancing component is, at some price and for some consumers, an acceptable substitute for a set with the component.) Under this analysis, the only sales the plaintiff loses as a result of the infringement are sales to those consumers for whom the picture-enhancing component is a decisive factor in their purchasing decision. Thus, rather than having to determine which portion of the profits earned by the defendant, or lost by the plaintiff, are attributable to the component, a court using this approach would have to determine only what sales were lost and award the plaintiff all the profits he would have earned on those sales. Although the casual observer might expect this inquiry to be no more tractable than trying to determine what portion of total profits are \*16 attributable to a patented component, modern economic analysis does provide some techniques for estimating losses under this alternative approach.<sup>61</sup>

The inadequacy of the apportionment framework the courts actually employed nevertheless soon became apparent in cases in which a patented component clearly was the principal reason that most buyers of a multicomponent product were interested in buying that product. Using our television example from above, suppose that the component at issue revolutionized television technology in some way—say, by allowing the user to access thousands of stations from around the globe, without using cable or a satellite dish, and at a fraction of the cost—that effectively made ordinary televisions obsolete.<sup>62</sup> In such a case, one might surmise that the infringer would have made no sales if he had refrained from infringing, and that awarding the patent owner only a portion (albeit, perhaps, a hefty one) of the profits she would have earned on sales of the final product would leave her worse off than if the infringement had never occurred. To deal with such cases, courts developed what has come to be known as the “entire market value rule” (hereinafter EMVR).<sup>63</sup> According to its most recent articulation, the rule allows the patent owner to recover the entire profit she would have earned on sales of a final product incorporating a patented component, when the patented component is the “basis for customer demand” for that product.<sup>64</sup> Despite its vagueness, courts have continued to cite the rule to the present day, viewing it either as an exception to the \*17 apportionment principle, or as an application of that principle in cases in which 100% of the profit properly can be attributed to the patented component.<sup>65</sup>

### 3. The Panduit Factors

In 1978, the Sixth Circuit summarized many of the rules we have examined in the preceding paragraphs in *Panduit Corp. v. Stahlin Bros. Fibre Works, Inc.*<sup>66</sup> In *Panduit*, the court set forth four factors to establish lost profits damages in a patent infringement case:

- (1) demand for the patented product, (2) absence of acceptable noninfringing substitutes, (3) his manufacturing and marketing capability to exploit the demand, and (4) the amount of the profit he would have made.<sup>67</sup>

Courts continue to recite and apply the *Panduit* factors today,<sup>68</sup> although they also caution that it may not be necessary for the plaintiff to prove every factor in every case.<sup>69</sup> To satisfy the third factor, capacity to exploit the demand for the patented product, the patent owner may need to present evidence of such things as excess manufacturing capacity, ability to obtain financing, and ability to market additional units of the product.<sup>70</sup> Disputes most frequently center, however, on **\*18** application of the second factor, relating to the presence or absence of adequate noninfringing substitutes, and we shall examine this factor in some detail. (The first factor, proof of demand for the patented invention, is often not contested;<sup>71</sup> when it is, it is usually satisfied by proof of substantial sales of products incorporating the patented invention,<sup>72</sup> or else it is subsumed within the second factor.<sup>73</sup>)

In assessing the adequacy of noninfringing substitutes, courts traditionally have considered whether the infringer had access to an alternative comprising the same advantages as the patented device.<sup>74</sup> As noted above, however, in determining **\*19** whether consumers would view one product as a substitute for another, it is necessary to consider not only function but also price. In some cases, courts have begun to consider both factors<sup>75</sup> and, more generally, to apply explicitly economic criteria to the issue of whether one product is an adequate substitute for another. In *SmithKline Diagnostics, Inc. v. Helena Laboratory Corp.*,<sup>76</sup> for example, the court rejected the plaintiff's argument that noninfringing products lacking one or more features of the patented invention cannot be adequate substitutes for that invention, noting that noninfringing products "by definition . . . do not represent an embodiment of the invention."<sup>77</sup> Instead, the analysis should center on whether the "realities of the marketplace" are such that, but for the infringement, purchasers would have bought the patented product or would have been satisfied with products lacking the patented product's unique features.<sup>78</sup> Similarly, in *Grain Processing Corp. v. American Maize-Products Co.*,<sup>79</sup> the Court of Appeals affirmed the district court's decision not to award lost profits, based upon a finding that, in the absence of infringement, the defendant would have resorted to an alternative, noninfringing process for manufacturing a type of food additive.<sup>80</sup> Even so, patent litigants rarely **\*20** estimate the cross-elasticity of demand between the infringing product and the noninfringing alternative, despite the potential usefulness of this information in determining whether the infringement has cost the patentee any sales.<sup>81</sup>

With respect to the fourth element--the amount of profit the patent owner would have made absent the infringement--courts for the most part recognize that they should take into account not only the price at which the patent owner would have made these sales, but also any additional costs he would have incurred in connection with these sales. In estimating costs, courts typically use an "incremental income" approach, which:

recognizes that it does not cost as much to produce unit  $N + 1$  if the first  $N$  (or fewer) units produced already have paid the fixed costs. Thus fixed costs--those costs which do not vary with increases in production, such as management salaries, property taxes, and insurance--are excluded when determining profits.<sup>82</sup> **\*21** Courts also recognize, however, that if the volume of diverted sales is sufficiently large, these sales would have entailed additional costs (such as the cost of additional manufacturing facilities), which, though usually categorized as fixed, must be deducted as well to achieve an accurate estimate of lost profits.<sup>83</sup> Finally, taxes that would have been paid on revenues earned from additional sales are not deductible, in light of the fact that the damages award itself will be taxed.<sup>84</sup>

Use of this methodology can sometimes result in lost profits awards that are much higher than one might initially expect. To see why, consider Paul Janicke's example of a firm that owns a patent on a formula for a household soap:

Fixed costs, principally advertising campaigns and marketing overhead, may run 90% of revenue for an item like a patented household soap formulation. Suppose the soap sells at wholesale for \$0.60 per bar. Fixed costs would then be \$0.54. Variable costs, e.g., labor, materials, and shipping, are so called because they vary rather directly with volume. Suppose in our soap example they run 5% of revenue, or \$0.03, leaving a 5% net profit, also \$0.03.

If an infringer diverts sales of this soap from the patentee, the infringer will be liable for \$0.60 (lost revenue) minus \$0.03 (variable costs), or \$0.57 per bar.<sup>85</sup>

In other words, as Skenyon et al. note, “the patent owner’s ‘lost profit’ for each infringing sale is necessarily greater than the actual profit the patent owner earned for each patented item it actually did make and sell.”<sup>86</sup> Although at first glance this result may seem perverse, it is economically sound. In the absence of infringement, the patentee would have amortized the fixed costs over a larger number of sales, such that the profit per unit sold would have been higher. To illustrate, suppose that, in Janicke’s example, the patent owner sold 10,000 bars at \$0.60 each during the period of infringement. It thereby earned \$6,000 in gross revenue which, minus \$5,400 in fixed costs, leaves \$600. Subtracting \$300 in variable costs (5% of gross revenue) leaves a profit on goods actually sold of \$300. Ignoring for now the effect of price erosion, and assuming for simplicity that the \*22 patent owner faces a constant marginal cost curve, let us assume that, in the absence of infringement, the patent owner would have sold 1000 more bars at the same price, earning an additional \$600 in gross revenue. Subtracting 5% of this additional gross revenue, or \$30, leaves a lost profit of \$570. On these facts, it is easy to show that the sum of the patent owner’s lost profit (\$570) and its actual profit (\$300) is exactly what the patent owner would have earned absent the infringement: 11,000 bars sold at \$0.60 each would have generated \$6,600 in gross revenue; subtracting \$5,400 in fixed costs would have left \$1,200; and further subtracting variable costs of 5% of gross revenue, or \$330, would have left total profits of \$870.<sup>87</sup>

### C. Lost Profits: Toward Adoption of a “But For” Standard

Although the preceding discussion involved some of the more recent case law, the most important development in the law of patent damages over the past two decades or so has been the gradual, albeit incomplete, adoption of an alternative framework to the miscellany of rules examined in the preceding section. In this section, we show how the courts began, in the mid-1980s, to supplement (and in some cases, override) the traditional perspective with cause-in-fact and proximate cause standards borrowed from the law of torts, and how in doing so they have modified the law concerning both apportionment and the recovery of lost profits on so-called conveyed and derivative goods. Although in some ways these developments herald a much simpler analysis, they also require courts to apply a greater degree of economic sophistication.

Two cases that are usually cited as foreshadowing the adoption of a but-for causation standard are the Supreme Court’s decisions in *Aro Manufacturing Co. v. Convertible Top Replacement Co. (Aro II)*<sup>88</sup> and *General Motors Corp. v. Devex Corp.*<sup>89</sup> At issue in the Aro litigation was a patent reading on a structure for an automobile convertible top, which included as one of its elements a fabric for the top.<sup>90</sup> Both General Motors and Ford used the invention in convertibles they manufactured from 1952 to 1954, though only GM was licensed to use it at that time; Ford was not authorized to use the invention until it reached a settlement with the patent owner in 1955.<sup>91</sup> Meanwhile, Aro began manufacturing and selling a fabric that had no use other than as an element of the patented invention.<sup>92</sup> The patent owner then filed suit against Aro, alleging that owners of Ford and GM \*23 1952-54 model convertibles who used the Aro fabric when the original convertible-top fabric wore out directly infringed the patent, and that Aro was liable as a contributory infringer for supplying the customers with the replacement fabric.<sup>93</sup> In Aro I, the Supreme Court held that customers who used the replacement fabric on GM cars were entitled to make such repairs without incurring liability as direct infringers, and that Aro therefore could not be liable for contributory infringement with respect to those activities.<sup>94</sup> In Aro II, however, the Court held that owners of the Ford cars were liable for unauthorized use of the patent until the Ford settlement took effect in 1955, and that Aro was liable as a contributory infringer with respect to sales made to Ford customers before that time.<sup>95</sup>

In a bit of extended dictum, Justice Brennan, writing for himself and three other justices only, also addressed the issue of what damages the patent owner could hope to recover against Aro on remand.<sup>96</sup> Noting first that the Patent Act now appears to have eliminated the option of awarding restitution of the infringer’s profits, Justice Brennan concluded that the current rule “is that only ‘damages’ may be recovered.”<sup>97</sup> Justice Brennan then went on to quote the Court’s 1878 decision in *Yale Lock Manufacturing Co. v. Sargent*,<sup>98</sup> an early price erosion case, for the proposition that patent damages “constitute ‘the difference between [the patent owner’s] pecuniary condition after the infringement, and what his condition would have been if the infringement had not occurred,’”<sup>99</sup> and the Fifth Circuit’s decision in *Livesay Window Co. v. Livesay Industries*<sup>100</sup> for the proposition that the principal question with respect to damages is “‘had the Infringer not infringed, what would Patent Holder-Licensee have made?’”<sup>101</sup> In light of these standards, Justice Brennan concluded that the patent owner probably was not entitled to the lost royalties it sought because, on the specific facts presented, it was unlikely that Aro would have agreed to pay the patent owner for the right to make and sell the replacement fabric, even in the absence of the 1952-54

infringement.<sup>102</sup>

\*24 At issue in *Devex* was whether § 284 of the current Patent Act authorizes courts to award prejudgment interest from the date of infringement, or whether it was intended to incorporate earlier case law under which interest was awarded only from the date on which damages were liquidated (i.e., ascertainable), absent exceptional circumstances.<sup>103</sup> In holding that the current act permits interest to accrue from the date of infringement, the Court noted that § 284 states that “[u]pon finding for the claimant the court shall award . . . interest and costs as fixed by the court,” and does not expressly limit this authority to exceptional circumstances.<sup>104</sup> The Court also concluded, upon review of the legislative history of the 1946 act, that “Congress sought to ensure that the patent owner would in fact receive full compensation for ‘any damages’ he suffered as a result of the infringement;”<sup>105</sup> that the rules relating to prejudgment interest “should be consistent with Congress’ overriding purpose of affording patent owners complete compensation;”<sup>106</sup> and that prejudgment interest is usually “necessary to ensure that the patent owner is placed in as good a position as he would have been in had the infringer entered into a reasonable royalty agreement.”<sup>107</sup> The Court therefore held that interest should be awarded “absent some justification for withholding” it, such as when the patent owner has delayed prosecution of the suit.<sup>108</sup>

In recent years, the Federal Circuit has taken to quoting the above language from *Aro II* and *Devex* in support of a more flexible standard, under which the patent owner is entitled to recover whatever profits he would have earned but for the infringement.<sup>109</sup> In two circumstances in particular, this but-for standard can result in much more generous damages awards than would be permitted under a strict reading of *Panduit*: first, in cases in which the patent owner can prove a partial, but not complete, absence of adequate noninfringing substitutes for the patented item (*Panduit* factor two); and second, in cases in which the patent owner can prove that the infringement has cost it sales of unpatented products (thus, in some instances, obviating the need to prove *Panduit* factor three, demand for the patented product). With respect to the first class of cases, the court has permitted the recovery of damages on a market-share basis. The second class of cases, as we \*25 shall see, raises more difficult policy questions, and for this reason has been much more controversial.

### 1. Market-Share Damages and the Death of Apportionment

The case that is usually cited as establishing the market-share approach is *State Industries v. Mor-Flo Industries*.<sup>110</sup> In *State Industries*, the plaintiff owned a patent on a method of using polyurethane for insulating water-heater tanks, and it had a 40% share of the market for energy-efficient residential gas water heaters from 1984 to 1986.<sup>111</sup> After finding that the defendant *Mor-Flo* had infringed the patent, the district court assessed lost profits damages based upon the assumption that, but for the infringement, *State* would have made 40% of *Mor-Flo*’s infringing sales during the relevant period of time.<sup>112</sup> Overlooking a mathematical error on the part of the district court, the Court of Appeals affirmed.<sup>113</sup> More specifically, the extent to which the market-share test accurately estimates lost profits will depend upon the extent to which the products sold by the patentee, infringer, and competitors are substitutes. The assumption that the infringer’s sales would have divided neatly among the noninfringing firms in proportion to their market shares, in other words, will not be accurate under all conditions.<sup>114</sup> Subsequent case law has recognized that this market-share principle in effect creates an exception to *Panduit* factor two. The principle assumes that, in a market characterized by a range of imperfect substitutes, infringement is likely to deprive the patent owner of some of the sales made by the infringing party but that other (lawful) competitors probably would have earned some of those sales as well.<sup>115</sup> For that matter, a court may \*26 entertain evidence that the infringer itself would have earned some share of the market by selling a noninfringing substitute product.<sup>116</sup>

One final observation concerns the relationship between the market-share approach and the apportionment principle we discussed above. Borrowing from our previous example, suppose that a firm owns a patent on a component that it \*27 incorporates into a final product, television sets; that a rival manufacturer incorporates an infringing component into its sets; and that these are the only two firms within the relevant market. As we have seen, traditionally the general rule is said to be that the patent owner is entitled only to the lost profits that are directly attributable to the patented component, rather than the entire profit it would have earned on lost sales of television sets. The exception arises when demand for the sets is driven by the presence of the patented component, in which case the EMVR entitles the patent owner to its entire lost profit. But when does the “general rule” ever apply? Suppose, first, that a television without the component is not an adequate noninfringing substitute for a television with the component. As we have seen, the more recent decisions recognize that the question of whether one product is an adequate substitute for another depends upon consumer demand, not technical interchangeability. To say that there are no adequate noninfringing substitutes, then, essentially means that the rival manufacturer would have made no sales absent the infringement. In such a case, however, the patented component “drives the demand” for the product, and the EMVR should entitle the patent owner to its entire lost profit on forgone sales of TVs.<sup>117</sup> Alternatively, if a television

without the component is an adequate noninfringing substitute for a set with the component, a straightforward reading of *Panduit* suggests that the patent owner is entitled to no lost profits damages at all.<sup>118</sup> Analysis of this nature has led some observers to conclude that the apportionment rule is a dead letter.<sup>119</sup>

The question nevertheless arises whether the market-share approach could give rise to circumstances under which apportionment might still apply. Borrowing again from the previous example, suppose that the patent owner, the infringer, and two other noninfringing firms each have a 25% share of the market for television sets during the period of infringement. Following *State Industries*, if we assume that the infringer would have vanished from the market absent the infringement, we should divide the infringer's sales among the remaining firms in proportion to their market shares; here, the conclusion would be that the patent owner (and each of its two noninfringing rivals) would have made one-third of the infringer's sales.<sup>120</sup> The conclusion that the infringer would have lost one-third of its sales to the patent owner, absent the infringement, might seem to suggest that, with respect to those sales, the patented component once again "drove the demand," and that the patent owner should recover its entire profit on those sales in accordance with the EMVR. \*28 On the other hand, the analysis also suggests that the infringer lost two-thirds of its sales to the two noninfringing rivals--and yet the patent could not have driven demand with respect to those sales (unless the noninfringing rivals were licensees of the patent owner), because those rivals are, by definition, non-users of the patent. Moreover, the premise that some (in fact, most) of the infringer's customers do not care so much about the patented feature that they would have purchased from the patentee, had the infringer chosen not to infringe, calls into doubt our initial assumption concerning the motivation of the minority who would have switched to the patent owner. Specifically, the question arises whether it would have been the patented feature or some other factor--such as geographic proximity or the patent owner's business reputation--that would have motivated these customers to switch from the infringer to the patent owner rather than from the infringer to a noninfringing rival.<sup>121</sup> To the extent that purchaser motivation remains unclear, one might argue that the EMVR cannot apply and that, by default, the apportionment principle must be resurrected at least under these limited circumstances.

We nevertheless doubt that apportionment has any meaningful role to play even in these circumstances. To see why, let us divide the one-third of consumers who would have switched from the infringer to the patent owner, absent the infringement, into two groups: those who would have bought from the patent owner because they want the patented feature, and those who would have bought from it for other reasons. (Perhaps one could make a rough estimate of the composition of the two groups by means of survey evidence, although we do not claim that this would be cheap or easy.) With respect to the first group, once again the EMVR compels recovery of the entire profit lost, rather than merely an apportioned part, because for these customers the patent clearly formed the basis of their demand. With respect to the second group, however, the more logical choice would appear to be between awarding the entire lost profit--on the theory that the patent owner would have made these sales but for the infringement, and therefore needs compensation in order to be made whole-- and awarding nothing, on the theory that the patent would have played no role in this group's decision to purchase from the patent owner. Although we shall take up the issue of whether the patent owner should recover its but-for profit, or some lesser amount, in greater detail in a subsequent part, for now we note only that the far simpler rule in this case would be to award the patent owner its entire lost profit on all of the forgone sales, in order to avoid having to investigate purchaser motivation. In either event, however, there appears to be no reason to apply the apportionment principle as traditionally understood, that is, as requiring a distinction between lost profits attributable to the patented and unpatented parts of a unitary product.

## **\*29 2. Lost Profits on Sales of Unpatented Goods**

The second principal consequence of the courts' move toward adoption of a but-for standard has been the evolution of case law permitting the patent owner to recover lost profits on sales of unpatented items--including unpatented components, unpatented goods that are sold along with patented goods (so-called "convoyed sales" or "collateral goods"),<sup>122</sup> and unpatented spare parts (sometimes referred to as "derivative goods")<sup>123</sup>--if those losses are traceable to an act of patent infringement. In this regard, three cases are of particular significance: *Paper Converting Machine Co. v. Magna-Graphics Corp.*,<sup>124</sup> *Rite-Hite Corp. v. Kelley Co.*,<sup>125</sup> and *King Instrument Co. v. Peregó*.<sup>126</sup>

In the first case, *Paper Converting*, the district court held that the defendant infringed a reissue patent claiming an improvement in a machine used to manufacture rolls of toilet paper, and awarded the patent owner lost profits not only on the sales of two of these machines but also on the sales of other, separate machinery that was used in the manufacturing process.<sup>127</sup> In affirming the damages calculation, the Court of Appeals cited with approval two earlier cases in which the United States Court of Claims<sup>128</sup> had suggested that the EMVR applies whenever an unpatented good has "financial and marketing dependence on the patented item,"<sup>129</sup> or the patentee normally can anticipate selling the patented and unpatented

**\*30** items together.<sup>130</sup> Applying this standard, the court noted that every firm within the industry, including the purchasers of the two infringing machines at issue in this case, almost always bought an entire line of products from the manufacturer of the rewinder machine.<sup>131</sup> This restatement of the EMVR, as depending upon the patent owner's reasonable expectations, departed from the more traditional articulation of the rule as applying only when the patented feature is the "basis for demand" for the unpatented feature. As John Schlicher has noted, however, the two ways of stating the rule are hardly identical.<sup>132</sup>

The second case, *Rite-Hite Corp. v. Kelley Co.*,<sup>133</sup> simultaneously expanded and reduced the patent owner's ability to recover under the standards announced in *Paper Converting*.<sup>134</sup> At issue was the '847 Patent, which covered "a device for securing a vehicle to a loading dock to prevent the vehicle from separating from the dock during loading or unloading."<sup>135</sup> The patent owner, Rite-Hite, used this device in an inexpensive vehicle restraint known as the MDL-55, but it also sold a more expensive motorized restraint, the ADL-100, that made use of a different patent or patents.<sup>136</sup> The defendant Kelley marketed a restraint known as the Truk-Stop, which infringed the '847 Patent and which competed against both the MDL-55 and the ADL-100.<sup>137</sup> The district court awarded Rite-Hite lost profits not only on 80 lost sales of the MDL-55, but also on 3,243 lost sales of the ADL-100 and on 1,692 lost sales of "dock levelers," an unpatented device that Rite-Hite typically sold with the restraints and that was used as a bridge platform between the vehicle and the restraint.<sup>138</sup> In a divided ruling, the Federal Circuit, sitting en banc, affirmed the award with respect to the ADL-100 but reversed as to the dock levelers.<sup>139</sup>

**\*31** With regard to the ADL-100, a majority of the court joined in Judge Lourie's opinion that claims of patent infringement are subject to the same cause-in-fact and proximate cause standards as are other tort claims,<sup>140</sup> and that, as a general matter, these standards entitle a patent owner to recover damages for the reasonable, objectively foreseeable consequences of the infringement.<sup>141</sup> Thus, while some consequences may be "too remote to justify compensation"<sup>142</sup>--for example, "a heart attack of the inventor or loss in value of shares of common stock of a patentee corporation caused indirectly by infringement"<sup>143</sup>--in this case the lost sales of the ADL-100, a product that directly competed with the infringing product, were "reasonably foreseeable" and therefore compensable.<sup>144</sup> The court also suggested that allowing the patent owner to recover under these circumstances would be consistent with the constitutional policy of "'promot [ing] the Progress of . . . the useful Arts' by providing a stimulus to the development of new products and industries."<sup>145</sup>

In reaching this conclusion, the court rejected Kelley's three principal arguments against allowing Rite-Hite to recover for the ADL-100 sales. First, the court concluded that recovery would not conflict with "antitrust case law condemning the use of a patent as a means to obtain a 'monopoly' on unpatented material," reasoning that the present case did not risk "expanding the limits of the patent grant" or "exclud[ing]. . . competitors from making, using, or selling a product not within the scope of" the '847 Patent, but rather "simply asks, once infringement of a valid patent is found, what compensable injuries result from that infringement, i.e., how may the patentee be made whole."<sup>146</sup> Second, the court rejected Kelley's argument "that, as a policy matter, inventors should be encouraged by the law to practice their inventions," noting that the government issues patents in exchange for inventors' disclosures (rather than use) of their inventions, and that the Patent Act does not require inventors to practice their patents.<sup>147</sup> Finally, the court rebuffed Kelley's argument that the case law, as reflected by *Panduit*, "uniformly requires that 'the intrinsic value of the patent in suit is the only proper basis for a lost profits award.'" <sup>148</sup> In this regard, the court **\*32** asserted that *Panduit* is not the exclusive test for assessing lost profits, but rather expresses only one way in which but-for causation may be proven.<sup>149</sup> The court concluded that it could find no reason in "the statute, precedent, policy, or logic to limit the compensability of lost sales of a patentee's device that directly competes with the infringing device if it is proven that those lost sales were caused in fact by the infringement."<sup>150</sup>

**\*33** A majority of the court nevertheless voted to vacate with respect to the dock levelers, for which the district court had awarded lost profits damages based upon the EMVR.<sup>151</sup> Writing for himself and five of the other eleven judges, Judge Lourie downplayed those statements in *Paper Converting* that "articulated the entire market value rule in terms of the objectively reasonable probability that a patentee would have made the relevant sales,"<sup>152</sup> and that "emphasized the financial and marketing dependence of the unpatented component on the patented component."<sup>153</sup> That language, Judge Lourie wrote, should be read in the overall context of the general principle, as applied in *Paper Converting*, that permits the recovery of lost profits on unpatented components only when those components and the patented components "function together . . . in some manner so as to produce a desired end product or result," in a manner "analogous to components of a single assembly or . . . parts of a complete machine, or . . . constitute a functional unit."<sup>154</sup> In the present case, the dock levelers--which could be used independently of the vehicle restraints (and vice versa), but which were sold together merely "as a matter of **\*34** convenience or business advantage"--did not meet this test.<sup>155</sup> Judge Lourie distinguished the court's decision to allow damages on the unpatented ADL-100s on the ground that the latter were competitive with the infringing device, thus formulating a rule that damages may not be recovered "for items that are neither competitive with nor function with the patented invention."<sup>156</sup> Judge

Nies and three other judges, who dissented from the court's decision as to the ADL-100s, not surprisingly agreed with the majority's decision to vacate the award as to the dock levelers.<sup>157</sup> Although only six of the twelve judges concurred in the adoption of a "functionality" test for convoyed goods, subsequent panels appear to have adopted that test as the governing rule.<sup>158</sup>

The third case, *King Instrument Corp. v. Perego*,<sup>159</sup> goes so far as to permit the recovery of lost profits even when the patent owner does not market any product embodying the patented invention. At issue in *King Instrument* was, among other things, the '461 Patent, which read on an assembly for connecting magnetic audio- or videotape to nonmagnetic "leader" tape connected to the hubs of a cassette.<sup>160</sup> Both the patent owner, King, and the defendant Tapematic marketed tape loaders--machines that spliced and wound magnetic tape into videocassettes--but there were significant differences between their products.<sup>161</sup> In particular, Tapematic's model included a so-called "double pancake" reel changer, consisting of "two reels of magnetic tape so that when one reel is empty the machine is automatically fed from the second reel of magnetic tape thus avoiding down time for changing reels."<sup>162</sup> The district court found this feature of the product to infringe the '461 Patent.<sup>163</sup> King's competing model was a "single pancake loader" that lacked this \*35 feature and, therefore, did not embody King's '461 Patent.<sup>164</sup> The court nevertheless awarded King lost profits on sales of its machine<sup>165</sup> based on the following assumptions. First, as a first approximation, the court concluded that King had a 70% share of the tapeloader market prior to Tapematic's infringement, and that but for the infringement customers would have purchased these machines "according to the other sellers' market share."<sup>166</sup> Second, taking into account the differences between the Tapematic and King devices, the court reduced the number of lost sales from 54 to 49 machines.<sup>167</sup> The court also awarded lost profits on spare parts that King would have sold,<sup>168</sup> and a reasonable royalty on sales of "acceptable noninfringing alternatives" that would have been made by the competitors who controlled the remaining 30% of the market, but for the infringement.<sup>169</sup>

Affirming as to both liability and damages, the Court of Appeals rejected Tapematic's argument that a patent owner may recover lost profits only when it markets a product embodying the patent at issue.<sup>170</sup> In reaching this conclusion, the court framed its analysis in quasi-economic terms:

The market may well dictate that the best use of a patent is to exclude infringing products, rather than market the invention. A patentee, perhaps burdened with costs of development, may not produce the patented invention as efficiently as an infringer. Indeed, the infringer's presence in the market may preclude a patentee from beginning or continuing manufacture of the patented product. Thus, as apparent in this case, the patentee may acquire better returns on its innovation investment by attempting to exclude infringers from competing with the patent holder's nonpatented substitute.

\*36 Under this situation, the Patent Act is working well. The patentee is deriving proper economic return on its investment in acquiring a patent right. The public benefits from the disclosure of the invention and the ability to exploit it when the patent term expires.<sup>171</sup>

Unfortunately, the court did not explain why, if the patentee is less efficient, it would be in her interest to let the patent remain idle rather than to license the would-be user. If either party could earn the same return from using the next-best alternative to the patent, the patentee has an incentive to license the would-be user if the latter can earn more from the use of the patented product than can the patentee.<sup>172</sup> On the other hand, if the patentee can earn more from the alternative than from either using the patent herself or licensing the would-be user, she will allow it to remain idle, but whether this result is consistent with the goals of the patent system deserves more consideration than the court devoted to it, as we shall see.<sup>173</sup> Second, the court considered a hypothetical in which the patent owner is more efficient than the would-be user.<sup>174</sup> In such a case, the court recognized, "[t]he patentee profits more by supplying the demand itself than by granting a license on terms which would allow the competitor to reasonably operate," and "[t]he value of exercising the right to exclude is greater than the value of any economically feasible royalty."<sup>175</sup> Asserting that a patentee who recovers only a reasonable royalty in this situation does not receive adequate compensation, the court apparently concluded that, a fortiori, where the patentee can make an even greater profit by neither using nor licensing the patent, a reasonable royalty does not provide adequate compensation.<sup>176</sup> Whether a reasonable royalty is "adequate," in light of the goals of patent law, when the patentee has disclosed but not used that invention is a much more difficult question than the court appears to have realized. As discussed below, we are inclined to agree with the court's conclusion, but only if the defendant is on notice of the existence of the patent, and even then the question is a very close one.<sup>177</sup>

\*37 In addition, on its facts *King Instrument* does not present a compelling case for an award of lost profits under the but-for causation principle. The court specifically held that adequate noninfringing substitutes for the patented device were available,<sup>178</sup> but, if so, then it is not at all clear that Tapematic's infringement cost King any sales. More likely, absent the

infringement, Tapematic (like the competitors who purportedly made up the other 30% of the market) would have sold the noninfringing substitute, rather than vanishing altogether.<sup>179</sup> Indeed, the court's finding that only five out of 54 customers would have purchased nothing if the defendant had not been selling its "double pancake" loader<sup>180</sup> suggests that the patented reel changer had relatively little to do with demand for either plaintiff's or defendant's products. Whatever the merits of the court's policy analysis, it seems doubtful that King should have been awarded any lost profits even under a standard causation test.<sup>181</sup> If anything, the case highlights the dangers of a wooden, fact-insensitive application of market-share analysis.<sup>182</sup>

#### D. Reasonable Royalties

As we have seen, in cases in which the patent owner cannot prove the fact or amount of its lost profit or of an established royalty, the Patent Act authorizes an award of "a reasonable royalty for the use made of the invention by the infringer."<sup>183</sup> Although the governing legal rules with respect to reasonable \*38 royalties are somewhat more straightforward than the rules relating to lost profits, courts have aptly described the actual calculation of the royalty as "'involv[ing] more the talents of a conjurer than those of a judge."<sup>184</sup>

Perhaps the most frequently cited<sup>185</sup> modern case on reasonable royalties is a 1970 district court opinion, *Georgia-Pacific Corp. v. United States Plywood Corp.*,<sup>186</sup> which catalogued some fifteen factors that courts over the years had considered in assessing reasonable royalties.<sup>187</sup> In any given case, however, a court \*39 is likely to focus on only a small number of these factors, such as other royalty rates to which the patent owner and willing licensees have agreed,<sup>188</sup> or the hypothetical amount to which a willing licensor and licensee would have agreed at the time of infringement.<sup>189</sup> In the alternative, some courts have applied the so-called "analytical" approach, under which the defendant's rate of return on noninfringing merchandise is subtracted from his rate of return on infringing goods; the resulting rate, multiplied by the number of infringing sales, is awarded as a reasonable royalty.<sup>190</sup> These various approaches, however, are not necessarily mutually exclusive in every case. The amount a willing licensee would have agreed to pay, after all, is constrained by the amount he could have expected to earn on sales of \*40 other goods;<sup>191</sup> and the willing licensor/licensee approach itself may be viewed more as a matter of emphasis than as a rejection of the other factors set forth in *Georgia-Pacific*.<sup>192</sup>

As a matter of logic, the willing licensor/licensee approach suggests that the range of possible royalties the parties would have agreed to (assuming that they would have agreed to anything—an important qualification, as we shall see) as of the date the infringement began<sup>193</sup> should fall between the maximum incremental profit<sup>194</sup> (or cost saving)<sup>195</sup> the infringer could have expected to earn from use of the invention and the maximum profit the patentee could have expected to earn from her next-best alternative to licensing the invention. Courts generally seem to recognize this logic,<sup>196</sup> though subject to two important exceptions.<sup>197</sup> The first is \*41 that, for purposes of these hypothetical negotiations, the patent is presumed to be valid and the defendant's proposed use infringing,<sup>198</sup> despite the fact that the parties to real negotiations almost certainly would have discounted the value of the license to reflect uncertainty with respect to both validity and infringement.<sup>199</sup> The presumption nevertheless makes economic sense, because an award that reflected the parties' uncertainty at the time of the hypothetical negotiations in effect would require the plaintiff to bear the risk of uncertainty twice: first, at the time of those negotiations, and second when deciding whether to proceed to trial.<sup>200</sup> Second, courts sometimes take into account events that have occurred after the infringement, such as the patent's having met with commercial success, despite the fact that this success may have been unanticipated at the time of the hypothetical negotiations.<sup>201</sup> As Sherry and Teece point out, this use of hindsight is analogous to \*42 awarding the owner of a stolen lottery ticket the ex post value of the ticket (either \$0 or \$1,000,000, depending on whether the ticket was a winner) rather than its expected value ex ante (\$1,000,000, discounted by the very low probability of its being a winner).<sup>202</sup> In theory either ex ante or ex post damages should be sufficient to deter infringement,<sup>203</sup> although the use of such "ex post" data may be more consistent with most people's intuitive sense of justice and fair play.<sup>204</sup>

Critics nevertheless have perceived two major problems with using the willing licensor-licensee standard to estimate the amount of a reasonable royalty. The first is that the standard may not have a sufficient deterrent effect, to the extent that an award of what the defendant would have paid absent the infringement leaves him no worse off for having infringed.<sup>205</sup> This critique, however, does not take account of the defendant's litigation costs and attorney's fees, or of his potential exposure (in cases of willful infringement) for treble damages and plaintiff's attorney's fees. Moreover, this critique does not recognize the substantial costs that accompany an injunction, which thereby renders the infringer's inventory valueless. Finally, at least one court has responded to this argument by emphasizing that under *Georgia-Pacific*, the willing licensor/licensee concept is only one factor to be considered among others in setting the amount of the royalty<sup>206</sup> (although the Federal Circuit has also

cautioned against awarding a “kicker” as a means of compensating the patent owner for litigation and other expenses).<sup>207</sup> The second, more fundamental critique is that a willing buyer and seller might not have reached agreement on any \*43 royalty ex ante, because the patent owner would have expected to earn more from making, using, or selling the invention than from licensing it to the defendant.<sup>208</sup> Of course, in such a case, the patent owner should be entitled to recover her lost profit unless, for some reason, she is unable to prove the amount of the lost profit with the requisite degree of certainty.<sup>209</sup> In this instance, a reasonable royalty is really a substitute for the patent owner’s lost profit, rather than compensation for some actual forgone royalty,<sup>210</sup> and logically should exceed the infringer’s expected profit. In fact, courts sometimes have suggested that it may be appropriate for a reasonable royalty to exceed the profit the infringer could have expected to earn from the use of the invention, though without explaining the economic logic behind this conclusion.<sup>211</sup>

A final issue that arises from time to time is whether the royalty should reflect the profit expected to be earned on sales of an entire product in cases in which the patent covers only a component (or on sales of complementary goods, in \*44 cases in which such goods are typically sold along with the patented product). In such instances, courts apply the EMVR in the same way as when dealing with lost profits; thus, a component that is the “basis for the demand” for an entire product should result in a royalty based upon the profit earned from the entire product.<sup>212</sup> Where the patented invention does not have this effect, courts sometimes claim to base the royalty on the invention’s more limited contribution to the infringer’s profits, that is, to apply an apportionment principle.<sup>213</sup>

Even here, however, the use of an apportionment principle as traditionally understood—that is, as entitling the patentee to a recovery based only on the patented features of an invention comprising patented and nonpatented components—is problematic. If the use of the patented component is expected to increase the licensee’s sales of the final product (because some consumers want a final product that incorporates that component) or reduce his costs (and, concomitantly, increase some sales for that reason as well), thereby making him better off than he otherwise would have been in the amount of \$x, an agreed-upon royalty should be some portion of \$x. If the apportionment principle means only that “x” will be a small number if the patented component is a relatively minor innovation, we have no quarrel with it, but again this is not apportionment in the traditional sense.

As this discussion shows, the transition toward a but-for and proximate causation framework in patent law has been anything but smooth, both in terms of the justification for this framework and in terms of its application. In the following parts, we present an economic argument for applying the standard tort-law concepts of but-for and proximate causation in patent law. As we shall see, this approach radically simplifies the law, by rendering the EMVR and Panduit irrelevant, while at the same time demanding a much more sophisticated understanding of the economic consequences of infringement.

## II. Cause-in-Fact

In this Part, we examine the advantages and disadvantages of a general rule awarding the patent owner such damages as will restore her to the position she would have occupied but for the infringement. We begin by demonstrating how a cause-in-fact standard might promote both invention and disclosure, at least in cases in which the patent owner herself makes use of her patented invention. We then discuss (though ultimately reject) an argument, suggested by recent work of Ayres and Klemperer, that the social cost of awarding the patentee 100% of her but-for damages may exceed the social benefit.

### \*45 A. The Goals of the Patent System

Our analysis of cause-in-fact is based upon the premise that the principal goals of the patent system are to encourage the discovery and dissemination of new ideas,<sup>214</sup> although there are other possible goals as well.<sup>215</sup> More precisely, we shall assume that the optimal patent system maximizes social value, defined as the difference between the social benefits of invention and disclosure, on the one hand, and the social costs, on the other. Ideally, the costs and benefits of the patent system should be measured relative to the costs and benefits society would incur from alternatives to a patent system. One alternative would be no government involvement at all in the inventive process, in which case inventors would have to rely upon other measures (principally first-mover advantages,<sup>216</sup> secrecy,<sup>217</sup> or contracts<sup>218</sup>) to recoup their investment in invention. For better or worse, the patent system assumes that these alternatives are insufficient. Other alternatives to the patent system might include a system of cash rewards or prizes, or direct government funding of research and development. Although both of these alternatives are used to some extent (consider the use of grants administered by agencies such as the National Institute of Health, or the awarding of Nobel Prizes), and commentators sometimes argue for greater reliance upon them,<sup>219</sup> a

principal drawback is that they require the government to value innovation, or to decide which projects are likely to produce value in the future.<sup>220</sup> Reliance upon a patent system therefore reflects a judgment that the market is likely to be a better judge of these matters, and less susceptible to regulatory capture, than is the government.<sup>221</sup>

In opposition to the social benefits are four social costs of a patent system. The first is the systemic cost of processing, enforcing, and maintaining patent rights, which requires at a minimum a patent office and courts to resolve patent infringement claims.<sup>222</sup> Second is the potential for the patent system to inhibit future innovation based upon existing patented inventions. Innovation tends to be cumulative, and thus one consequence of a patent system is to raise the cost of creating follow-up innovations based upon a pioneering invention.<sup>223</sup> Third is the cost of duplicative efforts on the part of multiple inventors to invent the same thing.<sup>224</sup> This cost of course would arise-and perhaps be even more problematic-in the absence of a patent system, but variations in the substantive law of patents can ameliorate it in varying degrees.<sup>225</sup> Fourth is the potential deadweight loss attributable to the conferral of exclusive rights in patented inventions.<sup>226</sup> Although few patents ultimately lead to full-blown monopoly power in any meaningful economic sense, most commercially successful patents probably do give rise to some degree of market power, with the attendant deadweight loss to social welfare.<sup>227</sup> From an economic standpoint, the creation of a patent system therefore reflects a judgment that the social benefits of conferring exclusive rights upon inventors outweigh these potential social costs, and that the difference between cost and benefit exceeds the difference under alternative schemes.

The theory behind a system of patent rights can be illustrated by means of a simple example. Let  $C$  represent the total cost to the would-be inventor of conducting the search for a patentable invention. That is,  $C$  represents expenditures on equipment, supplies, labor, and materials that are necessary to conduct the inventive effort. In the event that the investment produces an economically useful idea, it will yield profits to the inventor over the economic life of the idea ( $T$ ). If we denote the profit in period  $t$  as  $\pi_t$ , the net present value (NPV) to the inventor of the investment is

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\*47 or in a more compact form

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where  $r$  is the discount rate and  $\Sigma$  is the summation operator.<sup>228</sup> Thus, the net present value of the effort is equal to the discounted present value of the flow of future profits minus the cost of creating the idea that generates the future flow of profits.

On these assumptions, the managerial investment criterion is straightforward: if the NPV is positive, the investment should be undertaken because the discounted present value of the future profit flow exceeds the cost of creating the idea.<sup>229</sup> In that case, the investment will bestow a positive benefit upon the inventor and (if the theory is correct) upon society as well. We should note, however, that investing in the creation of new inventions is fraught with risks.<sup>230</sup> First, one cannot be sure that the inventive effort will bear fruit, i.e., the search for a better mousetrap may not pan out. Second, even if the inventive effort bears fruit, there may be no market for the idea. It could be that some other idea is better, or it could be that no one wants a product embodying the idea. For example, a new pharmaceutical may have sufficiently unpleasant side effects that few will buy it. Third, the cost of creating the idea may not be known at the outset. The effort may take more time than anticipated, more testing, more expensive materials, and so on. Finally, there is the risk of infringement, i.e., the risk that someone will appropriate at least part of the value of the idea. In what follows, we ignore all of the uncertainties except for the possibility of infringement.<sup>231</sup>

What makes infringement likely, in the absence of enforceable patent rights, is the fact that information and ideas, while often costly to produce, may be relatively easy to reproduce and disseminate to others.<sup>232</sup> The relative ease of reproduction encourages competition with the inventor, which in turn threatens to reduce the inventor's expected profit  $\pi$  (and, therefore, NPV) without affecting the value of  $C$ . Indeed, the copier may operate at a competitive advantage vis-a-vis the inventor, who (unlike the copier) must recoup the cost  $C$  of creating the invention in the first place. Foreseeing this possibility in advance, the inventor has three options. The first is to proceed with the invention and keep it secret. This option may be costly, however, and in some cases altogether impossible if the resulting product is to be marketed to the public. A second option is to invent and disclose, in the hope that the advantage of being a first mover will be sufficient to allow the inventor to recoup  $C$ . If first-mover advantages are insufficient, however, the inventor may opt instead not to invest in the invention at all. The result may be an underproduction of ideas that would confer net social benefits, whenever the private cost  $C$  exceeds

the private benefit to the inventor.<sup>233</sup>

On this reasoning, the Patent Act's conferral upon the patentee of the right to exclude others from making, using, or selling the invention for a period of time can be viewed as a means for correcting a potential failure in the market for the production and dissemination of new ideas. As we have noted in previous work, U.S. law protects patent entitlements by means of a property rule, which entitles the owner to enjoin infringing behavior, rather than by means of a liability rule, which would allow one to infringe and pay damages indefinitely.<sup>234</sup> One consequence of this approach is to encourage would-be users of the patented invention to negotiate with the patent owner, the theory being that the outcome of these private negotiations is likely to result in a license fee that more accurately reflects the value of the invention than would a compulsory-licensing fee set by the government.<sup>235</sup> A second consequence is that, if the system works perfectly and infringement is preemptively deterred or enjoined before it can have any effect, the patentee stands to earn NPV over the course of her patent term. In effect, the patent system presumes that allowing the patent owner to recover NPV is necessary to induce her to invent and disclose her invention.<sup>236</sup>

The question nevertheless remains which damages rules to apply in cases in which infringement continues for a period of time before an injunction is entered. We have argued in previous work that, if the above assumptions are correct, the court should award damages that render the patent owner no worse off as a result of **\*49** the infringement (so as to preserve her incentive to invent and disclose) and the infringer no better off (so as to preserve his incentive to negotiate for a license).<sup>237</sup> In this regard, we have argued that the optimal rule is to award the patent owner the greater of her own lost profit or the defendant's profit attributable to the infringement.<sup>238</sup> The courts, however, have interpreted the current Patent Act as precluding the latter option, such that the patent owner instead may recover the greater of her lost profit or a reasonable royalty.<sup>239</sup> Nevertheless, if courts are reasonably competent in estimating the license fee to which the parties would have agreed ex ante (a big "if"), this rule may work just as well to induce the desired behavior.<sup>240</sup> In the sections that follow, we discuss in greater detail exactly what the patent owner's compensation should comprise under this rule. We then consider a challenge to the underlying premise that the patent owner must recover NPV in order to preserve her incentive to invent.

## **B. But-for Compensation**

As the preceding section suggests, a but-for rule requires the court to restore the patentee to the position she would have occupied had the infringement never occurred. This restoration requires, most obviously, an accurate calculation of either lost profits or lost royalties, with lost profits defined as the difference between the profits the patentee actually earned and the amount that she would have earned but for the infringement and lost royalties as the sum of the royalties the parties would have agreed to but for the infringement. With respect to lost profits, the (relatively) easy task is to measure the patentee's actual profits. The more difficult job is to measure the amount that would have been earned absent the infringement, although as noted above once the plaintiff has proven fact of injury she faces a somewhat lower burden in proving the amount of damages suffered.<sup>241</sup> With respect to lost royalties, as discussed above, it may be feasible to assess the range of possible royalties the parties would have considered, although the **\*50** reconstruction of the actual agreed-upon royalty may involve some guesswork concerning the parties' relative bargaining strength.

Before proceeding further with our analysis of but-for profits and royalties, however, we should note a few straightforward implications of the but-for rule that are imperfectly reflected in the governing legal standards. The first implication is that a pure but-for damages system would take account of the fact that litigation is expensive<sup>242</sup> by awarding the patent owner all of the costs of litigation, including attorney and expert witness fees, out-of-pocket expenses for filing, copying, and the like, and the opportunity costs of the plaintiff's time.<sup>243</sup> In reality, however, the recovery of costs is much more circumscribed. Although there is little case law on point, it would appear that courts interpret the statutory mandate to award the prevailing plaintiff "costs as fixed by the court"<sup>244</sup> as encompassing only such commonplace items as docket and witness fees.<sup>245</sup> We are aware of no cases (in this or any other field) in which courts have awarded opportunity-cost damages. Moreover, in keeping with the so-called American rule,<sup>246</sup> the Patent Act authorizes awards of attorney fees only in "exceptional cases,"<sup>247</sup> which generally means only when the defendant willfully infringed.<sup>248</sup> The law is nevertheless consistent with a **\*51** second implication of the but-for rule, which is to account for the passage of time that elapses from the date of infringement to the date of judgment, and from the date of judgment to the date of payment.<sup>249</sup> As we have seen, the Supreme Court has held that courts normally should award prejudgment interest to the prevailing plaintiff in a patent infringement suit,<sup>250</sup> consistent with the Patent Act's language permitting an award of "interest . . . as fixed by the court."<sup>251</sup> Postjudgment interest is assessed as in all civil cases pursuant to 28 U.S.C. § 1961.<sup>252</sup> Third, it is possible for damages to extend into the future beyond the time of trial. In such cases, courts properly reduce these future damages to present value so as to avoid overcompensating the

patentee.<sup>253</sup> We also have argued in previous work that a court may need to increase (or decrease) the award so to achieve the optimal level of deterrence, taking into account the likelihood that some acts of infringement may go undetected.<sup>254</sup>

### C. Lost Profits Revisited

The Patent Act provides for a damages award that is adequate to compensate for the infringement. We shall argue that, as a general matter, this standard requires a but-for measure of damages equal to the difference between the patentee's actual profits and the profits that would have been earned but for the infringement. In this section, we examine this measure with the assistance of some standard economic models. For the moment, we abstract from the litigation costs. As we shall see, \*52 there is no simple formula for capturing the damages suffered. The actual damages depend upon the behavior of the infringing entrant, the behavior of the patentee, cost conditions, and the reactions of buyers.

Let us begin with a relatively simple case and a concrete numerical example. The patentee produces widgets at a constant marginal (and average) cost of \$40. The demand for widgets can be expressed as

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by producing where marginal revenue and marginal cost are equal.<sup>256</sup> In this case, the patentee will produce where

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Solving this equation for  $Q$  yields the optimal (i.e., profit maximizing) quantity, which is 300. Substituting this quantity into the demand function (equation (1) above) provides the profit maximizing price, which is 70. The patentee's maximum profit is then

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or \$9,000. This is the patentee's maximum profit if there is no infringement; therefore, it provides a benchmark for comparison.

#### 1. Infringement: The Cournot Case

If infringement occurs, we must know something about the behavior of the infringer and the patentee to determine the economic effect of infringement. There are several cases to consider. We begin with the Cournot case in which the firms compete by setting quantities.<sup>257</sup> For analytical simplicity, suppose that the \*53 infringing entrant can produce widgets at the same cost as the patentee. The impact of infringing entry depends upon the appropriate time horizon. We investigate two cases: (1) the case where infringement is discovered immediately, but the patentee was unaware of the impending entry; (2) the case where the patentee was aware of the impending entry and is initially unaware that the entrant will infringe.

Hit-and-Run Infringement. Consider the case where the infringer plans on being in the market for a single period, perhaps because he expects to be detected quickly. Under these conditions, the infringer must select an output that provides maximum profit for that one-shot infringement. Suppose that the infringer has observed the patentee producing 300 units prior to its entry. If neither cost nor demand changes, the infringer will expect the unwary patentee to continue producing 300 units. In that event, the infringer observes a residual demand of

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where  $Q_i$  is the output of the infringing entrant,<sup>258</sup> and will find it optimal to produce an output of 150.<sup>259</sup> Since the patentee will produce 300, the total quantity in the market will be 450. Substituting 450 into the demand function (equation (1)), we find that the price has fallen to 55. As a result, the patentee's profit will fall to

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or \$4,500, i.e., one-half of its former level.

There are several things to note here. First, the patentee's damages are equal to the difference between her actual profit of \$4,500 and the but-for profit of \$9,000, i.e., damages are equal to \$4,500. Second, the profit to the infringer<sup>260</sup> is only \$2,250, which means that the damages suffered by the patentee are much larger than the illicit gains of the infringer. Thus, restitution, which is not currently an option, would undercompensate the patentee and thereby fail to fully restore the **\*54** incentive for inventive effort.<sup>261</sup> Finally, the damage is entirely due to price erosion. The patentee continues to sell its pre-infringement quantity, but because of the infringer's production, the price is reduced.

**Figure 1**

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These results can be seen quite clearly in Figure 1. Demand and the associated marginal revenue are shown as D and MR, respectively. The constant marginal (and average) production cost is shown as MC. Profit maximization leads the patentee to produce 300 units of output because marginal revenue equals marginal cost at that quantity. The price will be \$70 while the unit cost is \$40. The profits, which are  $(\$70 - \$40)(300) = \$9,000$ , are shown in Figure 1 as area abdc. Infringement leads to a total output of 450--300 units will be produced by the patentee and 150 by the infringer. For this quantity, the price will be \$55 and the **\*55** patentee's profit will fall to  $(\$55 - \$40)(300) = \$4,500$ , which is shown as area efcd. Infringement causes the patentee's profits to drop by area abfe. It is obvious from the graph that this loss is due to price erosion as the quantity is 300 in both cases while price has fallen from \$70 to \$55.

Multi-Period Infringement. Instead of hit-and-run infringement, the infringer may establish a presence in the market before the infringement is discovered. In this case, the patentee will know about the existence of the infringer, but will be unaware that the new entrant's product actually infringes its presumably valid patent. If the patentee and the infringer compete in quantities, then they have to adjust their outputs while taking into account the presence of one another. The patentee's profit function will be

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Similarly, the infringer's profit function will be

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In order to maximize profits, the firms will want to produce where marginal revenue equals marginal cost:

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and

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The interdependence of the two firms can be seen quite clearly by solving conditions (6) and (7) for  $Q_p$  and  $Q_i$ , respectively:

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and

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Obviously, the optimal (i.e., profit maximizing) output of each firm depends on the output of the other firm.

An equilibrium exists when neither firm has an incentive to change its own output given the output of the other firm. This can be found by solving (8) and (9) simultaneously.<sup>262</sup> The result is that each firm will produce 200 units and, therefore, total output will be 400. Substituting this into the demand function yields a Cournot equilibrium price of \$60.

**\*56** Damages to the patentee equal the difference between the "but for" profit of \$9,000 and the actual profit when its

quantity equals 200 and the price is \$60. This will be

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Thus, the damage due to infringement will be \$5,000. In this case, the damage is partly due to the fall in price from \$70 to \$60 and partly due to a reduction in output from 300 to 200.

### Figure 2

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These results can be seen in Figure 2. The pre-infringement output is 300 and price is \$70. As before, profit is shown in Figure 2 as area abdc. Infringement leads to a Cournot equilibrium with price equal to \$60 and the patentee producing 200 units. Thus, the new profit level is represented by area efgc. In the graph, the difference between the actual profit and the “but for” profit is the irregular area abdgfe. If there were some point to attributing this loss to price erosion, sales diversion, and quantity accretion, one could do so.<sup>263</sup> But this is an unnecessary exercise.

## 2. Bertrand Behavior

If the patentee and the infringing entrant compete on price rather than quantity, they exhibit Bertrand behavior.<sup>264</sup> The results are the same for hit-and-run infringement and for a more permanent sort of infringing entry: the patentee’s actual profit falls to zero. Assuming that the goods produced by the patentee and the infringing entrant are identical and that buyers see them as being perfect substitutes, the hit-and-run strategy will be to set the price just below the patentee’s price. Since the products are homogeneous, everyone will switch to the entrant’s product. The patentee will sell nothing and, therefore, will earn no profits. In this case, the difference between the actual profit and the but-for profit will equal the full but-for profit. The infringing entrant will earn slightly less than the but-for profit of \$9,000 due to the slightly lower price that is charged. In this case, restitution closely approximates the damages suffered by the patentee.

Interestingly, the result is the same for the patentee when the infringing entrant establishes a more permanent presence. In that case, the two firms know that the firm with the lower price will make all of the sales. The best strategy for the patentee to adopt is to sell at the competitive price, which is equal to average cost. In our example, the patentee will sell at a price equal to \$40, which equals marginal and average cost. As a result, the patentee’s profits will fall from the pre-infringement level of \$9,000 to zero. Again, the damage due to infringement is equal to the but-for profit of \$9,000. In this case, however, restitution will not be an adequate measure of damages because the infringing entrant earns no profit.

## 3. Chamberlinian Behavior

Dissatisfied with the state of duopoly theory, Chamberlin suggested that the firms might optimally take into account each other’s presence by mutual accommodation.<sup>265</sup> Presumably, both firms know that competition will lead to total profits smaller than the pre-entry level of profits. This means that the firms might rationally restrain their competitive impulses and each produce one-half of the pre-entry output. In Figure 3, we can see that the pre-infringement profit was area abdc, which equals \$9,000. If the patentee and the infringing entrant each produce 150 units, total output will remain at 300 units and price will remain at \$70. The total profit of \$9,000 will be split evenly. Thus, the patentee’s actual profit of \$4,500 will be half of the but-for profit of \$9,000, and, therefore, the damage will be equal to \$4,500. In this case, there is no price erosion. All of the damage is due to sales diversion. Putting a label on the nature of the loss is unnecessary if one adopts a but-for measure of damages.

### Figure 3

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## 4. Summary

We can see from the examples above that the extent of the damages suffered depends upon the economic behavior of the patentee and the infringing entrant. These examples do not exhaust the possibilities, as there are other reactions to entry that we have not explored here. Moreover, the results will be different if the two firms have different costs of production. The results will also be different if the production costs increase with increases in output. We have also assumed that the infringing product is identical to the patented product and that buyers so view them. This, of course, may not be true. Product differentiation - real or imagined - will require further modification to the analysis. But whatever the essential features are \*59 they can be modeled and the difference between the actual profits and the but-for profits can be used as the measure of damages.<sup>266</sup>

#### D. Reasonable Royalties Revisited

As we have seen, a “reasonable royalty” can mean one of two things in patent law. First, it may mean the royalty that the parties would have agreed to ex ante, had the defendant chosen not to infringe. Accurately calculating this amount will depend in large part upon the accurate reconstruction of actual market conditions, along the lines discussed in the preceding subsection. For example, in cases in which the parties proceeded as Cournot oligopolists, the calculation of the reasonable royalty should be conducted in light of the profit each could have expected to earn from operating in this fashion. Presumably, the patent owner would have agreed to a royalty equal to no less than the profit she could have expected to earn from manufacturing the invention herself; the infringer would have agreed to a royalty equal to no more than the amount he could have expected to earn from using a non-infringing alternative. Of course, this framework makes economic sense only in cases in which the infringer is at least as efficient as the patentee. If the patentee can earn higher profits from manufacturing the product than from licensing it, the parties would not have agreed to any licensing agreement and the proper relief should be lost profits, if lost profits can be adequately proven.

A second type of reasonable royalty is awarded precisely in the latter type of case, when the patentee is unable to prove with the requisite certainty the amount of her lost profit. With regard to this type of award, economic analysis has relatively little to say, other than that the award should be greater than the amount of the defendant’s expected profit attributable to the infringement (which may be very difficult to estimate, to be sure). By making infringement unprofitable, an award of this nature should deter infringement and thereby preserve the incentive to invent. Ideally, a court should award the patentee the court’s best estimate of her lost profit, suitably discounted in light of the uncertainty that prevents the patentee from recovering directly under a lost-profits theory. In light of the inherently deficient information, however, there is little doubt that this exercise will be plagued by measurement error.

#### E. The Importance of Notice or Search

Implicit in the preceding sections is the premise that the infringer knows that his conduct is infringing. A more realistic analysis, however, is complicated by two additional factors: namely, that patent infringement is a strict liability tort,<sup>267</sup> and that independent discovery of an already patented invention is not a defense.<sup>268</sup>

\*60 If we accept these parameters as given, the question arises whether it is optimal to award substantial but-for damages when the infringer was “innocent,” in the sense that he independently invented the same invention as the patentee, and then marketed that invention without knowledge of its patented status.

We can model this dilemma in the following manner. Let us assume that there are two potential inventors, A and B, and that the governing rule is that the patent owner can recover all of her damages caused in fact by the infringement, whether or not the infringer has prior notice of the patent. Let us assume further that A decides at time  $t_1$  whether to invest in creating a new invention which, if invented, will be patented and marketed at time  $t_2$ . Finally, A must decide at time  $t_2$  whether to put B on notice of A’s patent. At time  $t_1$ , A’s expected return ( $E[R]$ ) if A does not give notice at time  $t_2$  is

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\*61 where  $\pi_A$  is A’s expected profit from the invention;<sup>269</sup>  $L_A$  is A’s expected cost of litigating a patent infringement suit; and  $p$  is A’s subjective probability that a latecomer will independently discover and market the same invention at time  $t_3$ , thus necessitating a suit at time  $t_4$ .<sup>270</sup> Alternatively, let us assume that if A provides notice at time  $t_2$ , B will not invest in creating the same invention. Thus, A’s expected return if A gives notice at time  $t_2$  is

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where  $c_A$  is the cost of putting B on notice.<sup>271</sup> A will choose to put B on notice only if  $c_A < pL_A$ . Whenever A puts B on notice, B's expected return is zero.

Assuming that A does not give B notice, B must decide at time  $t_2$  whether to invest in creating a new invention, which if successful will be marketed at time  $t_3$ . B's expected return depends not only on his expected profit from marketing this invention, but also on the probability that his invention will accidentally infringe an existing patent. To reduce the latter possibility, B may decide to conduct a pre-invention search. B's expected return if he does not search is

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where  $\pi_B$  is B's expected profit from marketing his invention;  $r$  is B's subjective probability that his invention will infringe a valid patent and that he will be sued successfully;  $d$  represents the expected damages award that B will incur if he infringes;  $s$  represents certain sunk costs;<sup>272</sup> and  $L_B$  is B's litigation costs if he is sued. If B decides to conduct a pre-invention search, his expected return is equal to the probability that his invention does not infringe a valid patent ( $1 - r$ ), multiplied by the profit that he could earn by marketing his invention minus the cost of the search. This can be written as

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\*62 where  $c_B$  is the cost of conducting a search (for example, by reviewing existing patents). B will search only if the expected return from doing so exceeds the expected return without a search, i.e., if

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If A and B are equally efficient,  $\pi_B$  will equal  $d$ , because  $\pi_B$  will equal A's lost profit. In that event, a search will occur provided that  $c_B < r(s + L_B)$ . If A is more efficient than B, the damages award ( $d$ ) will exceed B's profit ( $\pi_B$ ). In that event, a search will be optimal if  $r(\pi_B - d) + c_B < r(s + L_B)$ . Since  $(\pi_B - d)$  is negative,  $r(\pi_B - d) + c_B < c_B$  and a search is more likely than when B expects his potential competitor A to be only equally efficient.<sup>273</sup>

To illustrate a case in which this game might lead to a suboptimal result, let us suppose that A's expected profit is high; B's expected profit, because B is a much less efficient producer than A, is relatively low; A's expected damages, including lost profits on the sale of collateral goods, is high; the probability of independent discovery, as well as the cost of putting B on notice, is low; and the probability of infringement, the cost of searching, and each party's litigation cost is moderately high. For example, assume that  $\pi_A$  is \$20,000;  $\pi_B$  is \$2,000;  $d$  is \$10,000;  $p$  is 0.10;  $r$  is 0.50;  $c_A$  is \$200;  $c_B$  is \$1,000; and  $L_B$  is \$1,000. On these facts, A's expected payoff if A gives no notice is  $\$20,000 - (\$1,000)(0.1) = \$19,900$ ; her expected payoff if she gives notice is  $\$20,000 - \$200 = \$19,800$ . She therefore will not give notice. Absent notice from A, and assuming no sunk costs, B's expected payoff if he does not search is  $(\$2,000) - (\$10,000 + \$1,000)(0.50) = -\$3,500$ , whereas his expected payoff if he searches is  $(\$2,000)(1 - 0.50) - \$1,000 = \$0$ . B, therefore, is as well off not investing in the invention at all, even though half the time he would create a marketable, noninfringing product.<sup>274</sup> B will be deterred from inventing even when A does not exist, as long as the probability of A's existence is large enough.

Now suppose instead that A cannot recover damages unless B has knowledge of A's patent. If A does not put B on notice, A's expected return is the probability that B will not independently discover and subsequently market A's invention ( $1 - p$ ) multiplied by the expected profit ( $\pi_A$ ), plus the probability of B's independently inventing and marketing A's invention ( $p$ ) multiplied by a quantity equal to the sum \*63 of the reduced profit that A will earn due to the infringement ( $\pi_A'$ ) minus the cost of litigation to obtain an injunction ( $L_A'$ ):

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Again, if A gives notice at time  $t_2$ , B will not invest in creating the infringing invention, and so A's expected return is

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A, therefore, has an incentive to give notice whenever the expected return from doing so exceeds the expected return without notice. This will be true when

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This condition can be expressed as

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Thus, notice will be given when the cost of doing so is less than the expected reduction in profit,  $p(\pi_A - \pi_A')$ , plus the expected cost of obtaining an injunction,  $pL_A'$ . B's expected return if notice is given is zero.

If A's only remedy is injunctive relief when she fails to give notice, it is unlikely that B will have an incentive to search. As before, B's expected return if he searches is given by

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B's expected return if no notice is given and B does not search is

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where  $\pi_B'$  is B's profit if he is enjoined at time  $t_1$  after marketing the invention at time  $t_2$ , but no damages are assessed; and  $L_B'$  is B's litigation expense. B will conduct a search only when A does not provide notice and the expected return with a search exceeds the expected return without a search, i.e., when

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This reduces to  $-c_B > r(\pi_B' - L_B')$ . As long as  $\pi_B'$  exceeds  $L_B'$ , this condition cannot be satisfied because the left-hand side is always negative and the right-hand side would be positive. In other words, B will search only in a subset of cases in which his expected litigation costs exceed his expected profits in the event that his invention infringes.<sup>275</sup>

\*64 Using the hypothetical numbers above, and assuming further that  $\pi_A'$  is \$10,000,  $\pi_B'$  is \$1,000, and  $L_A'$  and  $L_B'$  are each \$500, A's expected return if no notice is given is  $\$20,000(1 - 0.10) + (\$10,000 - \$500)(0.10) = \$18,950$ . A's expected return with notice is  $\$20,000 - \$200 = \$19,800$ . A, therefore, will provide notice, and B's actual payoff will be zero. Importantly, if A did not exist, B would proceed with his invention and enjoy an actual return of \$1,000.

We deliberately chose the hypothetical numbers in the above example to illustrate a case in which a rule requiring the defendant to pay but-for damages could deter the defendant from engaging in potentially beneficial conduct. With other numbers, that risk could be increased or diminished. Moreover, conditioning A's right to recover damages upon the provision of notice to B reduces A's expected return from inventive activity to some degree; whether this reduction in incentive will be significant may vary from case to case. A nevertheless will choose to provide notice whenever the expected benefit of doing so exceeds the expected cost. Likewise, when the burden is instead allocated to B, B will conduct a search as long as the expected benefits exceed the cost. B's assessment of those benefits will depend upon his estimate of: (1) the probability that someone else has already invented and patented the same invention; (2) his likely damages in the event of infringement; and (3) his expected cost of litigation.<sup>276</sup> Whether the law should require notice as a condition of recovering damages depends upon whether such a rule would encourage more inventive activity than it would inhibit, and this is a difficult question to answer on a priori grounds.

As we have seen, Patent Act § 287 resolves the issue to some extent by precluding a patentee from recovering damages for any infringement occurring prior to the patentee giving either actual notice of the infringement or, by marking, constructive notice of the patent.<sup>277</sup> Once the defendant is put on notice, his choice is to either infringe or not infringe. At this point, as discussed above, the logical choice, if we wish to deter infringement, is to render him potentially liable for any lost profits. The marking statute, nevertheless, has several imperfections that may preclude the smooth operation of this notification system. First, even when the plaintiff properly marks all of the articles she makes and sells, there is no requirement that the defendant actually encounter any of those articles. Because marking provides only constructive notice, it leaves open the possibility that an "innocent" defendant who independently discovers the same invention, but who has not been exposed to the marked articles, could be liable for damages. Theoretically, the defendant could be liable for damages in cases in which the cost of the search exceeds the expected benefits; for example, when the plaintiff markets only a few token articles (all of which are, however, properly marked). Second, the requirement does not apply to things that cannot be marked, such as patented \*65 processes.<sup>278</sup> A defendant, therefore, may be liable for damages caused by virtue of his infringement of a

process, even if he has no knowledge of the patent. Third, with respect to cases in which the patentee does not mark her articles, courts have construed the word “notified” in § 287 to mean that the patentee must provide the alleged infringer with actual, specific notice of the infringement, even if the infringer already has actual knowledge of it.<sup>279</sup> Requiring the patentee to notify a knowing infringer, however, wastes social resources.<sup>280</sup> It also gives the knowledgeable infringer an incentive to continue infringing until actual notice is provided.<sup>281</sup> A fourth problem is illustrated by King Instrument, in which the plaintiff markets no products covered by the patent.<sup>282</sup> In such a case, a defendant who has no knowledge of the patent could be liable for lost profits on sales of whatever goods the plaintiff does sell, if those goods compete with the infringing product. If the optimal rule is to require “A” s, rather than “B” s, to bear the cost of notice/search, this application of § 287 reduces social welfare.<sup>283</sup> In light of these problems, the marking statute either goes too far or not far enough, depending on one’s analysis of the notice and search cost problem. If the optimal rule is to hold only knowing infringers liable for damages, Congress should amend the statute to require either actual or constructive notice in all cases, or else proof of actual knowledge. If the optimal rule is instead to require users to search, the marking statute serves no purpose and should be abolished.

As noted, the question of whether it is preferable to require notice or knowledge as a condition of damages recovery or whether would-be users should bear the burden of searching cannot be conclusively resolved a priori. Given that every “A” can be a “B” with respect to some earlier inventor, however, there are several reasons that lead us to suspect that the better rule is to require either notice or actual knowledge as a prerequisite to damages liability. The first is that the cost of searching is likely to be substantial. Because patents last for a long time (up to \*66 twenty years),<sup>284</sup> the number of patents B would have to search to be confident that his product does not infringe may be in the thousands. Of course, B may have an incentive to search even in the absence of damages liability, due to the possibility of injunctive relief; there is no getting around this problem, as long as independent discovery is not a defense.<sup>285</sup> Rendering B liable for damages as well, however, only increases the burden of conducting a thorough search. Second, the burden of putting potential users on notice may not be severe, as long as we accept some form of constructive notice, whatever its defects, as sufficient. (Allowing patentees to recover damages from users with actual knowledge in lieu of notice might help to alleviate this burden as well.) If so, then the patentee may be able to avoid the harm of infringement at a lower cost than can the potential user. In other words, if the cost of notice is relatively low compared to the potential gains to A, and the cost of searching is relatively high in comparison with the potential gains to B, the risk of deterring B from inventing may outweigh the reduction in expected profit to A. Particularly if other incentives to be first in the market with a new product already exist, a relatively small decrease in A’s expected profit due to providing notice may have little effect on A’s incentive to invent; by contrast, if the cost of the search would in some cases deter or inhibit invention, due to the fear of ruinous liability, the effect on social welfare could be substantial. A third consideration is that placing the burden on the patentee in effect allows patentees to signal whether they are interested in maximizing their potential damages recovery. Those who choose not to put potential infringers on notice may, in some cases, induce some degree of pre-injunction infringement; but, if the losses attributable to this interim infringement have no effect on the patentee’s ex ante incentives, this interim infringement benefits the public by reducing price and increasing output. Fourth, as we discuss in the following section, the case for allowing nonmanufacturing patent owners to recover lost profits on sales of goods that compete with infringing products is a close one. To the extent there are good reasons to permit this recovery, however, those reasons are significantly weaker if the infringer is not aware that his product infringes (and the potential anticompetitive effect of this rule is more serious). These conclusions are tentative, but they suggest some advantages of a notice/knowledge system. In the sections that follow, we will assume the existence of either notice or actual knowledge on the part of the defendant; absent this condition, our conclusions in favor of the recovery of lost profits on sales of unpatented goods are much weaker.

## **F. Challenging the But-for Causation Standard**

In a recent article, Professors Ayres and Klemperer argue that, contrary to the conclusions we have sketched above, social welfare would increase if patent owners were entitled to recover only some portion, less than 100%, of the losses \*67 they incur as a result of infringement.<sup>286</sup> Although we agree that, as in other tort-law contexts, principles of proximate causation should at some point limit the patent owner’s right to recover for “remote” harms (such as loss of profits on goods that are only weakly complementary to the patented product, which we discuss below), Ayres and Klemperer advance the more sweeping proposition that courts should compensate patent owners for only a portion of their direct, proximately-caused injury.<sup>287</sup> In our view, however, both theoretical and practical difficulties render this thesis less than compelling for purposes of establishing a rational damages regime. Of course, even if we are wrong and Ayres and Klemperer are right, their thesis does not affect our observations below concerning proximate causation.

Ayres and Klemperer present their partial damages thesis in connection with the broader argument that some degree of delay

and uncertainty in the enforcement of patents would increase social welfare.<sup>288</sup> Specifically, Ayres and Klemperer observe that a small reduction from a monopolist's profit-maximizing price will cause a disproportionately large reduction in the attendant deadweight social welfare loss; thus, they argue, measures that limit the patent owner's ability to exploit her market power to the maximum would be justified by the resulting increase in consumer welfare.<sup>289</sup> To illustrate, suppose that the patentee/monopolist faces demand, marginal revenue, and marginal cost curves identical to those depicted in Figure 1. Recall that the profit-maximizing price is \$70, quantity is 300, and the patentee's profit is \$9,000. Monopoly causes an allocative welfare loss (usually referred to as a deadweight social welfare loss, or "deadweight loss") resulting from the monopolistic restriction of the quantity produced.<sup>290</sup> In our example, the deadweight loss is equal to  $(70 - 40)(300)$ , or \$4,500 (equal to triangle bdc). Now assume that the monopolist reduces her price by 1%, to \$69.30. The corresponding quantity sold is 307, and the patentee's profit falls to  $(\$69.30 - 40)(307) = \$8,995.10$ --a reduction of only \$4.90, or five one-hundredths of one percent (0.05%). The impact on social welfare, however, is quite substantial: the deadweight loss is now only  $(\$69.30 - 40)(293) = \$4,292.45$ , which amounts to a change of \$207.55 (4.6%). Thus, a minute reduction of the patentee's profit (0.05%) leads to a disproportionately large decrease in the social welfare loss (4.6%). Based on a similar analysis, Ayres and Klemperer argue that constraining patent owners from charging the full monopoly price may substantially reduce the deadweight loss attributable to the exercise of patent rights, while at the same time having relatively little effect on the patent owner's incentive to invent and \*68 disclose.<sup>291</sup> They further argue that awarding the patent owner less than 100% of her but-for profit may have a similar effect of inducing limited amounts of infringement, without materially affecting her ex ante incentive to invent.<sup>292</sup>

To illustrate this latter point, suppose that the patentee and infringer face identical marginal cost curves, and that they compete as Cournot oligopolists as depicted in Figure 2. Assume further that the patent owner is entitled to recover as damages 75% of her lost profit of \$5,000, that is, \$3,750. On these facts, and ignoring for the moment the cost of litigation, the infringer makes a profit net of damages of \$250 (that is, \$4,000 - \$3,750), before being enjoined from further infringement. As Ayres and Klemperer note, under such a system "interim producers would be certain to pay damages, but because the damages would not increase the patentee's payoffs to the monopoly level, limited amounts of infringement would occur."<sup>293</sup> Moreover, during this period of interim infringement, the deadweight loss in our example decreases by over 55%, from \$4,500 to \$2,000.<sup>294</sup> If the additional \$1,250 the patent owner would have recovered under a make-whole regime is not material to her ex ante incentive to invent, this result is efficient, in that consumers obtain the benefits of the invention at a lower social welfare cost. Ayres and Klemperer therefore argue that rules resulting in awards of "partial damages . . . on the order of say 70-90% . . . of the losses relative to full monopoly profit"<sup>295</sup> might "induc[e] limited amounts of infringement without unduly lessening innovation incentives,"<sup>296</sup> and thus would be "generally socially beneficial."<sup>297</sup> As an example of such a rule, Ayres and Klemperer cite the Panduit standard, which as they note "often mean[s] that instead of being awarded lost profits (what amounts to make-whole damages), patentees must settle for the smaller reasonable royalty measure."<sup>298</sup>

We nevertheless remain skeptical of partial damages regimes for several reasons. The first is that, for a partial damages rule to work as intended, the proportion of damages awarded to the patent owner must be calculated with sufficient precision to induce only limited infringement, on the one hand, and to avoid deterring inventive activity, on the other. In our hypothetical above, for \*69 example, setting the percentage of damages recoverable at 80% or higher would not induce limited infringement because it would leave the infringer with zero (or negative) profits net of damages.<sup>299</sup> (Indeed, even if damages were set at a percentage below 80%, the infringer might retain no net profit after litigation expenses, which we ignored in our example above; patent litigation is reputed to be the most expensive form of litigation in existence, on average outstripping even antitrust.)<sup>300</sup> Setting damages at some lower percentage, on the other hand, would at some point induce limited infringement and thereby reduce the deadweight loss (in the amount of about 55% in our example). But it would do so only at the cost of reducing the patent owner's expected payoff from inventing, and we are not as sanguine as Ayres and Klemperer that this reduction in incentive would be de minimis. In our example above, it takes at least a 20% reduction in damages (and probably more, once litigation costs are factored in) to induce any welfare-enhancing limited infringement. Of course, one might construct other models in which a lesser reduction will still induce some limited infringement,<sup>301</sup> but this observation only underscores the point that the real world presents a variety of possible cost curves, each having its own unique characteristics.<sup>302</sup> Crafting a partial damages rule that applies across-the-board to all cases of patent infringement,<sup>303</sup> and that on balance both induces limited infringement and preserves the ex ante incentive to invent, would raise some daunting empirical questions, to say the least. In a world in which no one really knows the effect of the patent incentive upon behavior, it is not at all clear that the reductions necessary to induce limited infringement would have the benign effect envisioned by Ayres and Klemperer.<sup>304</sup>

\*70 Several other objections relate to both practical and theoretical problems with implementing the Ayres-Klemperer thesis. First, even if it were possible to calculate the optimal amount of partial damages (70%? 80%?), it is not clear that any existing

patent rule, whether embodied in *Panduit*, *Rite-Hite*, or any other case achieves the desired target. Of course, one could recommend in the place of the existing rules an explicit command to award patent owners (say) 75% of their provable loss, and not more; but, absent compelling proof that 75% is the “right” figure, any such recommendation would be rash, as well as politically infeasible. A second problem is that many, perhaps most, patent owners do not charge the full monopoly price to begin with, in light of actual and potential competition from noninfringing alternatives. As Ayres and Klemperer themselves recognize, this fact may suggest that deadweight loss is not as severe as the model assumes.<sup>305</sup> At the same time, if the patentee’s expected payoff is already a substantial discount from the monopoly price, any further reduction due to a partial damages rule will only further reduce the incentive to invent. Finally, the fact that litigation expenses typically are not recoverable unless the defendant acted in bad faith further reduces the amount ultimately recovered by victorious patent owners, perhaps substantially in light of the expense of patent litigation.

For these reasons, we remain skeptical about proposals to consciously reduce the patent owner’s damages to some amount below her actual loss. Ayres and Klemperer may be correct that small decreases would have no effect upon incentives, but the magnitude of reductions necessary to induce limited infringement may be more significant than Ayres and Klemperer assume. Of course, Ayres and Klemperer may also be right that cases such as *Panduit* roughly implement their recommendation of reducing patent damages to some portion of the patent owner’s actual loss. The trend away from strict adherence to *Panduit*, however, and toward something more nearly approaching a but-for test, suggests that, for better or worse, the courts are moving in precisely the opposite direction.

### III. Proximate Cause

#### A. Some General Considerations

A standard principle in tort law is that, even when the defendant breaches a duty owed to the plaintiff, and this breach is the cause-in-fact (but-for cause) of the plaintiff’s injury, the defendant is not liable unless the breach was also the \*71 “proximate” or “legal” cause of the injury.<sup>306</sup> Courts frequently state that the proximate cause doctrine screens out claims that are “unforeseeable,”<sup>307</sup> “indirect,”<sup>308</sup> “remote,”<sup>309</sup> “speculative,”<sup>310</sup> or barred for “policy considerations,”<sup>311</sup> without much analysis beyond the use of these conclusory terms.<sup>312</sup> A standard law-and-economics account is that proximate cause serves to prevent recovery in cases in which the defendant’s conduct (for example, the failure to take a safety step), though a but-for cause of the plaintiff’s injury, did not materially increase the risk of injury *ex ante*.<sup>313</sup> In such a case, the social costs of imposing liability may exceed the social benefit of a reduction in injury, because the imposition of liability when the probability of injury is very low will have little if any *ex ante* deterrent effect, and may impose substantial administrative costs.<sup>314</sup> At first blush, this reasoning suggests that patent infringement should be viewed as not only the but-for cause but \*72 also the proximate cause of the patentee’s lost profits in two problematic but recurring situations—first, when the infringement causes the patentee to lose profits on sales of goods (either unpatented or covered by another patent) that compete with the infringing product (as in *Rite-Hite* and, supposedly, *King Instrument*);<sup>315</sup> and second, when the infringement causes the patentee to lose profits on sales of complementary goods (as in *Paper Converting and Rite-Hite*).<sup>316</sup> Presumably, the user’s conduct (if defined as the infringement of the patent) materially increases the risk that the patentee will suffer harm of this nature; and while the administrative costs of assessing the amount of damages are not trivial, they are perhaps no more significant than the cost of assessing lost profits damages generally.<sup>317</sup>

As we noted in the preceding part, however, a more refined analysis must examine carefully whether it makes sense to equate “defendant’s conduct” with “infringement of the patent,” as well as whether the plaintiff’s loss of profits on sales of unpatented goods should be viewed as a legally cognizable “harm.” With regard to the first issue, it is clear that once the defendant is aware that the invention he intends to use is patented, he has only two choices: either (1) to use the invention without permission and suffer the consequences, or (2) to refrain from infringing. If he refrains, he may either obtain a license from the patentee, or use the next best available technology.<sup>318</sup> We shall assume (for now) that, in order to preserve the patentee’s incentive to invent and disclose, as well as to encourage would-be users to negotiate with the patentee, the general rule should be that infringers are liable for all losses caused-in-fact by their infringement; and that, since the decision whether to infringe or not is likely to materially affect the probability that the patentee will suffer lost profits on sales of unpatented and collateral goods, the defendant who knowingly infringes normally should be required to compensate those losses as well. As suggested above, however, we are much less sanguine about a rule that would require an “innocent” infringer to pay lost profits damages, particularly on lost sales of unpatented goods. In what \*73 follows, we shall assume that proper notice has been given; and that, if not, an enlightened proximate cause standard probably would cut off recovery for these more

“remote” harms.

A second critique of the application of proximate cause analysis to patent infringement cases is provided by John Schlicher, who argues that some harm that is foreseeably caused by an act of infringement should nevertheless be uncompensable.<sup>319</sup> To illustrate, Schlicher suggests the example of a patent owner who (1) sells 100 units of unpatented “Model A” for \$100 each, and (2) owns a patent on “Model B,” which costs the same amount to produce as Model A and can also sell for \$100.<sup>320</sup> Now suppose that another company sells 50 units of Model B for \$100 each, such that the patentee’s sales of Model A fall to 50 units.<sup>321</sup> On these facts, the patentee should recover no lost profit damages, because his patent has no economic value, that is, no advantage over the next best alternative.<sup>322</sup> Schlicher therefore concludes that, although foreseeability of harm “is useful in tort and contract cases where the law is trying to create appropriate financial incentives to avoid harming others and to perform contracts,”<sup>323</sup> it “has little to do with identifying the lost value of an invention and awarding that value to the patent owner.”<sup>324</sup>

In our view, however, it is not the concepts of proximate cause (or “foreseeability,” in the sense of probability) that are problematic. As our mathematical analysis above demonstrates, the degree to which the consequences of infringement, notification, and searching are foreseeable may well have an effect on the incentive to invent. The problem that Schlicher has pinpointed can instead be resolved in either of two ways. The first is that, in Schlicher’s hypothetical, the availability of a noninfringing alternative (Model A) means that the infringer has not “caused” any harm at all, since the patent owner would have suffered the same loss absent the infringement. In this regard, the user’s taking the “safety step” of not infringing would not have increased the ex ante probability of harm, and therefore should not be viewed as the proximate cause of the patentee’s lost profit. A second response to the problem relates to the definition of “harm.” Again, the \*74 patentee in Schlicher’s example would have suffered exactly the same harm even if the infringer had used the noninfringing substitute Model A; in other words, the patentee suffered no harm beyond the competitive harm that she would have suffered in the absence of infringement. If we borrow the concept of “antitrust injury” from antitrust law, the patentee in Schlicher’s example does not suffer “patent injury” in the sense of an “injury of the type the [patent] laws were intended to prevent.”<sup>325</sup> Incorporating a “patent injury” requirement into the analysis should be sufficient to avoid the type of problem Schlicher has identified, without discarding the concept of proximate causation altogether.

It still remains to determine, however, whether the harm suffered by the patentee when she loses profits on the sale of unpatented or complementary goods should be viewed as harm of the type the patent laws were intended to prevent, assuming that this harm would not have been incurred in the absence of infringement. In the following two sections, we discuss these issues in turn. We conclude, first, that awarding lost profits on the sale of unpatented goods, when the patentee does not market any goods covered by the patent, raises some difficult issues but is (probably) consistent with the purpose of the patent laws. Second, we conclude that awarding lost profits on the sales of complementary goods is consistent with that purpose, at least in cases in which the degree of complementarity is relatively high. Somewhat surprisingly, the Federal Circuit’s vague rule permitting the recovery of lost profits on sales of complementary goods only when those goods are functionally integrated with the patented device may be as good an articulation as any of the appropriate proximate cause standard. We also reject the view that the recovery of complementary-good profits threatens to facilitate anticompetitive tying arrangements.

## **B. The Case of the Idle Patent**

The first case we shall consider involves the measurement of damages in cases in which the patentee neither uses the patented invention herself nor authorizes anyone else to do so. Because the idle patent directly generates no income, one might expect that the patentee’s recovery would be limited to a reasonable royalty for any infringement that occurred prior to the entry of an injunction prohibiting the defendant from further use of the invention. As we have seen, this expectation would have been correct prior to *Rite-Hite* and *King Instrument*.<sup>326</sup> As the Federal Circuit recognized in those two cases, however, it is possible for an infringement to cause the patentee to lose sales, and hence profit, with respect to those goods that she does make, use, or sell. For example, suppose that Alice makes machine X, which is covered by her patent, Patent 1; and that she also owns, but does not use, \*75 Patent 2, which reads on a slightly less marketable variation, X’. If Bruce infringes Patent 2, by making and selling quantities of X’, he does not cause Alice to lose any sales of X’, which Alice was not marketing anyway. To the extent that X and X’ are substitutes for one another, however, Bruce may cost Alice sales of X. According to *Rite-Hite* and *King*, Alice may recover her profit on lost sales of X that are attributable to the infringement.<sup>327</sup> The question is whether this result is sound (or, if not, what the appropriate remedy should be). In the two most insightful analyses of this problem to date, two student commentators, Julie Turner<sup>328</sup> and Brent Rabowsky,<sup>329</sup> argue that it is not. Although we find much that is

persuasive in their work, we remain unconvinced that their proposed modifications would have no effect upon prospective patentees' incentives to create and disclose. Moreover, both commentators' proposed solutions have the purpose and effect of encouraging at least some interim infringement of idle patents. Even if this outcome were desirable as a matter of policy, it is (like the Ayres-Klemperer proposal discussed above) difficult to reconcile with U.S. and international patent policy as it now exists.

Following Turner and Rabowsky, we agree that the best place to begin the analysis is by considering why the patent owner may choose not to commercialize her patent. Possible reasons include (1) the patented technology is not commercially viable, due to factors such as lack of demand, cost, lack of financing, inability to develop a marketable embodiment, or underestimation of its commercial value;<sup>330</sup> (2) the technology is commercially viable but less promising than other technologies the patent owner is investigating;<sup>331</sup> (3) the technology lacks commercial applications within the area of the patent owner's expertise;<sup>332</sup> (4) \*76 the patent owner has overestimated the value of the patent, and therefore has been unable to find a willing licensee;<sup>333</sup> and (5) the patent owner resists commercialization, because the new invention would compete against some other product the patent owner currently markets.<sup>334</sup> As we shall see, it is only when the patent owner fails to commercialize for reason number (5) that the recovery of lost profits is even tenable; whether it is desirable as a matter of policy may depend upon how frequently reason number (5) forms part of an anticompetitive scheme on the part of a patent monopolist.

Economic logic strongly suggests that the patent owner who has failed to commercialize for reasons (1) through (4) should recover only a reasonable royalty, not lost profits. Consider first the patent owner who has failed to commercialize because she does not believe the invention to be commercially viable, for one or more of the reasons suggested above. On these facts, Bruce is likely to infringe only if he disagrees with Alice's assessment of the demand for, cost of, or value of the patent, or if Bruce is better able to obtain financing or to envision a commercial embodiment of the invention. Absent the infringement, it would have made sense for the parties to have agreed to a royalty (since Bruce expected to earn more from the use of the patent than did Alice), and a court can attempt to estimate the amount of this royalty in light of the Georgia-Pacific factors. Second, suppose that Alice allows the patent to remain idle for reasons (2) or (3), but not for reasons (4) or (5). For example, suppose that Alice is not manufacturing the invention because some other technology looks more promising to her, but that Alice has not overvalued the patent (reason (4)) and is not concerned about possible competition from another's use of it (reason (5)). In such a case, we again would expect the parties to reach agreement in the absence of infringement, as long as Bruce expects to earn more from the patented technology than from his next-best alternative.<sup>335</sup> Similarly, if Alice is not commercializing the patent because it has no commercial applications in her field, but Bruce wants to use it because it does have commercial applications in his field, then again we would expect rational parties to reach agreement, which the court can attempt to reconstruct. Third, suppose that Alice is not licensing the patent because she overestimates its value (reason (4)), but not because she fears the effect of such licensing upon her profits from other products she sells (reason (5)). Presumably, Alice is not using the patent herself for one of the other reasons above (e.g., it is less promising than other technologies she is investigating). Normally, we would expect a license in this situation, but for Alice's imperfect information. Once again, a court can award a reasonable royalty based upon its superior, hindsight information about the true value of the patent.

\*77 A lost profits theory is plausible, however, when the patent owner refuses to use a commercially viable, properly-valued invention or to license it to a willing licensee due to the effect that such commercialization is expected to have upon the patentee's profit from sales of other goods. On these assumptions, a rational patent owner would allow her patent to remain idle if she expected that doing so would result in more profit (from sales of other goods) than either using the invention herself, or licensing it to someone else (who will be willing to pay no more than what he expects to earn from the use of the invention). Thus, the patent owner's expected lost profits on the other goods must exceed the amount of the royalty to which the parties would have agreed. If the patent owner can prove actual lost profits consistent with these expectations, then under Rite-Hite and King Instrument she may recover damages in excess of a reasonable royalty.<sup>336</sup> Turner and Rabowsky both contend that this remedial scheme should be modified in order to reduce the patent owner's incentive to allow her patent to remain idle.<sup>337</sup>

In support of this thesis, Rabowsky argues, among other things, that awarding lost profits to the nonmanufacturing patent owner also may facilitate the anticompetitive practice of "preemptive patenting."<sup>338</sup> To illustrate the concept of preemptive patenting, suppose that Alice has a monopoly over the proverbial widget, either because she owns a patent for which there are initially no close substitutes or for other reasons. Sensing, however, that a substitute product (call them schmidgets) may be technologically viable and could compete with widgets, Alice engages in a patent race with her potential competitor, Bruce, to be the first to develop and patent schmidgets. If Alice wins the race, she may conclude that she is better off letting her

schmidget patent sit idle, as long as her profits from selling only widgets are expected to exceed her potential profits or licensing revenues on schmidgets, along with profits on reduced sales of widgets. By winning the race, she is able to prolong her monopoly, to the detriment of consumers. Although allegations of preemptive patenting abound,<sup>339</sup> the theoretical literature suggests \*78 that Alice is likely to succeed in such a scheme only if both (1) the race is conducted against only one or a small number of potential competitors,<sup>340</sup> and (2) the payoff from investing in research and development into the new invention is relatively certain.<sup>341</sup> Rabowsky nevertheless observes that awarding lost profits to the nonmanufacturing patent owner increases the incentive for engaging in preemptive patenting schemes.<sup>342</sup>

Turner and Rabowsky also argue that none of the reasons commonly cited for having a law of patents-namely, the encouragement of invention, disclosure, innovation, and “prospecting”-support the currently remedial scheme with respect to unused patents.<sup>343</sup> Turner in particular is dubious about the efficacy of the patent system as a means of inducing invention, and would argue against having a patent \*79 system if this were its only justification.<sup>344</sup> Whether such general skepticism is warranted or not remains uncertain,<sup>345</sup> though in the limited context of preemptive patents the more general conclusion that the social costs of awarding a patent to the first to invent outweigh the social benefits may be correct. As discussed above, preemptive patenting is assumed to occur (if it occurs at all) within the context of a race between Alice (a monopolist) and Bruce (a potential competitor) to develop a new technology. Conferring a patent reward upon Alice, if she wins the race, may provide little if any net social benefit in cases in which (1) Alice chooses not to commercialize the technology, and (2) she expected the loser (Bruce) to develop the same technology within a short time. In other words, there may be no compelling reason to provide Alice with an incentive to invent first and then suppress the invention, if another party would have invented and then commercialized the invention shortly thereafter.<sup>346</sup> Second, both Turner and Rabowsky reject the argument that rewarding nonmanufacturing patentees advances the goal of public disclosure of new technologies, regardless of their exploitation.<sup>347</sup> Turner reasons that an inventor who does not expect her competitors to independently discover the new technology, and who does not intend to use or license it herself, will prefer to keep it secret.<sup>348</sup> On the other hand, one who does anticipate independent discovery and who therefore patents to forestall competition would perform a greater disclosure service by commercializing the invention, because a commercial embodiment often discloses \*80 more information than can be gleaned from the patent.<sup>349</sup> Third, both Turner and Rabowsky assume that patents do encourage innovation (as opposed to invention), which can be defined as the work necessary to bring the invention to market (i.e., commercialization), and they therefore conclude that a rule that rewards the noncommercializing inventor undermines this goal.<sup>350</sup> Fourth, both authors note Kitch’s “prospect” theory, under which the patent system enables the owner of a “pioneering” patent to efficiently coordinate investment in follow-up inventions, thereby reducing the social cost of inefficient rent-seeking.<sup>351</sup> To the extent (if any)<sup>352</sup> that the patent system serves this purpose, it is undermined when the patent owner uses the patent not for the purpose of coordinating investment in follow-up inventions, but rather for the purpose of forestalling others’ use of that technology.<sup>353</sup>

Although the logic of these arguments might suggest that unused patents should not be enforceable at all, both Turner and Rabowsky recognize that this outcome is difficult to sustain under current U.S. law.<sup>354</sup> The Supreme Court has refused to invalidate patents on the ground of failure to work,<sup>355</sup> and the Patent Act \*81 itself refuses to equate nonuse with misuse.<sup>356</sup> Similarly, courts have held that, as a general rule, a patent owner does not violate the antitrust laws by unilaterally refusing to license her patent,<sup>357</sup> and this reasoning would suggest that a unilateral refusal to use would similarly not constitute the offense of monopolization.<sup>358</sup> Turner therefore recommends that courts enforce unused patents pursuant to a liability rule (meaning that the defendant must pay damages, but will not be enjoined from further infringement) rather than pursuant to a property rule (under which the court enters an injunction).<sup>359</sup> Turner argues that this outcome is more efficient than a property rule in this context,<sup>360</sup> and that (despite the general presumption of injunctive relief in patent cases) it could be accommodated under current patent law.<sup>361</sup> Finally, although Turner professes agnosticism over whether the damages she envisions would encompass reasonable royalties or lost profits,<sup>362</sup> our discussion above suggests that an award of lost profits would tend to have the same effect as injunctive relief. In this scenario, the patent owner’s lost profits would likely exceed any royalty to which the defendant would have agreed ex ante, thus making it unprofitable for the defendant to infringe in the first place. Turner’s \*82 reasoning therefore suggests that the nonmanufacturing patent owner should recover a royalty only-not lost profits or injunctive relief-and that this royalty should be less than the amount of her lost profit. Rabowsky, in contrast, does not suggest the elimination of injunctive relief, but he does recommend the more limited step of limiting nonmanufacturing patent owners’ damages to a reasonable royalty.<sup>363</sup>

There are nevertheless at least three problems with the analyses presented by Turner and Rabowsky that mandate caution in denying the nonmanufacturing patent owner a lost profits award. The first relates back to the argument that enforcing nonmanufacturing patent owners’ rights does not promote the public disclosure of new technologies since an inventor who anticipates the independent discovery of a new technology by her competitors would still have an incentive both to patent and to commercialize that technology, rather than to keep it secret, if her rights were unenforceable (or less enforceable) in the

absence of commercialization. As Turner herself recognizes, however, inventors who are uncertain of the likelihood of independent discovery may not have the same incentive structure to patent and commercialize; for this class of inventors, a rule that penalizes patent nonuse could be the decisive factor in choosing secrecy, in which case the public loses the benefit of disclosure unless and until independent discovery does take place.<sup>364</sup> Although this disclosure may not be as extensive as that which would accompany commercialization, it is still preferable to no disclosure at all.<sup>365</sup>

A second problem relates to Rabowsky's preemptive patenting argument. As noted above, preemptive patenting occurs when a patent owner/monopolist patents and then suppresses technology 2, specifically for the purpose of preserving the monopoly that arises from the patent on technology 1. The scheme is likely to succeed, however, only in the relatively uncommon case in which all of the necessary conditions (including the possession of market power in the market supported by the patent on technology 1, the absence of other substitute technologies, a small number of potential competitors, and a relatively deterministic research and development process) are met.<sup>366</sup> But even if it makes sense to limit the enforceability of preemptive patents, because of their anticompetitive effects, it is less clear that the same rule should apply when the patent owner decides not to commercialize a technology only after its development, rather than as part of a preemptive patenting scheme, even if her motivation for the \*83 subsequent noncommercialization is to prevent one technology from competing with another. To illustrate the possible consequences of such a rule, suppose that a firm must decide whether to develop and patent technology 1, technology 2, or both, and that it does not know which technology is likely to have more commercial applications. In addition, the firm knows that if it patents both but subsequently winds up using only technology 1, it will not be able to recover its lost profits (or injunctive relief, under Turner's proposal) from the sale of products embodying technology 1 when the patent on technology 2 is infringed. In effect, this rule (1) encourages others to infringe technology 2, and (2) threatens to leave the firm worse off than it otherwise would have been absent that infringement. These effects in turn have two possible consequences. The first is that they might encourage the firm to decide early in the development process to develop and patent only one technology, and to suppress the other.<sup>367</sup> This would be unfortunate, not only because of the technology suppression aspect, but also because the firm may pick the wrong technology, thus depriving consumers of the more commercially useful product. Balanced against this incentive, however, is the fact that not patenting both technologies leaves the firm vulnerable to competitors who themselves may discover and patent the suppressed technology; in addition, there may be adequate market incentives to avoid locking oneself into the "wrong" technology too early, regardless of the potential remedies that may be available in some hypothetical future patent litigation.<sup>368</sup> Alternatively, the firm could decide to patent both technologies and to commercialize both to some extent, in order to preserve its ability to recover lost profits on the sale of either, but this may not be an efficient use of resources. Once again, however, the market incentive to sell commercially useful products may be stronger than the incentive provided by a hypothetical patent recovery. Nevertheless, to the extent that it may be important to distinguish between preemptive and nonpreemptive nonmanufacturing patent owners, the need to make this distinction adds further costs, both administratively and in terms of potential errors.<sup>369</sup>

A third problem is that even the modified enforceability regimes advocated by Turner and Rabowsky would be difficult to square with U.S. (and perhaps \*84 international) law as it now exists. Turner's proposal to award nonmanufacturing patent owners only damages is functionally the equivalent of a working requirement coupled with compulsory licensing since, for reasons stated above, a lost profits recovery would tend to have the same effect as injunctive relief, which Turner wishes to avoid. For similar reasons Rabowsky's plan, which would couple injunctive relief with an interim royalty, may encourage some interim infringement in exchange for (what is effectively) a compulsory licensing fee. U.S. law nevertheless has consistently avoided working requirements, as discussed above, as well as the compulsory licensing of patents.<sup>370</sup> Of course, other countries have embraced working requirements and compulsory licensing as components of their patent systems<sup>371</sup> and critics of the U.S. approach argue that working and licensing requirements can be efficient, at least under some circumstances.<sup>372</sup> Nevertheless, as with the Ayres and Klemperer proposal discussed above, we question whether it would be appropriate for the courts to manipulate damages law in order to induce efficient infringement, when Congress thus far has chosen (whether rightly or wrongly) to reject this approach as a general matter. For these reasons, we remain moderately skeptical of proposals to deny the nonmanufacturing patent owner her lost profits in all cases.

### **\*85 C. Complementary Goods**

The second issue we shall address is whether the patentee should be able to recover lost profits on sales of complementary goods, whether they be collateral (convoys) or derivative (spare parts) products, if these losses are the but-for consequence of infringement. As we have seen, the Federal Circuit has taken the position that the patentee must prove that these complementary goods function with the patented product, though without providing a clear definition of that term. In our view, the resolution of this issue depends in part on how complementary the products are, although this factor cannot be

easily quantified either. To refine the analysis, we begin with a brief explication of the economics of complementarity. We then argue that the recovery of lost profits on some complementary goods is consistent with the goals of the Patent Act. We also reject an argument that allowing patent owners to recover these damages would facilitate anticompetitive tie-ins.

### 1. The Economics of Complementarity

To illustrate complementarity, let us assume that the demand for a patented product A is a function of its price, the prices of related goods, income, and a host of socio-economic variables.<sup>373</sup> In general form, we write the demand function for A as

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where  $Q_A$  denotes quantity;  $P_B$ ,  $P_C$ ,  $P_X$  represent prices of related goods;  $M$  is income; and the dots represent other variables that we have not specified.

If the quantity of A demanded falls when the price of B rises,<sup>374</sup> then products A and B are said to be complements. The intuition is easy to grasp. People eat peanut butter and jelly sandwiches. If the price of jelly rises due, for example, to a Concord grape crop failure, the quantity demanded of jelly will fall. As less jelly is consumed, less peanut butter will be consumed. Thus, the increase in the jelly price causes a decrease in the quantity of peanut butter demanded because peanut butter and jelly are consumed together.

To get a sense of how complementary two products are, we look to the cross-elasticity of demand, which is defined as the percentage change in the quantity of A divided by the percentage change in the price of B.<sup>375</sup>

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\*86 where  $\Delta$  denotes a small change.<sup>376</sup> Since  $P_B$  and  $Q_A$  must be positive - negative prices or quantities make no economic sense - the sign of  $\epsilon_{A,B}$  is determined by the sign of  $\Delta Q_A / \Delta P_B$ . When A and B are complements,  $\Delta Q_A / \Delta P_B$  will be negative by definition and, therefore,  $\epsilon_{A,B}$  will be negative for complements.

The larger in absolute value is the cross-elasticity of demand, the stronger is the degree of complementarity. For example, if  $\epsilon_{A,B} = -1$ , then a five percent increase in the price of B will lead to a five percent reduction in the quantity demanded of A. In contrast, if  $\epsilon_{A,B} = -2$ , then a five percent increase in the price of B will lead to a ten percent decline in the quantity of A demanded. When  $\epsilon_{A,B} = -2$ , the degree of complementarity between A and B is stronger than when  $\epsilon_{A,B} = -1$ .

There is an extreme case that is worth mentioning: perfect complements.<sup>377</sup> In this case, the two products are consumed in fixed proportions. There are classic examples of perfect complements: right and left shoes (or gloves). In such cases, it often makes more sense to define the product as a pair of shoes. Although it is not common to find perfect complements in consumption, it is not so rare to find perfect complements in production.

In the short run, at least, there are many examples of intermediate goods that serve as inputs and are employed in fixed proportions. For example, one needs a hammer head and a handle to make a hammer. Many products are assemblies of components. For example, a PC requires a keyboard, a monitor, a hard drive, a microprocessor, and so on. Each component is necessary: one cannot use an extra hard drive in place of a monitor. These intermediate goods are not consumed by themselves, but instead are consumed as part of a final good.

### 2. Recovery of Lost Profits on Sales of Complementary Goods

The argument in favor of awarding the patentee her lost profits on sales of complementary goods that she would have made, but for the infringement, is the same one we have made above in connection with lost profits generally: namely, that this measure of damages preserves the incentive to invent, by ensuring that the patentee is no worse off as a result of the infringement, and discourages would-be infringers by ensuring that they will be no better off when they infringe. Awarding lost profits on sales of complementary goods when those goods are only weakly complementary, however, may be problematic, as we shall see. Indeed, even when the goods are strongly complementary, it is not clear that infringement will necessarily reduce the patentee's sales of the complementary good. Somewhat surprisingly, the Federal Circuit's vague "functionality" test may be as good as any \*87 to delimit the circumstances under which the patentee should recover lost

profits on sales of complementary goods.<sup>378</sup>

To illustrate, consider a hypothetical case in which the cross-elasticity of demand between good A (unpatented) and good B (patented) is -1, and in which the aggregate quantity demanded of good A ( $Q_A$ ) pre-infringement is 100. Using our examples from Part IIC above, consider first the case of hit-and-run infringement. In our example, the quantity of good B supplied by the patentee remains at 300 units, the quantity of good B supplied by the infringer is 150 units, and the price of good B ( $P_B$ ) falls from \$70 to \$55. On these facts,  $Q_A$  increases from 100 to 121.43 units.<sup>379</sup> The effect of this change in  $Q_A$  upon the patentee is clear. Although the patentee may benefit from the increase in demand for good A, if she is a supplier of that good, any increase in profits on sales of good A cannot offset her loss of profits on sales of good B.<sup>380</sup> If reduced profits on sales of B could be more than offset by increased sales of A, the patentee would have reduced the price of B and expanded quantity on her own. Alternatively, if the patentee and the infringer are the only two suppliers of good A and if they sell in proportion to their sales of good B, the patentee will be worse off, as her sales of good A fall from 100 units to 80.96.<sup>381</sup> Or she may not be affected at all, if suppliers other than the infringer and the patentee are the only producers of good A. Thus, the mere fact that goods A and B are moderately complementary does not tell us whether the patentee is likely to gain sales of good A, lose sales of good A (and if so, at what profit margin), or be unaffected as a result of the infringement.

Second, let us consider the result if the infringement results in a multiperiod Cournot equilibrium. In our example above,  $Q_B$  supplied by the patentee falls from 300 to 200 units, while  $Q_B$  supplied by the infringer rises from 0 to 200; meanwhile,  $P_B$  falls from \$70 to \$60. On these facts, again assuming a cross-elasticity of demand of -1 and an initial  $Q_A$  of 100,  $Q_A$  increases by 14.3 units.<sup>382</sup> Once again, the effect on the patentee will depend upon whether consumers typically buy good A from the supplier of good B or from other sources. If, prior to the infringement, consumers purchased good A exclusively from the patentee, and afterwards in equal quantities from both patentee and infringer, the patentee will see her sales of good A decrease from 100 units to 57.2. On the other hand, if consumers continue to buy good A exclusively from the patentee, the patentee will increase her sales of that product; and if they buy from other sources, she may not be affected at all. Of course, she loses profits on sales of B in any event.

**\*88** Third, consider the results under a Bertrand equilibrium. If the infringement is hit-and-run, the patentee sells nothing, the infringer makes all the sales of good B, and the price of good B declines slightly. Whether this outcome affects the patentee's sales of good A, if any, cannot be determined solely from these facts. Alternatively, if the infringement forces the patentee to sell at the competitive price and quantity,  $Q_A$  increases from 100 to 142.9.<sup>383</sup> Whether the patentee makes any of these additional sales and, if so, at what profit, will depend on other facts. Finally, if the infringement results in Chamberlinian behavior, both infringer and patentee produce half of the patentee's former output of 300 units of good B, while the price remains the same. There will be no change in  $Q_A$ , but whether the patentee retains her previous share (if any) of the market for that good, or must split it as well with the infringer, is uncertain.

Interestingly, under some circumstances the patentee may suffer a loss even if the goods are not complementary at all. For example, suppose that  $\epsilon_{A,B}$  is zero but that consumers typically engage in "one-stop shopping," buying all of good A they need from the purveyor of good B. Under any of the scenarios in which the patentee loses sales of good B to the infringer, she will also lose sales of good A, even though the goods are not complementary in the traditional sense of that term.<sup>384</sup>

What we might expect to observe, then, are really two effects, one relating to (traditional) complementarity and the other to transactional complementarity (one-stop shopping). The more complementary the goods are in the traditional sense (that is, the higher the cross-elasticity of demand), the greater the demand will be for the unpatented good A under some infringement scenarios. This increase in demand could exacerbate or reduce the patentee's loss, depending upon (1) whether she gains or loses sales of good A, and (2) the profit margin from those sales (which will probably be lower as output increases); or it may have no effect whatsoever, if she does not supply good A. In addition, if the one-stop shopping effect is significant, the infringement may cause the patentee to lose some sales of good A even if the goods are not consumed together. The question remains whether these losses should be viewed as proximately caused by the infringement, and therefore compensable.

To answer this question, we need again to fall back upon first principles, namely that we want to (1) preserve the patentee's incentive to invent, disclose, and (perhaps) commercialize, and (2) deter infringement by channeling would-be users into voluntary transactions. In this regard, awarding the patentee her lost profits on lost sales of weakly complementary (or noncomplementary) goods due to the one-stop shopping effect may be hard to justify in terms of the incentive to invent. It would require considerable foresight on the patentee's part to invest in inventing **\*89** good B with the expectation that she will thereafter profit from sales of unpatented (and possibly unrelated) good A as well. At the same time, denying her these

damages is unlikely to provide would-be users with an incentive to infringe, since it is unlikely that the profits they would earn from increased sales of unpatented good A would exceed their potential damages liability for sales of good B (in addition to litigation and sunk costs). Indeed, the prospect of ruinous liability might lead to overdeterrence, in cases in which there is some uncertainty, or some risk of adjudicatory error, with respect to the issue of whether the accused device actually infringes.<sup>385</sup> At the same time, even if the goods are strongly complementary this does not necessarily mean that the patentee's ex ante expectation is to capture a significant share of the market for good A. And even when it does, it is possible for her market share (though not necessarily her profit margin) of good A to increase post-infringement.

What this analysis seems to suggest is that the Federal Circuit may have had the correct intuition when it decided, in *Rite-Hite*, that lost profits on sales of collateral goods should be limited to cases in which those goods and the patented article "constitute a functional unit."<sup>386</sup> In such a case, the goods are likely to exhibit a high degree of both consumption and transactional complementarity, meaning that consumers buy the products together due to both functional advantages and convenience. Moreover, in such a case it is at least somewhat more plausible that the patentee may have invented, or at least commercialized, in the expectation of profiting from sale of the complementary good, and the inability to recover these damages might in some cases make it profitable to infringe.<sup>387</sup> Finally, to award lost profits in other cases involving complementary goods might give rise to high administrative costs of determining whether a gain or loss in sales of good A is attributable to infringement or to other, lawful causes. Perhaps, then, one way to give content to the court's vague standard is along these lines: the patentee may recover lost profits on sales of collateral goods only when those goods exhibit a relatively high degree of both consumption and transactional complementarity, because only in these cases would recovery serve the purposes of the Patent Act. Although the application of this standard may seem as vague as the functionality standard, it at least provides a rationale for adopting a limitation of this kind.

### 3. Tying

One argument against permitting the recovery of lost profits on sales of complementary goods is that this rule encourages the patentee to market these \*90 goods along with the patented article, and that this joint marketing may have anticompetitive consequences. Specifically, the rule may reward the patentee who tries to leverage her patent "monopoly" into a monopoly in the market for the complementary product by tying sales of the patented and complementary products.<sup>388</sup> In our view, however, this concern should not affect the patent damages rules for two reasons. The first is that the patentee's marketing of complementary goods is unlikely to have anticompetitive consequences in the majority of cases. The second is that the damages rule advocated above is likely to provide little incentive for engaging in anticompetitive conduct, especially in light of existing antitrust laws and the patent misuse doctrine.

With respect to the likelihood of anticompetitive consequences, again the theory is that the patentee can leverage her patent "monopoly" into the market for good B if she coerces buyers to purchase good B as a condition of buying good A. Absent proof of such coercion, however, there is no anticompetitive conduct and, thus, no reason grounded in competition policy for denying the patentee lost profits on sales of good B, as long as the elements of cause-in-fact and proximate cause are met.<sup>389</sup> Moreover, even when the patentee has tied the goods together, the tie may serve a neutral or procompetitive purpose, such as the assurance of quality control<sup>390</sup> (and, for that reason, may be exempt from antitrust scrutiny).<sup>391</sup> Further, when the market for the tied product is competitive, economic analysis strongly suggests that the patentee cannot leverage her patent monopoly into a monopoly in \*91 the market for the tied product.<sup>392</sup> Although antitrust doctrine may still impose liability in some such cases, in order to satisfy noneconomic goals,<sup>393</sup> a patent damages rule grounded in economic analysis need not be based upon a faulty economic premise.

A second reason for rejecting the argument is that existing antitrust law and the patent misuse doctrine are likely sufficient to address the relatively infrequent situation in which the patent owner is capable of leveraging one monopoly into another. Economic theory suggests that tying schemes can facilitate monopoly leveraging (or deter entry into the market for the tied good) when, inter alia, the monopolist begins with some degree of market power in the market for the tied good.<sup>394</sup> Moreover, the return on investing in such a scheme is likely to be higher \*92 when the two goods are complementary.<sup>395</sup> Thus, it is precisely those cases in which the patent owner may be able to prove significant collateral damages—namely, cases in which the patent confers a degree of market power because there are few if any good substitutes for it, the collateral good is highly complementary, and the patentee is one of the few suppliers of that good—that are the most susceptible to anticompetitive ties. But when these conditions are present, the incentive to tie is likely to be substantial regardless of what sort of recovery the patent damages rules would permit in a patent infringement suit. The profitability of the tie is due to the market power the monopolist possesses in goods A and B, which allows her to credibly deter entry into both markets, and not to her ability to

recoup lost profits on sales of good B in the event of an infringement of good A. Of course, if this is true then one might argue that the patentee has an incentive to market good B regardless of any potential damages recovery for lost sales of good B in a suit alleging infringement of good A. The choice then is whether to (1) forbid the recovery of these damages in all cases; (2) forbid them only in cases in which the patentee engages in an anticompetitive tie; or (3) permit them in all cases and leave it to other legal doctrines, including antitrust law and the patent misuse doctrine, to regulate the tying problem.

Two factors suggest that choice (3) may be the best option. First, to the extent that ties can be pro- as well as anticompetitive, solutions (2) and (3) are both preferable to solution (1), which (at the margin) might deter some beneficial conduct on the part of the patentee or encourage infringement, for the reasons stated in the preceding section. Second, to the extent that solution (2) would impose high administrative costs in all cases in which the patentee seeks collateral damages, solution (3) may be preferable to (2). In cases in which the tie is anticompetitive, the defendant will normally have an ample incentive to litigate that issue, either by means of an antitrust counterclaim or pursuant to the patent misuse defense. To deny the patent owner any recovery of collateral lost profits solely to deter the relatively infrequent case of an anticompetitive tie would be overkill, in light of these existing remedies. Finally, if we accept the Federal Circuit's functionality doctrine as a limitation upon the patentee's ability to recover collateral <sup>93</sup> damages, the potential harm from rewarding anticompetitive ties should be minimized. To describe the relationship between two products as "functional" may suggest that the tie is not coerced, but rather is a matter of consumer demand, or alternatively that the procompetitive aspects outweigh the anticompetitive potential.

### Conclusion

We have argued that the standards the Federal Circuit has articulated over the past ten years for assessing damages in patent cases are largely consistent with the purposes of the Patent Act. In particular, we applaud the court's application of general tort-law principles to patent infringement actions, while at the same time providing some rational limitations on the extension of patent liability to "remote" harms. We also have concluded that concerns over the potential anticompetitive effect of these principles is, at present, speculative. At the same time, we recognize that the soundness of our analysis may hinge in large part on the issue, which has received inadequate attention to date, of whether courts should assess monetary damages against an "innocent" infringer. Moreover, further empirical evidence on the effect of the patent incentive may either strengthen or weaken our conclusions with respect to cause-in-fact and proximate causation.

### Footnotes

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<sup>1</sup> See Federal Courts Improvement Act of 1982, Pub. L. No. 97-164, § 127(a), 96 Stat. 37 (codified as amended at 28 U.S.C. § 1295(a) (1994 & Supp. V 1999)) (conferring upon Federal Circuit jurisdiction over patent appeals).

<sup>2</sup> For an interesting popular account, see Matthew Steinglass, *Voices Carry*, *Lingua Franca*, July-Aug. 2000, at 44-47.

<sup>3</sup> *Id.* at 45-47.

<sup>4</sup> Although one cannot patent an abstract idea, a law of nature, or a naturally-occurring physical phenomenon, see *Diamond v. Diehr*, 450 U.S. 175, 185, 209 U.S.P.Q. (BNA) 1, 7 (1981), it is possible to patent a machine or process that makes use of laws of nature, including mathematical equations, to produce a useful, concrete, and tangible result. See *AT&T v. Excel Comms., Inc.*, 172 F.3d 1352, 1358, 50 U.S.P.Q.2d (BNA) 1447, 1451 (Fed. Cir.), cert. denied, 528 U.S. 946 (1999).

5 See Patent Act of 1790, ch. 7, 1 Stat. 109-12, § 4 (stating that infringers “shall forfeit and pay... such damages as shall be assessed by a jury”). Cf. *Earle v. Sawyer*, 8 F. Cas. 254, 259 (D. Mass. 1825) (Story, J.) (expressing agreement with “some learned judges” who “have refused to lay down any particular rule of damages, and have left the jury at large to estimate the actual damages according to the circumstances of each particular case”).

6 Patent Act of 1793, ch. 11, 1 Stat. 318-23, § 5.

7 *Seymour v. McCormick*, 57 U.S. (16 How.) 480, 488 (1853).

8 *Id.* (quoting Act of Apr. 17, 1800, ch. 25, 2 Stat. 37, 38, § 3).

9 Act of Feb. 15, 1819, ch. 19, 3 Stat. 481-82, § 1.

10 See 7 Donald S. Chisum, *Chisum on Patents*, § 20.02[1][b], at 20-12 (1999) (stating that, prior to 1819, patent owners “could apparently obtain injunctive relief from a federal court if there was diversity of citizenship and from a state court if there was no such diversity,” and that the 1819 Act “eliminated a jurisdictional obstacle” under which a federal court could not award equitable relief in the absence of diversity jurisdiction); 3 William C. Robinson, *The Law of Patents for Useful Inventions*, § 1082, at 392 & n.1 (1890). State courts retained concurrent jurisdiction over at least some patent cases until 1819, and possibly until as late as 1836. See 8 Chisum § 21.02[1] [a], at 21-7 n.5; 7 Chisum § 20.02[1], at 20-11.

11 See *Seymour*, 57 U.S. (16 How.) at 488-89 (1853).

12 Patent Act of 1836, ch. 357, 5 Stat. 117-125, § 14 (stating that “whenever, in any action for damages... a verdict shall be rendered for the plaintiff... it shall be in the power of the court to render judgment for any sum above the amount found by such verdict as the actual damages sustained by the plaintiff, not exceeding three times the amount thereof, according to the circumstances of the case, with costs”).

13 For a brief history of this provision, see *Nike, Inc. v. Wal-Mart Stores, Inc.*, 138 F.3d 1437, 1443, 46 U.S.P.Q.2d (BNA) 1001, 1006 (Fed. Cir. 1998). As the court notes, Congress first required patentees to mark their products, or pay a fine of at least \$100, in 1842. *Id.* In 1861, Congress deleted the fine but required marking or actual notice as a precondition to recovering damages. *Id.*

14 35 U.S.C. § 287(a) (1994 & Supp. V 1999). The statute goes on to state that, when affixation cannot be accomplished due to the character of the article, the patentee may affix “a label containing a like notice.” *Id.*

15 *Id.* Omission from a “substantial number” of articles constitutes noncompliance. 7 Chisum § 20.03[7][c][iii], at 20-520.

16 *Nike*, 138 F.3d at 1443, 46 U.S.P.Q.2d at 1006 (stating that § 287 serves to minimize innocent infringement, to encourage patent owners to notify the public their articles are patented, and to aid the public in determining whether an article is patented). The statute nevertheless leaves several gaps. For example, it does not require even actual notice as a precondition to damages liability for infringement of a patented process; on the other hand, when the statute applies it exempts even a willful infringer from damages liability in the absence of actual notice.

17 Patent Act of 1870, ch. 230, 16 Stat. 198-217, § 59.

18 *Id.* § 55. Subsequent case law established that this provision was not to be read as authorizing the recovery of duplicative recoveries, however. In other words, the plaintiff could recover the greater of either his own lost profit or the defendant’s profit, but not both. See 7 Chisum, *supra* note 10, § 20.02[1][d], at 20-18 to -20. This remains the rule in copyright and trademark law. See Roger D. Blair & Thomas F. Cotter, *An Economic Analysis of Damages Rules in Intellectual Property Law*, 39 Wm. & Mary

L. Rev. 1585, 1605 & n.93, 1609-10 (1998).

19 7 Chisum § 20.02[3], at 20-39 to -40; 3 Robinson, supra note 10, § 1137, at 493.

20 See Blair & Cotter, supra note 18, at 1595-96 & n.45. The accounting remedy is still available in design patent cases, however. See 35 U.S.C. § 289 (1994).

21 35 U.S.C. § 284 (1994 & Supp. V 1999). The reference to a “reasonable royalty” can be traced back to 1922, when Congress first authorized, in cases in which actual damages or profits were likely sustained but not susceptible to calculation, an award of a “reasonable sum.” See Act of Feb. 18, 1922, ch. 58, 42 Stat. 389-93, § 8. This amendment codified a practice that courts had begun to develop in the late nineteenth and early twentieth centuries. See *Dowagiac Mfg. Co. v. Minn. Moline Plow Co.*, 235 U.S. 641, 648-50 (1915). Prior to that time, the plaintiff who did not license the patent for an established royalty, and who could not prove with reasonable certainty the amount of his lost profits or the infringer’s profits, was relegated to recovering only nominal damages. See 7 Chisum § 20.02[2], at 20-25 to -33.

The amount of damages to be awarded in a patent case is a question of fact, which the plaintiff must prove by a preponderance of evidence and which is subject to review for clear error. *SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 926 F.2d 1161, 1164, 17 U.S.P.Q.2d (BNA) 1922, 1925 (Fed. Cir. 1991). See also *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1580, 24 U.S.P.Q.2d (BNA) 1401, 1420 (Fed. Cir. 1993) (stating that the court will affirm a jury award of damages unless it is “grossly excessive or monstrous,” clearly not supported by the evidence, or based only on speculation or guesswork”) (quoting *Los Angeles Mem. Coliseum Comm’n v. National Football League*, 791 F.2d 1356, 1360 (9th Cir. 1986)). Certain subsidiary matters, however, such as “the choice of an accounting method for determining profit margin or the methodology for arriving at a reasonable royalty,” are discretionary and, hence, subject to review for abuse of discretion. *SmithKline*, 926 F.2d at 1164 (citations omitted).

22 35 U.S.C. § 284 (1994 & Supp. V 1999) . In practice, however, courts increase damages only in cases in which the defendant is found to have willfully infringed. See *Read Corp. v. Portec, Inc.*, 970 F.2d 816, 826-28, 23 U.S.P.Q.2d (BNA) 1426, 1435-36 (Fed. Cir. 1992) (listing factors relevant to whether, and to what extent, court should enhance damages). The decision to award enhanced damages, as well as the amount of such an award, is subject to review for abuse of discretion. See *id.*; *SmithKline Diagnostics*, 926 F.2d at 1164 n.2, 17 U.S.P.Q.2d at 1925 n.2.

23 Patent Act of 1793, ch.11, 1 Stat. 318-23, § 5 (authorizing award based on the price at which the patentee “usually sold or licensed” the patent to others); *Nickson Indus. v. Rol Mfg. Co.*, 847 F.2d 795, 798, 6 U.S.P.Q.2d (BNA) 1878, 1879-80 (Fed. Cir. 1988) (affirming award of established royalty under current Patent Act § 284).

24 *Rude v. Westcott*, 130 U.S. 152, 165 (1889). Both *Rude* and a subsequent Ninth Circuit decision, *Faulkner v. Gibbs*, 199 F.2d 635, 638, 95 U.S.P.Q. (BNA) 400, 402 (1952), which restates the *Rude* factors, continue to be cited as controlling authority with respect to the established royalty measure of damages. See, e.g., *Trell v. Marlee Elecs. Corp.*, 912 F.2d 1443, 1446, 16 U.S.P.Q.2d (BNA) 1059, 1061 (Fed. Cir. 1990); *Studiengesellschaft Kohle mbH v. Dart Indus.*, 666 F. Supp. 674, 680 n.6, 4 U.S.P.Q.2d (BNA) 1817, 1820 n.6 (D. Del. 1987). See also 7 Chisum § 20.03[2][b], at 20-171 to -176; John Skenyon et al., *Patent Damages Law & Practice*, § 3:10, at 3-22 to -28.

25 *Rude*, 130 U.S. at 165; see also *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1078, 219 U.S.P.Q. (BNA) 679, 682 (Fed. Cir. 1983) (noting that, under *Rude*, a single licensing agreement is usually not sufficient evidence of an established royalty); *Deere & Co. v. International Harvester Co.*, 710 F.2d 1551, 1557, 218 U.S.P.Q. (BNA) 481, 486 (Fed. Cir. 1983).

26 *Rude*, 130 U.S. at 165.

27 *Id.* at 164; *Panduit Corp. v. Stahlin Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1164 n.11, 197 U.S.P.Q. (BNA) 726, 736 n.11 (6th Cir. 1978). Evidence that the patent owner licensed, or offered to license, its patent in order to compromise a claim that was disputed as to validity or amount also would be inadmissible under the Federal Rules of Evidence, if offered to prove the amount of that claim. Fed. R. Evid. 408; *Hanson*, 718 F.2d at 1078, 219 U.S.P.Q. at 682.

- 28 E.g., *Bandag, Inc. v. Gerrard Tire Co.*, 704 F.2d 1578, 1582, 217 U.S.P.Q. (BNA) 977,981 (Fed. Cir. 1983) (stating that established royalty is not appropriate measure of damages unless defendant’s conduct is comparable to that of established licensees).
- 29 E.g., *Earle v. Sawyer*, 8 F. Cas. 254, 258 (D. Mass. 1825) (recognizing that widespread licensing may diminish patentee’s profit); 7 Chisum § 20.03[2][d], at 20-179 (noting decisions stating “that a reasonable royalty may be higher than an established royalty, particularly when the established royalty was depressed because the patent had not yet gained public recognition or acceptance or because of widespread infringing activity”). This insight reflects sound economics. If the demand for licenses has the usual negative slope, an additional licensee will decrease the fee that the patentee can command. Estimating the extent of the decrease, however, is not a trivial matter. See Roger D. Blair & Thomas F. Cotter, *The Elusive Logic of Standing Doctrine in Intellectual Property Law*, 74 *Tulane L. Rev.* 1323, 1397-1406 (2000) (demonstrating how excessive nonexclusive licensing can reduce aggregate profitability of patent).
- 30 7 Chisum § 20.03[2][b], at 20-172 (stating that “prior licenses that failed to set an actual established royalty could nevertheless be considered in setting a reasonable royalty”); Skenyon et al., *supra* note 24, § 3:10, at 3-22 (stating that “a patent owner is no longer required to prove each of the strict Rude criteria to obtain royalty-based damages,” but that courts may consider established rates in setting reasonable royalties).
- 31 See Blair & Cotter, *supra* note 18, at 1626-28. The same result follows when, instead of making and selling products embodying the patented invention, the patent owner and infringer use the patent to make and sell some other product. In this case, if use of the patent lowers the patent owner’s cost of production by more than it lowers the infringer’s cost of production, the patent owner’s lost profits will exceed the infringer’s profits attributable to the infringement. Cf. 3 Robinson, *supra* note 10, § 1060, at 335 (distinguishing between cases in which patentee and infringer make and sell the patented invention, and cases in which they use it to make and sell other goods).
- 32 See Blair & Cotter, *supra* note 18, at 1628-29. Similarly, if the patent owner and infringer use the patent to make some other product and the infringer is a more efficient user of the patent than is the patent owner, the infringer’s profits will exceed the patent owner’s lost profits, *ceteris paribus*. Note also that, where both patentee and infringer are equally efficient, the patentee’s lost profits and the infringer’s profits from infringement will be equal. *Id.* at 1625-26.
- 33 Both of these goals are, of course, contestable. See *id.* at 1632-33 (discussing potential weaknesses of incentive-to-innovate model); Arti Kaur Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 *Nw. U. L. Rev.* 77, 139 & n.319, 141-42 (1999) (noting, but disputing, argument that compulsory licensing of patents might facilitate greater research use of patented inventions). Cf. Ian Ayres & Paul Klemperer, *Limiting Patentees’ Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 *Mich. L. Rev.* 985, 987 n.2 (1999) (noting that “[e]conomists have understood that reducing the price of patented products with compulsory licensing and increasing the patent length (to maintain the patentee’s expected profit) can increase welfare”).
- 34 In fact, we argue that a court should award the greater of the patentee’s lost profits or the defendant’s profits attributable to the infringement, in order to avoid having to guess what the royalty is the parties would have agreed to in advance, and to preserve the property-like character of patent rights. See Blair & Cotter, *supra* note 18, at 1635-36. Following *Merges* and others, we view the latter point as important due to the inherent difficulties involved in third-party valuations of intellectual property. See *id.* at 1615-16, 1636. Since 1946, however, the position of Congress and the courts has been that calculation of a reasonable royalty is actually easier than the calculation of the defendant’s profits attributable to the infringement. See *id.* at 1647-48. If in fact the transaction and uncertainty costs of estimating the defendant’s profits are sufficiently high, the actual rule may be preferable to the one we advocate, particularly if overdeterrence of marginal conduct is a concern. Cf. *id.* at 1637-38 (discussing overdeterrence). Note, however, that in estimating the amount of a reasonable royalty the courts have suggested that one relevant factor is none other than the amount of the defendant’s profits attributable to the infringement!
- 35 E.g., *Hebert v. Lisle Corp.*, 99 F.3d 1109, 1119, 40 U.S.P.Q.2d (BNA) 1611, 1618 (Fed. Cir. 1996) (noting that “damages may include lost profits due to diverted sales, price erosion, and increased expenditures caused by the infringement”) (citations omitted).
- 36 E.g., *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1579-81, 24 U.S.P.Q.2d (BNA) 1401, 1418-19 (Fed. Cir. 1992) (affirming price erosion damages); *In re Mahurkar Double Lumen Hemodialysis Catheter Patent Litig.*, 831 F. Supp. 1354,

1386-92 (N.D. Ill. 1993) (Easterbrook, J.) (calculating price erosion damages), *aff'd*, 71 F.3d 1573, 37 U.S.P.Q.2d (BNA) 1138 (Fed. Cir. 1995). For an early case recognizing price erosion as a consequence of infringement, see *Yale Lock Mfg. Co. v. Sargent*, 117 U.S. 536, 553 (1886).

37 Sumanth Addanki, *Economics and Patent Damages: A Practical Guide*, 532 PLI/Pat 845, 852 (1998); Gregory J. Werden et al., *Economic Analysis of Lost Profits from Patent Infringement with and Without Noninfringing Substitutes*, 27 AIPLA Q.J. 305, 312-16 (1999). A few cases recognize this relationship between price erosion and quantity accretion. See, e.g., *Minn. Mining & Mfg. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1578-79 & n.11, 24 U.S.P.Q.2d (BNA) 1321, 1337-38 (Fed. Cir. 1992) (affirming price erosion damages based on assumption of “market contraction” that would have followed plaintiff’s price increases absent infringement); *Panduit Corp. v. Stahl Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1157, 197 U.S.P.Q. (BNA) 726, 730-31 (6th Cir. 1978) (affirming finding that losses caused by price reduction were more than compensated for by gains resulting from increased sales; note, however, that if this is true it means that the patentee was not selling at the profit-maximizing price pre-infringement). Nevertheless, cases in which courts estimate price erosion damages by multiplying the number of sales the patent owner actually made during the period of infringement by the price it would have charged in the absence of infringement, thus overestimating the extent of losses due to price erosion, are not uncommon. See, e.g., *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1063, 1067, 219 U.S.P.Q. (BNA) 670, 673, 676 (Fed. Cir. 1983); *Ristvedt-Johnson, Inc. v. Brandt, Inc.*, 805 F. Supp. 557, 567 (N.D. Ill. 1992).

38 *Scripto-Tokai Corp. v. Gillette Co.*, 788 F. Supp. 439, 444, 22 U.S.P.Q.2d (BNA) 1678, 1682 (C.D. Cal. 1992) (stating that “increased expenses for advertising and promotion” are acceptable components of a lost profits recovery). Cf. *Wahl v. Carrier Mfg. Co.*, 511 F.2d 209, 213 (7th Cir. 1974) (rejecting, for lack of evidence, plaintiff’s argument that but for infringement it would have reduced its advertising expenses by \$300,000).

39 E.g., *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1067-68 (Fed. Cir. 1983) (affirming award of damages for lost future profits resulting from plaintiff’s having to devote resources to infringement litigation); Christopher S. Marchese, *Patent Infringement and Future Lost Profits Damages*, 26 *Ariz. St. L.J.* 747, 778-81 (1994).

40 E.g., *Lam*, 718 F.2d at 1068, 219 U.S.P.Q. at 677 (attributing some lost future profits to loss of goodwill resulting from customer doubts attributable to problems encountered with infringing products); Skenyon et al., *supra* note 24, § 1:8, at 1-10 to -11; *id.* § 2:7, at 2-12 to -13.

41 E.g., *THK Am., Inc. v. NSK, Ltd.*, 917 F. Supp. 563, 571 (N.D. Ill. 1996) (referring to plaintiff’s theory that “after expiration NSK will resume its sales in a better position than it would have been [sic] had it never infringed the patent”); David S. Evans, *Market Definition in Antitrust and Patent Litigation*, 414 PLI/Pat 595, 618-19 (1995) (discussing accelerated market entry damages).

42 E.g., *Minco, Inc. v. Combustion Eng’g, Inc.*, 95 F.3d 1109, 1120-21, 40 U.S.P.Q.2d (BNA) 1001, 1009-10 (Fed. Cir. 1996) (declining to award additional damages for third party’s decision to purchase infringing firm, where the “district court’s reasonable royalty award already compensates Minco for any goodwill [the infringer] garnered by infringement”); Skenyon et al., *supra* note 24, § 1:8, at 1-10; *id.* § 2:7, at 2-12 to -13.

43 E.g., *Oiness v. Walgreen Co.*, 88 F.3d 1025, 1031-33, 39 U.S.P.Q.2d (BNA) 1304, 1308-10 (Fed. Cir. 1996) (reversing award of lost future profits, given absence of reliable evidence); *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1581, 24 U.S.P.Q.2d (BNA) 1401, 1419 (Fed. Cir. 1992) (affirming judgment that evidence of lost future profits was too speculative, and stating that “[t]he burden of proving future injury is commensurately greater than that for damages already incurred, for the future always harbors unknowns”). As in antitrust cases, courts sometimes state that “when the amount of the damages cannot be ascertained with precision, any doubts regarding the amount must be resolved against the infringer.” *Lam*, 718 F.2d at 1065, 219 U.S.P.Q. at 675 (citing *Story Parchment Co. v. Paterson Parchment Paper Co.*, 282 U.S. 555, 563 (1931)). See also *Minco*, 95 F.3d at 1118, 40 U.S.P.Q.2d at 1831 (stating that “[o]nce a patentee shows causation... the trial court may resolve doubts underlying the precise measurement of damages against the infringer”); *Kaufman Co. v. Lantech, Inc.*, 926 F.2d 1136, 1141, 17 U.S.P.Q.2d (BNA) 1828, 1832 (Fed. Cir. 1991) (stating that the patentee “need not negate every possibility that the purchaser might not have purchased a product other than his absent the infringement,” and that once the patentee shows “a reasonable probability that the infringing sales caused the loss of profits,” the burden shifts to “the infringer to show that it is unreasonable to infer that some or all of the infringing sales probably caused the patentee to suffer the loss of profits”). But see Skenyon et al., *supra* note 24, § 2:47, at 2-74 (noting that the patentee’s burden has become lighter over time, and citing case law from as late as 1977 purporting to require “strictest proof” of lost profits) (citing *Tektronix, Inc. v. United States*, 552 F.2d 343, 350 (Ct. Cl. 1977)). Nevertheless,

courts refuse to award damages that they characterize as “remote” or “speculative.” E.g., *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1546, 35 U.S.P.Q.2d (BNA) 1065, 1070 (Fed. Cir. 1995) (en banc); *BIC Leisure Prods., Inc. v. Windsurfing Int’l, Inc.*, 1 F.3d 1214, 1218, 27 U.S.P.Q.2d (BNA) 1671, 1674 (Fed. Cir. 1993).

44 *King Instrument Corp. v. Perego*, 737 F. Supp. 1227, 1241, 16 U.S.P.Q.2d (BNA) 1994, 2006 n.11 (D. Mass. 1990), *aff’d*, 65 F.3d 941, 36 U.S.P.Q.2d (BNA) 1129 (Fed. Cir. 1995); *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 35 U.S.P.Q.2d (BNA) 1065, (Fed. Cir. 1995) (en banc); *Paper Converting Mach. Co. v. Magna-Graphics Corp.*, 745 F.2d 11, 223 U.S.P.Q. (BNA) 591 (Fed. Cir. 1984).

45 7 Chisum § 20.03[1][b][v][C], at 20-98 to -99 (citing cases) (cited in *Werden et al.*, *supra* note 37, at 8 n.36).

46 *Werden et al.*, *supra* note 37, at 8.

47 *Pall Corp. v. Micron Separations, Inc.*, 66 F.3d 1211, 1222, 36 U.S.P.Q.2d (BNA) 1225, 1233 (Fed. Cir. 1995) (stating that patentee “must show a reasonable probability that, ‘but for’ the infringement, it would have made the sales that were made by the infringer,” and that “[i]n a market with only two suppliers, the patentee and the infringer, this requirement is readily met”) (quoting *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1545, 35 U.S.P.Q.2d (BNA) 1065, 1069 (Fed. Cir. 1995) (en banc)); *Del Mar Avionics, Inc. v. Quinton Instrument Co.*, 836 F.2d 1320, 1327, 5 U.S.P.Q.2d (BNA) 1255, 1260 (Fed. Cir. 1987) (stating that “[w]hen the patent owner and infringers were the only suppliers of the patented product, it is reasonable to infer that the patent owner would have made the sales made by the infringers” (citing *Lam*, 718 F.2d at 1065, 219 U.S.P.Q. at 675)). See also *Kori Corp. v. Wilco Marsh Buggies & Draglines, Inc.*, 761 F.2d 649, 655, 225 U.S.P.Q. (BNA) 985, 988 (Fed. Cir. 1985) (holding, in case involving two-supplier market, that “the infringer’s profits were properly looked at for comparison purposes with the patentee’s proof of his lost profits”). As an economic matter, this is apt to be wrong absent exceptional circumstances.

48 E.g., *Seymour*, 57 U.S. (16 How.) at 489 (stating that in cases in which the patentee makes and sells a patented product without licensing the patent to others, “the profit of the infringer may be the only criterion of the actual damage of the patentee”). See also *George Ticknor Curtis, A Treatise on the Law of Patents for Useful Inventions: As Enacted and Administered in the United States*, § 338, at 343 (3d ed. 1867); 3 *Robinson*, *supra* note 10, § 1063, at 351. This, of course, is also incorrect as a matter of economics.

49 See 3 *Robinson*, *supra* note 10, § 1061, at 336 n.1.

50 E.g., *Seymour*, 57 U.S. at 487-91 (reversing judgment based on jury instructions stating that there was “a legal presumption that if defendant had not made and sold machines, all persons who bought the defendant’s machines would necessarily have been compelled to go to the patentee and purchase his machines,” where patentee “had given no evidence to show that he could have made and sold a single machine more than he did”). See also 3 *Robinson*, *supra* note 10, § 1062, at 349-50. Courts continue to require proof of the patentee’s ability to supply the market under more modern damages methodologies.

51 *Pitts v. Hall*, 19 F. Cas. 754, 758 (C.C.N.D.N.Y. 1851) (No. 11,192) (noting that the infringer might be able to tolerate lower profit margin than patent owner, who must recoup its research and development costs) (cited in *Curtis*, *supra* note 48, § 338, at 345-46); 3 *Robinson*, *supra* note 10, § 1062, at 350.

52 Cf. 7 Chisum § 20.03[1][c][i], at 20-140 (suggesting that courts incorporated apportionment concept into actions at law “without careful analysis” of possible reasons for applying different rules in law and in equity).

53 For early case law recognizing this principle, see, for example, *Mowry v. Whitney*, 81 U.S. (14 Wall.) 620, 651 (1871) (stating, in a suit in equity, that “[t]he question to be determined... is, what advantage did the defendant derive from using the complainant’s invention over what he had in using other processes then open to the public and adequate to enable him to obtain an equally beneficial result,” and that “[t]he fruits of that advantage are his profits”); *Suffolk Co. v. Hayden*, 70 U.S. (3 Wall.) 315, 320 (1865). See also 3 *Robinson*, *supra* note 10, § 1062, at 342-47.

54 As an economic matter, products A and B are substitutes if an increase in the price of good B leads to an increase in the quantity

demand of good A. See Robert S. Pindyck & Daniel L. Rubinfeld, *Microeconomics* 109 (4th ed. 1998). See also John W. Schlicher, *Patent Law: Legal and Economic Principles*, § 9.05[2][1], at 9-92 (1999). This is consistent with our intuitive (less formal) understanding about substitution. Starting from some initial consumption pattern, suppose that the price of beef were to rise. If the price of pork remained constant, then pork would become cheaper relative to beef. If, as a result, consumers switched their purchases, at least to some extent, away from beef in favor of pork, then beef and pork would be deemed substitutes. Substitutability is not often an all-or-none proposition. That is, when the relative prices of two goods change, it would be unusual for everyone to stop consuming the relatively more expensive good. For example, when there is a price promotion on Coca-Cola, not everyone switches from Pepsi Cola to Coke. This is because they are somewhat imperfect substitutes. A formal way of capturing the degree of substitutability is provided by the cross-elasticity of demand. In general form, the quantity demanded of product A ( $Q_A$ ) can be expressed as a function of the price of A ( $P_A$ ), the prices of other goods ( $P_B$  and  $P_C$ ), and income ( $M$ ):

#### TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

If  $\partial Q_{A \text{ or } P_B} / \partial P_A < 0$ , then A and B are substitutes. The cross-elasticity of demand ( $\epsilon_{A,B}$ ) is defined to be  
Since the price of good B and the quantity of good A must necessarily be positive, the cross-elasticity of demand will be positive for substitutes because  $\partial Q_A / \partial P_B$  is positive if A and B are substitutes (the larger the cross-elasticity of demand, the stronger the degree of substitutability). On intuitive reasoning, we would expect large values for  $\epsilon_{A,B}$  when examining Coke v. Pepsi, Bud v. Miller, and Burger King v. McDonald's. Similarly, we would expect lower values of  $\epsilon_{A,B}$  when examining automobiles v. motorcycles, PCs v. typewriters, and light bulbs v. candles. The actual values of  $\epsilon_{A,B}$  are, of course, an empirical matter. In other words, the data will tell us to what extent goods A and B are substitutes.

55 See *In re Mahurkar Double Lumen Hemodialysis Catheter Patent Litig.*, 831 F. Supp. 1354, 1390, 28 U.S.P.Q.2d (BNA) 1801, 1829 (N.D. Ill. 1993) (noting "degrees of substitutability"), *aff'd*, 71 F.3d 1573, 37 U.S.P.Q.2d (BNA) 1138 (Fed. Cir. 1995).

56 E.g., *Philp v. Nock*, 84 U.S. (17 Wall.) 460, 462 (1873) (stating that "[w]here the infringement is confined to a part of the thing sold, the recovery must be limited accordingly. It cannot be as if the entire thing were covered by the patent...."). Moreover, as suggested in *Seymour*, 57 U.S. (16 How.) at 490, a contrary rule might be particularly troublesome in a case in which the final product incorporates two or more patents:

If the measure of damages be the same whether a patent be for an entire machine or for some improvement in some part of it, then it follows that each one who has patented an improvement in any portion of a steam engine or other complex machines may recover the whole profits arising from the skill, labor, material, and capital employed in making the whole machine, and the unfortunate mechanic may be compelled to pay treble his whole profits to each of a dozen or more several inventors of some small improvement in the engine he has built. By this doctrine even the smallest part is made equal to the whole, and "actual damages" to the plaintiff may be converted into an unlimited series of penalties on the defendant.

57 Thomas F. Cotter, *Is This Conflict Really Necessary?: Resolving an Ostensible Conflict Between Patent Law and Federal Trademark Law*, 3 *Marq. Intell. Prop. L. Rev.* 25, 30-31 (1999).

58 *Philp*, 84 U.S. at 462; *Seymour*, 57 U.S. at 489-91. See also 3 *Robinson*, *supra* note 10, § 1062, at 344 n.7 (describing the apportionment rule as "indisputable"). For more recent statements in favor of the apportionment rule, see, e.g., *Baumstimler v. Rankin*, 677 F.2d 1061, 1073, 215 U.S.P.Q. (BNA) 575, 584 (5th Cir. 1982); *Velo-Bind, Inc. v. Minn. Mining & Mfg. Co.*, 647 F.2d 965, 973, 211 U.S.P.Q. (BNA) 926, 933-34 (9th Cir. 1981). One way the inventor might try to get around the apportionment problem might be to claim an invention comprising the final product plus the component. Until recently, however, the Patent Office generally rejected these claims unless the new component, in combination with the old "environment," produced a "synergistic" result. See Brent Rabowsky, Note, *Recovery of Lost Profits on Unpatented Products in Patent Infringement Cases*, 70 *S. Cal. L. Rev.* 281, 290-93 (1996).

59 35 U.S.C. § 289 (1994) (stating that whoever without authorization applies a patented design to any article of manufacture for purposes of sale, or sells any such article, "shall be liable to the owner to the extent of his total profit, but not less than \$250"); *Trans-World Mfg. Corp. v. Al Nyman & Sons, Inc.*, 750 F.2d 1552, 1567, 224 U.S.P.Q. (BNA) 259, 269 (Fed. Cir. 1984) (noting that purpose of this provision was to overrule *Dobson v. Dornan*, 118 U.S. 10 (1886)-a case in which the Supreme Court held it was necessary to apportion damages attributable to the design and to the article itself-because the practical effect of this case was to "preclud[e] any recovery for violation of a design patent").

60 For example, Ford Motor Company earns a certain amount of its profit from the sale of Taurus automobiles. How much of that profit can be attributed to its ignition switch and how much to its transmission? In principle, these questions could be answered if Ford would offer varying configurations of the Taurus model, but it is unlikely to deviate from what it perceives to be the profit-maximizing configuration.

61 Addanki, *supra* note 37, at 855-57; Kenneth E. Krosin & Holly D. Kozlowski, Patent Damages, 300 *PLI/Pat* 53, 70-71, 89-90 (1990); Werden et al., *supra* note 37, at 307-08, 321-32; Marion B. Stewart, Calculating Economic Damages in Intellectual Property Disputes: The Role of Market Definition, 77 *J. Pat. & Trademark Off. Soc'y* 321, 327-28 (1995).

62 Whether or not this would be a great advance for civilization is debatable.

63 For early articulations of the rule, see *Garretson v. Clark*, 111 U.S. 120, 121 (1884) (stating, in a suit in equity in which the plaintiff sought the defendant's profits and any actual damages in addition to those profits, that "profits and damages are to be calculated on the whole machine" when "the entire value of the whole machine, as a marketable article, is properly and legally attributable to the patented feature") (quoting *Garretson v. Clark*, 10 F. Cas. 40, 44 (C.C.N.D.N.Y. 1878)); *Fay v. Allen*, 30 F. 446, 447-48 (C.C.N.D.N.Y. 1887) (stating, in a suit in equity, that the rule applies when "the entire market value of the machine is due to the invention;" and concluding that the rule applied in this case, because "[T]he market value of the machine was due solely to the invention. To remove the patented features was like taking out the heart and lungs of a human being. The machine was dead."). See also 3 *Robinson*, *supra* note 10, § 1052, at 348 (noting that rule applied equally at law and in equity); *id.* § 1053, at 35-54.

64 *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1362, 52 U.S.P.Q.2d (BNA) 1294, 1299 (Fed. Cir. 1999) (quoting *State Indus., Inc. v. Mor-Flo Indus., Inc.*, 883 F.2d 1573, 1580, 12 U.S.P.Q.2d (BNA) 1026, 1031 (Fed. Cir. 1989)). The court goes on to state that this

rule is appropriate where both the patented and unpatented components together are 'analogous to components of a single assembly,' 'parts of a complete machine,' or 'constitute a functional unit,' but not where the unpatented components 'have essentially no functional relationship to the patented invention and... may have been sold with an infringing device only as a matter of convenience or business advantage.

*Id.* (quoting *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1550 (Fed. Cir. 1995) (en banc)). This quotation suggests that the Federal Circuit has essentially merged the "entire market value rule" with the rules relating to the patentee's ability to recover damages for lost profits on sales of separate-but-related goods.

65 *Velo-Bind, Inc. v. Minn. Mining & Mfg. Co.*, 647 F.2d 965, 973, 211 U.S.P.Q. (BNA) 926, 933-34 (9th Cir. 1981) (referring to EMVR as an exception to the apportionment principle); *Crosby Steam-Gage & Valve Co. v. Consolidated Safety Valve Co.*, 141 U.S. 441, 453 (1891) (concluding that "the entire value of [the final product], as a marketable article, is properly and legally attributable to the patented feature"); *Dobson v. Hartford Carpet Co.*, 114 U.S. 439, 445 (1885) (referring to EMVR as an exception to the apportionment principle).

66 575 F.2d 1152, 197 U.S.P.Q. (BNA) 726 (6th Cir. 1978).

67 *Id.* at 1156, 197 U.S.P.Q. at 729-30.

68 A Westlaw search of the terms "(Panduit /s Stahlin) & da(since 1995)", conducted on June 21, 2000, discloses 32 citations encompassing the Federal Circuit, the U.S. district courts, and the Court of Federal Claims. E.g., *Fonar Corp. v. Gen. Elec. Co.*, 107 F.3d 1543, 1553, 41 U.S.P.Q.2d (BNA) 1801, 1808 (Fed. Cir. 1997) (stating that patentee may demonstrate lost profits "by means of the four-factor Panduit test"); *Biacore, AB, Biacore Inc. v. Thermo Bioanalysis Corp.*, 79 F. Supp. 2d 422, 469 (D. Del. 1999).

69 *Rite-Hite Co. v. Kelley*, 56 F.3d 1538, 1548, 35 U.S.P.Q.2d (BNA) 1065, 1071 (Fed. Cir. 1995) (en banc) (stating that some "fact situations may require different means of evaluation, and failure to meet the Panduit test does not ipso facto disqualify a loss from being compensable"); *Bio-Rad Labs., Inc. v. Nicolet Instrument Corp.*, 739 F.2d 604, 616 n.\* (Fed. Cir. 1984) (stating that Panduit standard is not "the exclusive one for determining entitlement to lost profits") (citations omitted).

- 70 Gargoyles, Inc. v. United States, 113 F.3d 1572, 1577-78, 42 U.S.P.Q.2d (BNA) 1760, 1765-66 (Fed. Cir. 1997) (holding that, as a matter of law, plaintiff lacked capacity to meet demand for patented product in light of minimal inventory, lower profit margins on government sales, and poor record of meeting business plan projections); Kori Corp. v. Wilco Marsh Buggies & Draglines, Inc., 561 F. Supp. 512, 526-27, 217 U.S.P.Q. (BNA) 1302, 1306-07 (E.D. La. 1981) (finding that plaintiff had sufficient facilities, capital, and labor force to meet demand for patented product), *aff'd*, 761 F.2d 649, 225 U.S.P.Q. (BNA) 985 (Fed. Cir. 1985); *cf.* Carella v. Starlight Archery & Pro Line Co., 804 F.2d 135, 141 (Fed. Cir. 1986) (rejecting defendant's challenge to lost profits award based on trial court's alleged failure "to make any findings as to Carella's production and marketing capacity," and noting both that Panduit is not the exclusive standard for assessing damages and that proof of lost profits "will vary with the size and complexity of the patentee's company and with the extent to which that information is challenged or contradicted by the infringer"). See also Paul M. Janicke, *Contemporary Issues in Patent Damages*, 42 Am. U. L. Rev. 691, 706 (1993) (noting that patent owners are not required to demonstrate "immediate plant capacity," but may instead show, *inter alia*, that "they could have subcontracted the production work or that their facilities were adequate or could have been made adequate to meet demand for the patented product") (citations omitted).
- 71 Gargoyles, Inc., 113 F.3d at 1577, 42 U.S.P.Q.2d at 1765; Central Soya Co. v. Geo. A. Hormel & Co., 723 F.2d 1573, 1578-79, 220 U.S.P.Q. (BNA) 490, 494 (Fed. Cir. 1983); Panduit, 575 F.2d at 1156, 197 U.S.P.Q. (BNA) 726, 729-30 (6th Cir. 1978).
- 72 State Indus., Inc. v. Mor-Flo Indus. Inc., 883 F.2d 1573, 1578-79, 12 U.S.P.Q.2d (BNA) 1026, 1029-30 (Fed. Cir. 1989); Gyromat Corp. v. Champion Spark Plug Co., 735 F.2d 549, 552, 222 U.S.P.Q. (BNA) 4, 6 (Fed. Cir. 1984).
- 73 BIC Leisure Prods. v. Windsurfing Int'l, Inc., 1 F.3d 1214, 1218-19, 27 U.S.P.Q.2d (BNA) 1671, 1674-75 (Fed. Cir. 1993) (stating that "evidence of sales of the infringing product may suffice to show" the first Panduit factor, as long as the patent owner and infringer "compete in the same market for the same customers" by selling products that are substantially similar in price and product characteristics; and that same factors tend to prove second factor as well); Kalman v. Berlyn Corp., 9 U.S.P.Q.2d (BNA) 1191, 1194-95 (finding for patentee with respect to first and second factors, in light of evidence that patented invention solved many problems associated with existing plastics technology), *aff'd*, 914 F.2d 1473, 16 U.S.P.Q.2d (BNA) 1093 (Fed. Cir. 1990). Several commentators have made the same point. Ned L. Conley, *An Economic Approach to Patent Damages*, 15 AIPLA Q.J. 354, 360 (1987) (noting that first and second factors overlap, because "[o]ne cannot determine what would be an acceptable alternative without determining what it is that the customers want"); John C. Jarosz & Erin M. Page, *The Panduit Lost Profits Test After BIC Leisure v. Windsurfing*, 3 Fed. Cir. B.J. 311, 320-21 (1993) (arguing that "in the but-for world, Panduit (1) and (2) are... virtually indistinguishable"); Rabowsky, *supra* note 58, at 307 (noting that "[i]f there is no demand for the patented product, noninfringing alternatives will be acceptable to consumers").
- 74 A case frequently cited for this proposition is TWM Manufacturing Co. v. Dura Corp., 789 F.2d 895, 229 U.S.P.Q. (BNA) 525 (Fed. Cir. 1986), in which the court stated:  
Mere existence of a competing device does not make the device an acceptable substitute. The special master committed no error in noting that none of the alleged substitutes had all beneficial characteristics of the patented device [citation omitted]. That finding supported the determination that there were no acceptable substitutes. "A product lacking the advantages of that patented can hardly be termed a substitute 'acceptable' to the customer who wants those advantages."  
(citing Panduit, 575 F.2d at 1162). See also Stryker Corp. v. Intermedics Orthopedics, Inc., 96 F.3d 1409, 1418, 40 U.S.P.Q.2d (BNA) 1065, 1072 (Fed. Cir. 1996) (affirming judgment that devices sold in competition with patented device were not adequate substitutes because "a 'product on the market which lacks the advantages of the patented product can hardly be termed a[n] [acceptable] substitute'" ) (brackets in original) (quoting Standard Havens Prods., Inc. v. Gencor Indus., 953 F.2d 1360, 1373, 21 U.S.P.Q.2d (BNA) 1321, 1331 (Fed. Cir. 1991)) Some of the cases, however, contain language that can be interpreted as supporting the economic perspective that a product has no substitutes only if it confers advantages that matter to consumers. E.g., Standard Havens, 953 F.2d at 1373, 21 U.S.P.Q.2d at 1331 (stating that "if purchasers are motivated to purchase because of particular features available only from the patented product, products without such features-even if otherwise competing in the marketplace-would not be acceptable noninfringing substitutes") (emphasis added); Panduit, 575 F.2d at 1162, 197 U.S.P.Q. at 734 (stating that "[a] product lacking the advantages of that patented can hardly be termed a substitute 'acceptable' to the customer who wants those advantages"). Taken in context, this language arguably suggests that the ultimate focus should be on whether consumers view a competing product as a substitute, rather than on whether it is functionally identical to the patented device. For further discussion of factors the courts have considered in assessing the adequacy of noninfringing alternatives, including factors that go beyond technical equivalency, see Skenyon et al., *supra* note 24, § 1:10, at 1-14 to -15; *id.* §§ 2:33 to:43; Harold R. Brown III, *Proof of Lost Profits Damages Following Rite-Hite v. Kelley*, 23 AIPLA Q.J. 577, 593-603 (1995).
- 75 BIC Leisure Prods., Inc. v. Windsurfing Int'l, Inc., 1 F.3d 1214, 1219, 27 U.S.P.Q.2d (BNA) 1671, 1675 (Fed. Cir. 1993) (stating that to be deemed acceptable the alleged acceptable noninfringing substitute "must not have a disparately higher price than or

possess characteristics significantly different from the patented product.”) (quoting *Kaufman Co. v. Lantech, Inc.*, 926 F.2d 1136, 1142, 17 U.S.P.Q.2d (BNA) 1828, 1832 (Fed. Cir. 1991)); *Biacore, AB, Biacore Inc. v. Thermo Bioanalysis Corp.*, 79 F. Supp. 2d 422, 470 (D. Del. 1999).

76 926 F.2d 1161, 17 U.S.P.Q.2d (BNA) 1922 (Fed. Cir. 1991).

77 *Id.* at 1166, 17 U.S.P.Q.2d at 1926.

78 *Id.*; *Slimfold Mfg. Co. v. Kinkead Indus.*, 932 F.2d 1453, 1458, 18 U.S.P.Q.2d (BNA) 1842, 1846 (Fed. Cir. 1991) (affirming finding that substitute lacking some advantages of the patented product was an acceptable substitute when plaintiff failed to prove that consumers wanted those advantages).

79 185 F.3d 1341, 51 U.S.P.Q.2d (BNA) 1556 (Fed. Cir. 1999), *aff’g* 979 F. Supp. 1233, 44 U.S.P.Q.2d (BNA) 1782 (N.D. Ind. 1997).

80 *Id.* at 1349-56, 51 U.S.P.Q.2d at 1562-67. In 1995, Judge Frank Easterbrook, sitting by designation as a district court judge for the damages portion of the trial, issued a judgment awarding the plaintiff a reasonable royalty in lieu of lost profits, based upon his finding that the defendant could have produced a noninfringing product, which consumers would have found no different in quality from the patented product, no later than October 1979. *Grain Processing Corp. v. American Maize-Prods. Co.*, 893 F. Supp. 1386, 1390-92, 37 U.S.P.Q.2d (BNA) 1299, 1301-03 (N.D. Ind. 1995). Although the defendant did not actually produce a noninfringing product until 1991 (after being found liable for infringement), because the process used to make the noninfringing product was slightly more expensive than the infringing process, the court concluded that the relevant technology was readily available long before then. *Id.* The court also concluded that the defendant could have used this technology without raising the price it charged consumers, and thereby causing some of them to purchase from the plaintiff, because its profit margin even with the use of the more expensive, noninfringing technology was already very high. *Id.* at 1392, 37 U.S.P.Q.2d at 1303. In an unpublished opinion, the Court of Appeals reversed on the ground that “to be an acceptable noninfringing substitute, the product or process must have been available or on the market at the time of the infringement.” *Grain Processing Corp. v. American Maize-Prods. Co.*, Nos. 95-1506, 95-1507, 108 F.3d 1392 (table), 1997 WL 71726, at \*2 (Fed. Cir. Feb. 20, 1997). On remand, the district court clarified that in its earlier opinion it had found that the alternative process was “available” during the relevant time period. *Grain Processing Corp. v. American Maize-Prods. Co.*, 979 F. Supp. 1233, 1234-35, 44 U.S.P.Q.2d (BNA) 1782, 1784 (N.D. Ind. 1997), and concluded that because this product was “within [the defendant’s] existing production abilities,” though not on the market, it “effectively constrain[ed] the patent holder’s profits.” *Id.* at 1236, 44 U.S.P.Q.2d at 1785. This time the appellate court affirmed. Noting that “[c]onsumer demand defines the relevant market and relative substitutability among products therein,” the court agreed that, in the eyes of consumers, the available noninfringing alternative “was the same product, for the same price, from the same supplier” as the product made by other processes. *Grain Processing Corp. v. American Maize-Prods. Co.*, 185 F.3d 1341, 1355, 51 U.S.P.Q.2d (BNA) 1556, 1566 (Fed. Cir. 1999). See also *id.* at 1354, 51 U.S.P.Q.2d at 1565 (noting the district court’s “unchallenged finding” that, in this case, there was no “economically significant demand for a product having all of the [claimed] attributes of the patented product”) (quoting *Grain Processing*, 979 F. Supp. at 1237, 44 U.S.P.Q.2d at 1787). The court also approved the lower court’s finding with respect to Panduit factor number one that there was no demand for the patented product, in the sense that there was no demand for a product having all of the attributes of the patented product; the evidence showed that consumer demand for the noninfringing version of the additive, which omitted two limitations of the patented invention (that the starch used to make the additive be waxy, and that it have a particular ratio of dextrose to other elements), was identical to the demand for the patented version. *Id.* at 1348, 51 U.S.P.Q.2d at 1561 (citing *Grain Processing*, 979 F. Supp. at 1237, 44 U.S.P.Q.2d at 1787).

81 As noted above, if the cross-elasticity of demand is very large, then the patentee may not have suffered much in the way of damages; its loss of sales and profits would be due primarily to the infringing firm’s entry rather than the infringement. Unless the patentee can separate out the effect of entry, its claim for damages should fail. In contrast, if the cross-elasticity of demand is very low, then it is reasonable to infer, all else being equal, that lost sales and profits are due to infringement rather than entry. Damages claims in such cases should fare much better than in cases where the cross-elasticity of demand is quite large. For discussion of some methods for estimating elasticities indirectly, see Addanki, *supra* note 37, at 856-57; Kenneth E. Krosin & Holly D. Kozlowski, *Patent Damages*, 300 PLI/Pat 53, 72-73; Werden et al., *supra* note 37, at 317-18.

82 *Paper Converting Mach. Co. v. Magna-Graphics Corp.*, 745 F.2d 11, 22, 223 U.S.P.Q. (BNA) 591, 599 (Fed. Cir. 1984). Litigation often centers on whether certain costs should be classified as fixed or variable. *Kalman v. Berlyn Corp.*, 914 F.2d 1473, 1485, 16

U.S.P.Q.2d (BNA) 1093, 1102 (Fed. Cir. 1990) (affirming judgment that plaintiff would not have incurred additional labor costs in producing additional merchandise); *W.R. Grace & Co.-Conn. v. Interacat, Inc.*, 60 F. Supp. 2d 316, 326, 52 U.S.P.Q.2d (BNA) 1331, 1338 (D. Del. 1999) (holding that plaintiff's "selling and general and administrative costs" would not have increased with increased sales activity). Parties may prove the amount of fixed and variable costs by subjecting the patent owner's profit and loss statements to a line-by-line analysis or by using regression analysis. *Stryker Corp. v. Intermedics Orthopedics, Inc.*, 891 F. Supp. 751, 825-32 (E.D.N.Y. 1995) (comparing line-by-line and regression analyses of plaintiff's lost profits), *aff'd*, 96 F.3d 1409 (Fed. Cir. 1996); *Schneider (Europe) AG v. Scimed Life Sys., Inc.*, 852 F. Supp. 813, 859 (D. Minn. 1994), *aff'd mem.*, 60 F.3d 839 (Fed. Cir. 1995). For further discussion of the methodologies, see Skenyon et al., *supra* note 24, § 2:46 to:47; Dorsey Baker, *Patent Damages-Quantifying the Award*, 69 J. Pat. & Trademark Off. Soc'y 121, 136-41 (1987); Peter B. Frank & Michael J. Wagner, *Computing Lost Profits and Reasonable Royalties*, 15 AIPLA Q.J. 338, 398-407 (1987).

83 *Schneider*, 852 F. Supp. at 847 (noting that "[f]ixed costs are only fixed within certain ranges of production," and that "[f]or large changes in production, fixed costs often become variable"); *In re Mahurkar Double Lumen Hemodialysis Catheter Patent Litig.*, 831 F. Supp. 1354, 1386, 28 U.S.P.Q.2d (BNA) 1801, 1826 (N.D. Ill. 1993) (noting that "costs of sales, general overhead, and the like, are not variable for small changes in output over the short run," but that "they are most assuredly variable for larger changes over the long run"), *aff'd*, 71 F.3d 1573 (Fed. Cir. 1995); Richard T. Rapp & Phillip A. Beutel, *Patent Damages: Updated Rules on the Road to Economic Rationality*, 572 PLI/Pat 865, 885 (1999) (noting that "'fixed' costs caused by the extra sales... should be counted... if they would have been necessary to make the infringer's sales") (underlined in original). Cf. *State Indus., Inc. v. Mor-Flo Indus., Inc.*, 883 F.2d 1573, 1580, 12 U.S.P.Q.2d (BNA) 1026, 1031 (Fed. Cir. 1989) (finding no abuse of discretion in district court's conclusion "that any increase in fixed costs was minimal and that award of incremental profits was appropriate"). Rapp and Beutel argue, however, that accounting conventions are inadequate for distinguishing fixed from variable costs because of their failure to accurately reflect opportunity costs. See Rapp & Beutel, *supra*, at 885.

84 *Kalman*, 914 F.2d at 1482, 16 U.S.P.Q.2d at 1100.

85 *Janicke*, *supra* note 70, at 708-09. See also *Krosin & Kozlowski*, *supra* note 81, at 97-98 (noting that "gross margin may be a substantial percentage of selling price, resulting in significant lost profits awards").

86 Skenyon et al., *supra* note 24, § 2:46, at 2-74 (emphasis in original).

87 Cf. *SafGard Prods. v. Serv. Parts, Inc.*, 491 F. Supp. 996, 1000-01, 206 U.S.P.Q. (BNA) 976, 979-80 (D. Ariz. 1980) (noting that failure to subtract fixed costs from gross revenue earned from lost sales would result in reamortizing those costs over the defendant's infringing units).

88 377 U.S. 476, 141 U.S.P.Q. (BNA) 681 (1964).

89 461 U.S. 648, 217 U.S.P.Q. (BNA) 1185 (1983).

90 *Aro II*, 377 U.S. at 478-79, 141 U.S.P.Q. at 683.

91 *Id.*

92 *Id.* at 479, 488 n.7, 141 U.S.P.Q. at 686, n.7.

93 *Id.* at 479, 141 U.S.P.Q. at 686.

94 *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 365 U.S. 336, 340-46, 128 U.S.P.Q. 354, 357-63 (1961) (*Aro I*) (applying what is sometimes referred to as the "first-sale" doctrine, under which the lawful purchaser of a patented article may use and resell it without the patentee's permission.) See 5 Chisum, *supra* note 10, § 16.03[2][a], at 16-137. Repair of a lawfully purchased patented

article is considered a permissible use; reconstruction of the article, however, is considered an unlawful manufacture rather than a permissible use. See *Aro II*, 377 U.S. at 479-80, 141 U.S.P.Q. at 683-84.

<sup>95</sup> *Aro II*, 377 U.S. at 482-502, 141 U.S.P.Q. at 681, 684-97.

<sup>96</sup> *Id.* at 502-13, 141 U.S.P.Q. at 681, 692-96.

<sup>97</sup> *Id.* at 507, 141 U.S.P.Q. at 694.

<sup>98</sup> 117 U.S. 536 (1886).

<sup>99</sup> *Aro II*, 377 U.S. at 507, 141 U.S.P.Q. at 694 (quoting *Yale Lock*, 117 U.S. at 552).

<sup>100</sup> 251 F.2d 469, 116 U.S.P.Q. (BNA) 167 (5th Cir. 1958).

<sup>101</sup> *Aro II*, 377 U.S. at 507, 141 U.S.P.Q. at 694 (quoting *Livesay Window Co. v. Livesay Indus., Inc.*, 251 F.2d at 471, 116 U.S.P.Q. at 168).

<sup>102</sup> *Id.* at 507-13, 141 U.S.P.Q. at 694-97. Whether the Court's conclusion of no damages on the facts presented was correct is a matter of some debate. See, e.g., *Schlicher*, supra note 54, § 9.05[2][n], at 9-105 to 9-111.

<sup>103</sup> *Devex*, 461 U.S. 648 at 649-52, 217 U.S.P.Q. 1185 at 1187.

<sup>104</sup> *Id.* at 652-53, 217 U.S.P.Q. at 1186-87 (quoting 35 U.S.C. § 284 (1994 & Supp. V 1999)).

<sup>105</sup> *Id.* at 654-55, 217 U.S.P.Q. at 1187-88.

<sup>106</sup> *Id.* at 655, 217 U.S.P.Q. at 1188.

<sup>107</sup> *Id.*

<sup>108</sup> *Id.* at 656-57, 217 U.S.P.Q. at 1188-89.

<sup>109</sup> *Grain Processing Corp. v. American Maize-Prods. Co.*, 185 F.3d 1341, 1349-50, 51 U.S.P.Q.2d (BNA) 1556, 1561-62 (Fed. Cir. 1999); *Rite-Hite Corp. v. Kelley Co., Inc.*, 56 F.3d 1538, 1544-45, 35 U.S.P.Q.2d (BNA) 1065, 1068-69 (Fed. Cir. 1995) (en banc); *SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 926 F.2d 1161, 1164, 17 U.S.P.Q.2d (BNA) 1922, 1924-25 (Fed. Cir. 1991); *Kori Corp. v. Wilco Marsh Buggies & Draglines, Inc.*, 761 F.2d 649, 652-53 (Fed. Cir. 1985); *Central Soya Co. v. Geo. A. Hormel & Co.*, 723 F.2d 1573, 1578-79, 220 U.S.P.Q. (BNA) 490, 493-94. (Fed. Cir. 1983); *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1064-65, 219 U.S.P.Q. (BNA) 670, 674-76 (Fed. Cir. 1983).

<sup>110</sup> 883 F.2d 1573, 12 U.S.P.Q.2d (BNA) 1026 (Fed. Cir. 1989).

<sup>111</sup> *Id.* at 1575-76, 12 U.S.P.Q.2d at 1026-28.

112 Id. at 1576, 12 U.S.P.Q.2d at 1027-28.

113 Id. at 1578-81. The court also affirmed an award of a reasonable royalty of 3% on the remaining 60% of the infringing sales, but it vacated a finding that the infringement was not willful and remanded with instructions to consider whether to award enhanced damages. Id. at 1581-82.

The mathematical error arises from the court's assumption that, absent the infringement, State would have retained the 40% market share that it enjoyed during the period of infringement. Id. at 1579-80. As others have noted, this assumption probably underestimates the amount of State's lost profits. To illustrate, suppose that during the period of infringement State had a 40% market share, and that Mor-Flo and three other companies each had 15%. If Mor-Flo were eliminated from the picture, and if each of the other firms had retained a market share equal to 37.5% of State's market share, then in the absence of infringement State would have had a 47.1% market share and the three remaining competitors each 17.6%. See Alan J. Cox, *Antitrust and Intellectual Property Market Definition*, 524 PLI/Pat 129, 145-46 (1998) (describing correct method); David S. Evans, *Market Definition in Antitrust and Patent Litigation*, 414 PLI/Pat 595, 616-17 (1995); Jarosz & Page, *supra* note 73, at 318 n.23 (contrasting correct approach with actual approach used in *State Industries*); Krosin & Kozlowski, *supra* note 81, at 81-82; Werden et al., *supra* note 37, at 319. The court's mathematical error has been repeated by some, but not all, subsequent courts that have applied market-share analysis. See Werden et al., *supra* note 37, at 320 n.50.

114 See *infra* note 115 and accompanying text. See also Rapp & Beutel, *supra* note 83, at 877; Werden et al., *supra* note 37.

115 For example, in *BIC Leisure Products v. Windsurfing International, Inc.*, 1 F.3d 1214, 27 U.S.P.Q.2d (BNA) 1671 (Fed. Cir. 1993), the court noted that the district court had "modified the Panduit test by presuming that [patentee] Windsurfing would have captured a share of [infringer] BIC's sales in proportion to Windsurfing's share of the sailboard market," and that it had accordingly "awarded Windsurfing lost profits based upon its pro rata percentage of BIC's sales for each year of the damages period." Id. at 1217, 27 U.S.P.Q.2d at 1673. The Court of Appeals reversed the award, on the ground that Windsurfing and BIC operated in such separate product markets--BIC's product appealing to more cost-conscious consumers, among other things--that there was no "reasonable probability that Windsurfing would have made its pro rata share of BIC's sales had BIC not been in the market." Id. at 1218, 27 U.S.P.Q.2d at 1674. Nevertheless, the court interpreted *State Industries* as standing for the proposition that "a patent owner may satisfy the second Panduit element by substituting proof of its market share for proof of the absence of acceptable substitutes," noting that this "approach allows a patentee to recover lost profits, despite the presence of acceptable, noninfringing substitutes, because it nevertheless can prove with reasonable probability sales it would have made 'but for' the infringement." Id. at 1219, 27 U.S.P.Q.2d at 1675. Commentators have largely approved of the manner in which the court analyzed the differences between the markets served by the plaintiff and defendant. See, e.g., Cox, *supra* note 113, at 146; Jarosz & Page, *supra* note 73, at 311-20; Rapp & Beutel, *supra* note 83, at 880-81; Marion B. Stewart, *Calculating Economic Damages in Intellectual Property Disputes: The Role of Market Definition*, 77 J. Pat. & Trademark Off. Soc'y 321, 328-29 (1995). But see Werden et al., *supra* note 37, at 328 (arguing that court was probably correct "to reverse the award premised on the market-share rule," but that Windsurfing nevertheless probably suffered some lost sales and price erosion, and proposing a method for estimating those losses). See also *Pall Corp. v. Micon Separations, Inc.*, 66 F.3d 1211, 1222-23, 36 U.S.P.Q.2d (BNA) 1225, 1233-34 (Fed. Cir. 1995) (affirming judgment limiting award of lost profits to the share (25%) of the defendant's sales that the patentee would have made after settling infringement litigation with another competitor); *Atlantic Thermoplastics Co. v. Faytex Corp.*, 5 F.3d 1477, 1481-82, 28 U.S.P.Q.2d (BNA) 1343, 1347 (Fed. Cir. 1993) (affirming award based on "market share percentage of the infringing sales"); *King Instrument Corp. v. Perego*, 65 F.3d 941, 953, 36 U.S.P.Q.2d (BNA) 1129, 1137-38 (Fed. Cir. 1995); *Minn. Mining & Mfg. v. Johnson & Johnson Orthopaedics, Inc.*, Civ. No. 4-86-359, 1991 WL 441901, at \* 52 (D. Minn. Apr. 30, 1991), *aff'd*, 976 F.2d 1559, 24 U.S.P.Q.2d (BNA) 1321 (Fed. Cir. 1992).

116 See *Atlantic Thermoplastics Co. v. Faytex Corp.*, 970 F.2d 834, 847, 23 U.S.P.Q.2d (BNA) 1481, 1492 (Fed. Cir. 1992) (remanding for district court to consider market-share approach, where infringer sold, along with infringing merchandise, a noninfringing product that may have been an adequate substitute for some consumers). Cf. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 939 F.2d 1540, 1545, 19 U.S.P.Q.2d (BNA) 1432, 1437-38 (Fed. Cir. 1991) (reversing judgment that awarded patent owner lost profits based upon only 80% of infringer's sales and assumption of 80% market share absent infringement, where infringer had not rebutted patent owner's evidence of lack of noninfringing substitutes); *Kaufman Co. v. Lantech, Inc.*, 926 F.2d 1136, 1140-42, 17 U.S.P.Q.2d (BNA) 1828, 1833-34 (Fed. Cir. 1991) (reversing judgment awarding patent owner lost profits based upon only eight of infringer's forty-four infringing sales, where infringer failed to rebut patent owner's evidence of all four Panduit factors). At least one commentator has read *Uniroyal* and *Kaufman* as standing for the proposition that the infringer bears the burden of proving that damages should be reduced in light of market share. Janicke, *supra* note 70, at 704-06. Whether this is the correct interpretation in light of the *BIC Leisure* court's statement that "a patent owner may satisfy the second Panduit element by

substituting proof of its market share for proof of the absence of acceptable substitutes,” see *BIC Leisure*, 1 F.3d at 1219, 27 U.S.P.Q.2d at 1675 (emphasis added), remains to be seen. Perhaps the better conclusion is that the plaintiff may present evidence that there are no adequate noninfringing substitutes, or of market share damages, as the evidence permits; and that in cases in which the plaintiff meets its burden of production with respect to the former, the defendant can attempt to rebut the evidence with proof that the plaintiff would have made only some, if any, additional sales absent the infringement.

The assumption that the infringer itself would have remained in the market by offering the noninfringing substitute may well be more reasonable than the assumption (implicit in *State Industries*) that the infringer would have dropped out altogether. After all, if there is an adequate noninfringing substitute available to the other competitors within the market, one would expect that substitute to be available to the infringer as well, unless the substitute is subject to patents or trade secrets owned by those other competitors. Of course, if the substitute is a perfect substitute, there is no basis for inferring that the infringer would have lost any sales to the patent owner in the absence of infringement. Only if the substitute is imperfect does it follow that the infringer could have remained in the market, but still lost some sales to the patent owner.

117 Alternatively, one might argue that, under the older case law that required an adequate noninfringing substitute to be technically equivalent to the patented device, a set without the component might be an inadequate substitute, even if no buyers would actually prefer a set with component to one without. On this assumption, the patent owner might conceivably satisfy Panduit factors one through three, but how could she prove factor four, the amount of her lost profits? What lost profits would there be, if the infringement had no effect upon sales?

118 Panduit, 575 F.2d at 1156, 197 U.S.P.Q. at 729-30.

119 *W.L. Gore & Assocs. v. Carlisle Corp.*, 198 U.S.P.Q. (BNA) 353, 364-65 (D. Del. 1978); Conley, supra note 73, at 371; Rabowsky, supra note 58, at 294-95.

120 Alternatively, we could assume that the infringer itself would have retained some market share had it chosen not to infringe, by offering the noninfringing substitute instead.

121 If the infringer would have remained in the market by selling the noninfringing substitute, however, see supra note 116, it may be more plausible to assume that all of the additional sales the patent owner would have made would have been due to the presence of the patented feature.

122 *Carborundum Co. v. Molten Metal Equip. Innovations, Inc.*, 72 F.3d 872, 881 n.8, 37 U.S.P.Q.2d (BNA) 1169, 1175 n.8 (Fed. Cir. 1995) (stating that “the expression convoyed sales should preferably be limited to sales made simultaneously with a basic item”); *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1578, 35 U.S.P.Q.2d (BNA) 1065, 1096 (Fed. Cir. 1995) (en banc) (Newman, J., concurring in part and dissenting in part) (referring to “sales of collateral items” as “convoyed sales”). Commentators often use the terms interchangeably. See, e.g., Karen D. McDaniel & Gregory Ansems, *Damages in the Post-Rite-Hite Era: Convoyed Sales Illustrate the Dichotomy in Current Damages Law*, 78 J. Pat. & Trademark Off. Soc’y 461, 467-68 (1996); Rabowsky, supra note 58, at 290.

123 *Carborundum Co.*, 72 F.3d at 881 n.8, 37 U.S.P.Q.2d at 1175 n.8 (referring to sales of spare parts as “derivative sales”).

124 745 F.2d 11, 223 U.S.P.Q. (BNA) 591 (Fed. Cir. 1984).

125 56 F.3d 1538, 35 U.S.P.Q.2d (BNA) 1065 (Fed. Cir. 1995) (en banc).

126 65 F.3d 941, 36 U.S.P.Q.2d (BNA) 1129 (Fed. Cir. 1995).

127 *Paper Converting*, 745 F.2d at 13-14, 22, 223 U.S.P.Q. at 593, 600.

- 128 This court (now known as the United States Court of Federal Claims) has jurisdiction over, among other things, cases involving the use or manufacture of patented inventions “by or for the United States without license of the owner thereof or lawful right to use or manufacture the same.” 28 U.S.C. § 1498(a) (1994 & Supp. V 1999). In such cases, the owner may file suit against the United States “for the recovery of his reasonable and entire compensation for such use and manufacture.” *Id.* Courts have interpreted this clause to mean that the patent owner may recover a reasonable royalty, but not injunctive relief; awards of lost profits are less common. E.g., *Standard Mfg. Co. v. United States*, 42 Fed. Cl. 748, 758 n.10 (1999). Cf. *Gargoyles, Inc. v. United States*, 113 F.3d 1572, 1575-77, 42 U.S.P.Q.2d (BNA) 1760, 1763-65 (Fed. Cir. 1997) (raising, but not deciding, issue of whether lost profits should be awarded more frequently in § 1498 actions).
- 129 *Paper Converting*, 745 F.2d at 22-23, 223 U.S.P.Q. at 599 (quoting *Leesona Corp. v. United States*, 599 F.2d 958, 974, 202 U.S.P.Q. (BNA) 424, 439 (Ct. Cl. 1981)).
- 130 *Id.* at 23, 223 U.S.P.Q. at 599 (quoting *Tektronix, Inc. v. United States*, 552 F.2d 343, 351, 193 U.S.P.Q. (BNA) 385, 393 (Ct. Cl. 1977)).
- 131 *Id.*, 223 U.S.P.Q. at 600 (stating that every time the patent owner had sold a rewinder to the two end users in this case, it had sold them “the entire rewinder line including auxiliary equipment,” and that of the patent owner’s “572 rewinder sales, only nine involved rewinders alone.”)
- 132 See Schlicher, *supra* note 54, § 9.05[2][m], at 9-99.
- 133 56 F.3d 1538, 35 U.S.P.Q.2d (BNA) 1065 (Fed. Cir. 1995) (en banc).
- 134 *Paper Converting*, 745 F.2d 11, 223 U.S.P.Q. 591.
- 135 *Rite-Hite*, 56 F.3d at 1542, 35 U.S.P.Q.2d at 1066.
- 136 *Id.* at 1543, 35 U.S.P.Q.2d at 1067.
- 137 *Id.* at 1542-43, 35 U.S.P.Q.2d at 1067.
- 138 *Id.* at 1543, 35 U.S.P.Q.2d at 1067. In particular, the district court expressed concern that, unless *Rite-Hite* could recover for lost profits on sales of the ADL-100, an infringer could “whip-saw” a patent owner by “developing a device using a first patented technology to compete with a device that uses a second patented technology and developing a device using the second patented technology to compete with a device that uses the first patented technology.” *Id.* at 1544, 35 U.S.P.Q.2d at 1068. See also *Rite-Hite Corp. v. Kelley Co.*, 774 F. Supp. 1514, 1540, 21 U.S.P.Q.2d (BNA) 1801, 1821 (E.D. Wis. 1991), *aff’d* in part, vacated and remanded in part, 56 F.3d 1538, 35 U.S.P.Q.2d (BNA) 1065 (Fed. Cir. 1995) (en banc) .
- 139 *Rite Hite*, 56 F.3d at 1543, 35 U.S.P.Q.2d at 1067. Kelley did not contest the award with respect to the MDL-55. *Id.*
- 140 *Id.* at 1544-46, 35 U.S.P.Q.2d at 1068-70.
- 141 *Id.* at 1546, 35 U.S.P.Q.2d at 1069-70.
- 142 *Id.*, 35 U.S.P.Q.2d at 1070 (citing *Holmes v. Securities Investor Protection Corp.*, 503 U.S. 258 (1992)).

- <sup>143</sup> Id., 35 U.S.P.Q.2d at 1069.
- <sup>144</sup> Id., 35 U.S.P.Q.2d at 1070.
- <sup>145</sup> Id. at 1547, 35 U.S.P.Q.2d at 1070-71 (quoting U.S. Const. art. I, § 8, cl. 8).
- <sup>146</sup> Id. at 1547, 35 U.S.P.Q.2d at 1070. But see id. at 1573-74, 35 U.S.P.Q.2d at 1093 (Nies, J., dissenting in part) (arguing that antitrust policy forbids Rite-Hite from receiving “tribute for infringement of one patent for losses in connection with a competitive product protected, if at all, only by other patents”).
- <sup>147</sup> Id. at 1547-48, 35 U.S.P.Q.2d at 1071 The court suggested, however, that in cases in which the failure to practice the invention “frustrates an important public need,” a court may exercise its equitable powers to deny injunctive relief against infringement. Id. at 1547-48, 35 U.S.P.Q.2d at 1071 (citations omitted).
- <sup>148</sup> Id. at 1548.
- <sup>149</sup> Id. at 1545, 1548, 35 U.S.P.Q.2d at 1069, 1071-72. The court also concluded that Panduit factors were satisfied in the present case, notwithstanding some legitimate questions concerning the existence of adequate noninfringing substitutes: Establishment of this factor tends to prove that the patentee would not have lost the sales to a non-infringing third party rather than to the infringer. That, however, goes only to the question of proof. Here, the only substitute for the patented device was the ADL-100, another of the patentee’s devices. Such a substitute was not an ‘acceptable, non-infringing substitute’ within the meaning of Panduit because, being patented by Rite-Hite, it was not available to customers except from Rite-Hite. Rite-Hite therefore would not have lost sales to a third party. The second Panduit factor thus has been met. If, on the other hand, the ADL-100 had not been patented and was found to be an acceptable substitute, that would have been a different story, and Rite-Hite would have had to prove that its customers would not have obtained the ADL-100 from a third party in order to prove the second factor of Panduit. Id. at 1548, 35 U.S.P.Q.2d at 1071. But see id. at 1568 n.15, 1572-73, 35 U.S.P.Q.2d at 1088 n.15, 1092 (Nies, J., dissenting in part) (disputing these conclusions and pointing out that, in finding that the ADL-100 was not an available substitute, the majority implicitly assumed, without proof, that the patent or patents covering that product (it was never established exactly what patent or patents these were) were valid).
- <sup>150</sup> Id. at 1548-49, 35 U.S.P.Q.2d at 1071-72. Judge Nies, in an opinion joined by three other judges, dissented from the award relating to the ADL-100s. Id. at 1556-57, 35 U.S.P.Q.2d at 1078 (Nies, J, dissenting in part). According to Judge Nies, the majority had taken out of context the statements from Aro II and Devex that suggest an expansive standard for assessing patent damages. Id. at 1557-58, 35 U.S.P.Q.2d at 1079 (arguing that the relevant language from Aro II, which speaks of awarding the patentee “the difference between his pecuniary condition after the infringement, and what his condition would have been if the infringement had not occurred,” was intended to preclude the patent owner from obtaining a double recovery by suing both direct and indirect infringers) (quoting Aro II, 377 U.S. at 507 (quoting Yale Lock, 117 U.S. at 552)); id. at 1560-61, 35 U.S.P.Q.2d at 1082 (arguing that, in Devex, the Court interpreted language added to the Patent Act in 1946 as expanding the patent owner’s ability to recover prejudgment interest, but that the relevant language relating to actual damages was unchanged and not intended to alter existing case law on lost profits). Judge Nies argued instead that nothing in the current Patent Act overrules a long line of case law standing for the proposition that “[p]atent damages are limited to legal injury to property rights created by the patent, not merely causation in fact.” Id. at 1557, 35 U.S.P.Q.2d at 1079. See also id. at 1561, 35 U.S.P.Q.2d at 1082-83 (arguing that actual damages are “limited to the extent of the defendant’s interference with the patentee’s market in goods embodying the invention of the patent in suit”); id. at 1569, 35 U.S.P.Q.2d at 1089 (stating that “compensation is due only for injury to patent rights”). Judge Nies cited a number of old Supreme Court cases (including many of the cases we cited above in Part I.A) asserting that, to recover lost profits, a patent owner must show that it is itself using the patented invention. Id. at 1563-64, 35 U.S.P.Q.2d at 1084-85 (citations omitted). She also cited several pre-1946 district court cases (and one appellate case) denying recovery of lost profits on conveyed goods and claimed that, from the enactment of the 1946 Patent Act until the creation of the Federal Circuit in 1982, “every other circuit which addressed the issue adhered to the basic tenet that a patent protects a patentee’s market for its own goods embodying the invention and no other market.” Id. at 1564-68, 35 U.S.P.Q.2d at 1084-87. In response, the majority noted that none of the Supreme Court cases involved “lost sales on diverted products such as those in this case,” and that the district court cases were not binding on the Federal Circuit. Id. at 1548 n.7, 35 U.S.P.Q.2d at 1071 n.7 . The majority also stated that the post-1946 cases “either relate to recovery for lost sales of items sold with devices covered by the patent in suit under the entire market value rule, or they stand for

the unremarkable proposition that the patentee must be in the business of selling a device in order to recover damages for alleged lost sales of such a device.” Id. At least one of the post-1946 appellate cases, however, did specifically reject a claim for lost profits on sales of unpatented conveyed goods. *Velo-Bind, Inc. v. Minn. Mining & Mfg. Co.*, 647 F.2d 965, 972-74 (9th Cir. 1981).

Second, although Judge Nies conceded that U.S. patent law does not require the inventor to commercialize its invention, she cautioned that this principle does “not lead to the conclusion that the patentee’s failure to commercialize plays no role in determining damages.” *Rite-Hite*, 56 F.3d at 1562, 35 U.S.P.Q.2d at 1083 (Nies, J., dissenting in part). Rather, the Patent Act is designed to encourage both disclosure and commercialization, the latter through affording the patent owner exclusivity for a period of time in order to attract capital, recoup its investment in research and production, and begin marketing its product. Id. at 1563, 35 U.S.P.Q.2d at 1084. Thus, while the patent owner has a right to “withhold from the public the benefit of use of its invention during the patent term,” there is no reason to believe that Congress intended to reward the patent owner for doing so. Id. at 1575, 35 U.S.P.Q.2d at 1094 (arguing that, if patentee is granted “lost profits on its established products, the incentive” to innovate is undermined).

Third, Judge Nies rejected the majority’s foreseeability standard, for several reasons. First, Judge Nies asserted that “‘foreseeability’ is a wholly anomalous concept to interject as the basis for determining legal injury for patent infringement,” a strict liability tort. Id. at 1570, 35 U.S.P.Q.2d at 1090. Judge Nies reasoned that unknowing infringers are liable for damages resulting from lost sales of a patentee’s patented product, notwithstanding their inability to foresee injury to the patentee, and that now they would be liable for “diverting sales of the patentee’s unprotected competitive products as well.” Id. Noting that *Rite-Hite* could not truthfully mark its ADL-100 product with notice of the ‘847 Patent, Nies asserted that to allow *Rite-Hite* to recover under these circumstances “would treat a patentee that does not practice its invention more favorably than a patentee that does.” *Rite-Hite*, 56 F.3d at 1571, 35 U.S.P.Q.2d at 1091 (Nies, J., dissenting in part). In response, the majority observed that the “law does not preclude assessing damages for lost sales of diverted products after actual notice of infringement has been given.” Id. at 1549 n.8, 35 U.S.P.Q.2d at 1072 n.8. The district court opinion suggests that all or most of the damages awarded in this case reflected conduct that occurred only after *Rite-Hite* had given *Kelley* actual notice. *Rite-Hite Corp. v. Kelley Co.*, 774 F. Supp. 1514, 1517, 1525, 21 U.S.P.Q.2d at 1071 n.7 (E.D. Wis. 1991) (stating that infringement lasted from February 15, 1983, to April 30, 1987, and that *Rite-Hite* filed suit on March 22, 1983), *aff’d*, 56 F.3d 1538 (Fed. Cir. 1995) (en banc). Judge Nies also argued that, as a matter of fact, *Kelley* could not have foreseen liability for lost profits on the ADL-100’s, given what she viewed as the radical departure of this result from preceding case law. *Rite-Hite*, 56 F.3d at 1571-72 (Nies, J., dissenting in part).

151 *Rite-Hite*, 56 F.3d at 1599, 35 U.S.P.Q.2d at 1073 (opinion of Lourie, J.); *id.* at 1557, 1575 (Nies, J., dissenting in part).

152 *Id.* at 1550, 35 U.S.P.Q.2d at 1073.

153 *Id.*

154 *Id.* (also stating that patentee may recover lost profits on sales of unpatented components when the patented and unpatented components together are “considered to be components of a single assembly” or are “analogous to a single functioning unit”).

155 *Id.* at 1550, 35 U.S.P.Q.2d at 1073.

156 *Id.* at 1551, 35 U.S.P.Q.2d at 1074.

157 *Rite-Hite*, 56 F.3d at 1575-76, 35 U.S.P.Q.2d at 1094. Judge Nies concurred in this result, however, because in her view the demand for the dock levelers was not attributable to the ‘847 Patent. Id. By contrast, Judges Newman and Rader, who concurred in the decision to award damages for lost sales of the ADL-100, would have permitted the dock leveler award as well, on the ground that patent infringement “should compensate for the actual financial injury... caused by the tort.” Id. at 1578, 35 U.S.P.Q.2d at 1096 (Newman, J., concurring in part and dissenting in part). Characterizing the “functionality” rule as both “legally ambivalent and economically unsound,” Judge Newman argued in favor of applying the traditional tort-law standard that the “wrongdoer is... responsible for the direct, foreseeable consequences of the wrong,” which in this case would have resulted in affirming the award with respect to the levelers. Id. at 1581, 35 U.S.P.Q.2d at 1099. Judge Newman also concluded that the award satisfied the majority’s functionality standard, inasmuch as the levelers and the restraints were used together. Id. at 1582, 35 U.S.P.Q.2d at 1099.

158 E.g., *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1362, 52 U.S.P.Q.2d (BNA) 1294, 1299 (Fed. Cir. 1999).

159 65 F.3d 941, 36 U.S.P.Q.2d (BNA) 1129 (Fed. Cir. 1995).

160 *Id.* at 944-45, 36 U.S.P.Q.2d (BNA) at 1131.

161 *Id.*

162 *King Instrument Corp. v. Perego*, 737 F. Supp. 1227, 1241, 16 U.S.P.Q.2d (BNA) 1994, 2006 n.11 (D. Mass. 1990), *aff'd*, 65 F.3d 941, 36 U.S.P.Q.2d (BNA) 1129 (Fed. Cir. 1995).

163 *King Instrument*, 65 F.3d at 946-47, 36 U.S.P.Q.2d at 1132.

164 *Id.* at 947, 36 U.S.P.Q.2d at 1132; see also, *id.* at 955-56, 36 U.S.P.Q.2d at 1140 (Nies, J., dissenting); *King Instrument Corp. v. Perego*, 737 F. Supp. at 1241-42, 16 U.S.P.Q.2d at 2006 (D. Mass. 1990).

165 *King Instrument*, 65 F.3d at 953, 36 U.S.P.Q.2d at 1137-38

166 *Id.*, 36 U.S.P.Q.2d at 1138 .

167 *Id.*; See also *King Instrument Corp. v. Perego*, 737 F. Supp. 1227, 1241-42, 16 U.S.P.Q.2d (BNA) 1994, 2006 (D. Mass. 1990), *aff'd*, 65 F.3d 941 (Fed. Cir. 1995).

168 *King Instrument*, 65 F.3d at 953, 36 U.S.P.Q.2d at 1138. As the dissent suggests, allowing the patent owner to recover for lost profits on spare parts in this case is somewhat ironic, given that in an earlier case in which the same plaintiff had marketed a product actually embodying one of its other patents, the court had found the evidence concerning lost profits from the sale of spare parts lacking under the EMVR. *Id.* at 957-58, 36 U.S.P.Q.2d at 1142 (Nies, J., dissenting) (referring to *King Instrument Corp. v. Otari*, 767 F.2d 853, 865-66, 226 U.S.P.Q. (BNA) 402, 410-11 (Fed. Cir. 1985)). However, subsequent case law reads *King Instrument v. Otari* simply as a case involving a failure of proof, and not as standing for any broader proposition concerning the recoverability of lost profits on the sales of spare parts. *Carborundum Co. v. Molten Metal Equip. Innovations, Inc.*, 72 F.3d 872, 881-82, 37 U.S.P.Q.2d (BNA) 1169, 1176 (Fed. Cir. 1995).

169 *King Instrument*, 65 F.3d at 953, 36 U.S.P.Q.2d at 1138.

170 *Id.* at 945-53, 36 U.S.P.Q.2d at 1131-38. Judge Nies again dissented, for largely the same reasons recited in her dissenting opinion in *Rite-Hite*. *Id.* at 953-61, 36 U.S.P.Q.2d at 1138-45 (also asserting the further difficulty of squaring *King Instrument* with (1) the EMVR, given that in this case the patented invention clearly did not drive demand for anything the plaintiff sold, and it is doubtful whether it materially affected demand for the defendant's products either; and (2) the marking or notice requirement of § 287, since in this case damages were awarded for a period of time prior to the defendant being put on actual notice of the infringement).

171 *Id.* at 950, 36 U.S.P.Q.2d at 1135.

172 See *infra* notes 193-96 and accompanying text; see also Blair & Cotter, *supra* note 18, at 1628-29; Blair & Cotter, *supra* note 29, at 1404-05.

173 See *infra* Part III.B.

174 See *King Instrument*, 65 F.3d at 951, 36 U.S.P.Q.2d at 1136.

175 *Id.*

176 *Id.*

177 The court further suggested two practical reasons why the patentee should recover in a case of this nature. First, the court posed a hypothetical case of an inventor who creates a novel, useful and nonobvious device comprising four elements, A, B, C, and Q<sub>1</sub>, and who knows that elements Q<sub>2</sub> and Q<sub>3</sub> could function in place of Q<sub>1</sub>. Suppose further that the inventor obtains a patent containing separate claims for these three embodiments (or three separate patents); that it markets a device ABCQ<sub>1</sub>, and that a competitor, unable to acquire a license, markets devices that infringe ABCQ<sub>2</sub> or ABCQ<sub>3</sub>. The court reasoned that to award only a reasonable royalty under these circumstances, due to the patent owner's not having marketed a device embodying ABCQ<sub>2</sub> or ABCQ<sub>3</sub>, would amount in effect to a compulsory license to use the latter invention. *King Instrument*, 65 F.3d at 952, 36 U.S.P.Q.2d at 1137. This is correct, although the "license" persists only for the interim period in between infringement and entry of an injunction. Second, the court asserted that requiring the patent owner to prove that its own product falls within the patent claims would increase the cost and complexity of patent trials. *Id.* Prior to *King Instrument*, however, the common wisdom was that the patent owner could not recover lost profits unless it marketed a product embodying the patent. *Rabowsky*, supra note 58, at 309-10. It is not clear that the cost of complying with this requirement was in fact excessive. Nor did the court attempt to square its concern over cost and complexity with *Rite-Hite* which, by permitting the patentee to prove that it lost sales on products covered by a patent not in suit, invites protracted litigation over an analogous issue.

178 *King Instrument*, 65 F.3d at 953, 36 U.S.P.Q.2d at 1133.

179 Cf. *Arun Chandra*, Note, *King Instrument Corp. v. Perego: Should Lost Profits Be Awarded on Unpatented Products Where Patentee Sits on Its Patents?*, 16 *Cardozo Arts & Ent. L.J.* 635, 661 n.172 (1998) (suggesting that, if "loss of sales on an unpatented device is foreseeable by the claims of the patented device," then the unpatented device is "a proper substitute for the patented device"); *Rabowsky*, supra note 58, at 329 (arguing that "'but for' causation cannot be established," because all but five of infringer's customers would have purchased the defendant's machine even if it lacked the infringing feature).

180 *King Instrument Corp. v. Perego*, 737 F. Supp. at 1242, 16 U.S.P.Q.2d at 2006.

181 The plaintiff would have been entitled to a reasonable royalty, however, under a more fact-sensitive approach.

182 Some indication that the court has backed away from *King* may be found in a subsequent decision, *Hebert v. Lisle Corp.*, 99 F.3d 1109, 40 U.S.P.Q.2d (BNA) 1611 (Fed. Cir. 1996). In *Hebert*, the patent owner claimed that the defendant had so saturated the market with an infringing product that the patent owner was unable to make any sales. *Id.* at 1119, U.S.P.Q.2d at 1618. The court's response to this argument was two-fold and somewhat contradictory. First, the court stated (without any mention of *King*) that "[w]hen the patentee does not seek to make and sell the invention, lost profits are not an appropriate measure of damages." *Id.* Second, however, the court stated that *Hebert* was entitled to present his evidence that he would have manufactured his device, and earned his asserted profits, but for the infringement. *Id.* The court nevertheless cautioned that "the burden on a patentee who has not begun to manufacture the patented product is commensurately heavy." *Id.* at 1120, U.S.P.Q.2d at 1618.

183 35 U.S.C. § 284 (1994 & Supp. V 1999). As the full text of the statute makes clear, a reasonable royalty is the minimum amount of actual damages to which the patent owner may be entitled. *Id.* ("Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer...."). See also *Del Mar Avionics, Inc. v. Quinton Instrument Co.*, 836 F.2d 1320, 1326, 5 U.S.P.Q.2d (BNA) 1255, 1260 (Fed. Cir. 1987) (stating that reasonable royalty provision of § 284 is intended "to set a floor below which the courts are not authorized to go") (citing *Seattle Box Co. v. Industrial Crating & Packing Inc.*, 756 F.2d 1574, 1581, 225 U.S.P.Q. (BNA) 357 (Fed. Cir. 1985)). The intuition that lost profits, if appropriate, should be greater than the amount of a reasonable royalty is consistent with the economic analysis of damages.

184 *Trell v. Marlee Elecs. Corp.*, 912 F.2d 1443, 1447, 16 U.S.P.Q.2d (BNA) 1059, 1062 (Fed. Cir. 1990) (quoting *Fromson v. Western Litho Plate & Supply Co.*, 853 F.2d 1568, 1574, 7 U.S.P.Q.2d (BNA) 1606, 1612 (Fed. Cir. 1988)).

185 A Westlaw search of “(318 pre/3 1116) & (reasonable pre/1 (royalty royalties)),” conducted on August 15, 2000, revealed 109 citations. For recent examples, see *Gargoyles, Inc. v. United States*, 113 F.3d 1572, 1580, 42 U.S.P.Q.2d (BNA) 1760, 1767 (Fed. Cir. 1997); *Maxwell v. J. Baker, Inc.*, 86 F.3d 1098, 1109-10, 39 U.S.P.Q.2d (BNA) 1001, 1008 (Fed. Cir. 1996); *Unisplay, S.A. v. American Elec. Sign Co.*, 69 F.3d 512, 517 n.7, 36 U.S.P.Q.2d (BNA) 1540, 1544 n.7 (Fed. Cir. 1995).

186 318 F. Supp. 1116, 166 U.S.P.Q. (BNA) 235 (S.D.N.Y. 1970), modified, 446 F.2d 295, 170 U.S.P.Q. (BNA) 235 (2d Cir. 1971).

187 See *Georgia Pacific*, 318 F. Supp. at 1120, 166 U.S.P.Q. at 238. The entire list of factors is as follows:

1. The royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty.
2. The rates paid by the licensee for the use of other patents comparable to the patent in suit.
3. The nature and scope of the license, as exclusive or non-exclusive; or as restricted or non-restricted in terms of territory or with respect to whom the manufactured product may be sold.
4. The licensor’s established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly.
5. The commercial relationship between the licensor and licensee, such as, whether they are competitors in the same territory in the same line of business; or whether they are inventor and promoter.
6. The effect of selling the patented specialty in promoting sales of other products of the licensee; the existing value of the invention to the licensor as a generator or sales of his non-patented items; and the extent of such derivative or conveyed sales.
7. The duration of the patent and the term of the license.
8. The established profitability of the product made under the patent; its commercial success; and its current popularity.
9. The utility and advantages of the patent property over the old modes or devices, if any, that had been used for working out similar results.
10. The nature of the patented invention; the character of the commercial embodiment of it as owned and produced by the licensor; and the benefits to those who have used the invention.
11. The extent to which the infringer has made use of the invention; and any evidence probative of the value of that use.
12. The portion of the profit or of the selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions.
13. The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.
14. The opinion testimony of qualified experts.
15. The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee—who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.

For an even more comprehensive list of potentially relevant factors, see *Conley*, supra note 73, at 387.

188 *Hughes Aircraft Co. v. United States*, 86 F.3d 1566, 1569-70, 1572, 39 U.S.P.Q. (BNA) 1065, 1067-69 (Fed. Cir. 1996) (discussing relevance of other licenses to which patent owner had agreed); *Maxwell v. J. Baker, Inc.*, 86 F.3d 1098, 1110, 39 U.S.P.Q.2d (BNA) 1001, 1007-09 (Fed. Cir. 1996); *Unisplay, S.A. v. American Elec. Sign Co.*, 69 F.3d 512, 519, 36 U.S.P.Q.2d (BNA) 1540, 1545 (Fed. Cir. 1995). See also 7 *Chisum* § 20.03[3], at 20-181 (describing “prior and existing licenses negotiated under the patent in suit” as “[t]he most influential factor”).

189 *Minco, Inc. v. Combustion Eng’g, Inc.*, 95 F.3d 1109, 1119, 40 U.S.P.Q.2d (BNA) 1001, 1008 (Fed. Cir. 1996) (stating that “[a] district court may calculate a reasonable royalty by postulating a hypothetical negotiation between a willing licensor and licensee at the time infringement commenced”) (citing *State Indus., Inc. v. Mor-Flo Indus., Inc.*, 883 F.2d 1573, 1580, 12 U.S.P.Q.2d (BNA) 1026, 1031 (Fed. Cir. 1989)); *Trell v. Marlee Elecs. Corp.*, 912 F.2d 1443, 1445, 16 U.S.P.Q.2d (BNA) 1059, 1061 (Fed. Cir. 1990) (citing *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1078, 219 U.S.P.Q. (BNA) 679, 682 (Fed. Cir. 1983)).

190 *Snellman v. Ricoh Co.*, 862 F.2d 283, 289, 8 U.S.P.Q.2d (BNA) 1996, 2001 (Fed. Cir. 1988); *TWM Mfg. Co. v. Dura Corp. and Kidde Inc.*, 789 F.2d 895, 898-900, 229 U.S.P.Q. (BNA) 525, 526-27 (Fed. Cir. 1986); *Georgia-Pacific Corp. v. U.S. Plywood-Champion Papers Inc.*, 446 F.2d 295, 299-300, 170 U.S.P.Q. (BNA) 369, 371-73 (2d Cir. 1971).

- <sup>191</sup> TWM, 789 F.2d at 899, 900, 229 U.S.P.Q. at 526-27 (alternately referring to methodology employed as the “analytical approach” and the “willing licensee/licensor approach”); Georgia-Pacific, 446 F.2d at 296-97, 299-300, 170 U.S.P.Q. at 371-72 (similar).
- <sup>192</sup> E.g., Maxwell v. J. Baker, Inc., 86 F.3d 1098, 1109, 39 U.S.P.Q.2d (BNA) 1001, 1008 (Fed. Cir. 1996) (stating that, to avoid underdeterrence, the trier of fact may consider additional factors as set forth in Georgia-Pacific Corp. v. United States Plywood Corp., 318 F. Supp. 1116, 1120, 166 U.S.P.Q. (BNA) 235, 238 (S.D.N.Y. 1970)).
- <sup>193</sup> As stated in Georgia-Pacific, 318 F. Supp. at 1120, 166 U.S.P.Q. at 238, for purposes of setting the royalty the court will assume that the hypothetical negotiations take place on the date the infringement began. Unisplay, S.A. v. American Elec. Sign Co., 69 F.3d 512, 517, 36 U.S.P.Q.2d (BNA) 1540, 1544 (Fed. Cir. 1995); Wang Lab., Inc. v. Toshiba Corp., 993 F.2d 858, 870, 26 U.S.P.Q.2d (BNA) 1767, 1778 (Fed. Cir. 1993). As the Federal Circuit has noted, however, this rule can appear strange when, for example, the defendant begins infringing on Date 1 but is not sued until Date 2, more than six years after Date 1. In such instances, the plaintiff can recover damages only for the six years prior to Date 2, but the reasonable royalty must be constructed as if the parties had negotiated for a long-term license on Date 1. Fromson v. Western Litho Plate & Supply Co., 853 F.2d 1568, 1575 n.12, 7 U.S.P.Q.2d (BNA) 1606, 1613 n.12 (Fed. Cir. 1988) (noting that infringement began almost eleven years prior to earliest date for which damages would be recoverable). Cf. Grain Processing Corp. v. American Maize-Prods. Co., 893 F. Supp. 1386, 1392, 37 U.S.P.Q.2d (BNA) 1299, 1303 (N.D. Ind. 1995) (rejecting assumption that royalty negotiated when infringement began in 1974 “necessarily would have held constant until 1991”), *aff’d mem. in part, vacated mem. in part on other grounds*, 108 F.3d 1392 (Fed. Cir. 1997).
- <sup>194</sup> That is, the maximum payment that a willing licensee would pay is the difference between the maximum profit he would earn from using the invention and the maximum profit he would earn without the invention.
- <sup>195</sup> For case law recognizing that a royalty may reflect the cost savings incurred by the infringer, see, e.g., Grain Processing, 893 F. Supp. at 1392-93, 37 U.S.P.Q.2d at 1303-04; Hanson v. Alpine Valley Ski Area, Inc., 718 F.2d 1075, 1080 (Fed. Cir. 1983) (citing cases).
- <sup>196</sup> Georgia-Pacific provides what it is perhaps the best articulation of this logic in the case law:  
What a willing licensor and a willing licensee would have agreed upon in a suppositious negotiation for a reasonable royalty would entail consideration of the specific factors previously mentioned, to the extent of their relevance. 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.  
Georgia Pacific, 318 F. Supp. At 1121, 166 U.S.P.Q. at 238. See also Polaroid Corp. v. Eastman Kodak Corp., 16 U.S.P.Q.2d (BNA) 1481, 1534-35 (D. Mass. 1990), *aff’d*, 789 F.2d 1556 (Fed. Cir. 1986); Ellipse Corp. v. Ford Motor Co., 461 F. Supp. 1354, 1368-75, 1379-80 (N.D. Ill. 1978), *aff’d mem.*, 614 F.2d 775 (7th Cir. 1979).
- <sup>197</sup> Note that under this approach a reasonable royalty typically leaves the infringer with some profit. See Hanson v. Alpine Ski Valley Area, Inc., 718 F.2d 1075, 1081, 219 U.S.P.Q. (BNA) 679, 684 (Fed. Cir. 1983) (citations omitted); Georgia-Pacific, 318 F. Supp. at 1122, 166 U.S.P.Q. at 239.
- <sup>198</sup> See, e.g., Accuscan, Inc. v. Xerox Corp., No. 96 Civ. 2579(HB), 1998 WL 603217, at \*6 (S.D.N.Y. Sept. 11, 1998) (citing Mobil Oil Corp. v. Amoco Chems. Corp., 915 F. Supp. 1333, 1352-53 (D. Del. 1994)); Janicke, *supra* note 70, at 722 & nn. 175, 177. A few courts carry this principle one step farther, by assuming that both parties are aware of all relevant information as of the date of the hypothetical negotiations. See Janicke, *supra* note 70, at 724 & n.183.
- <sup>199</sup> For example, one recent study shows that just under half of all litigated patents are invalidated. John R. Allison & Mark A. Lemley, Empirical Evidence on the Validity of Litigated Patents, 26 AIPLA Q.J. 185, 205-07 (1998).

- 200 Stephen H. Kalos & Jonathan D. Putnam, On the Incomparability of ‘Comparable’: An Economic Interpretation of ‘Infringer’s Royalties’, 9 No. 4 J. Proprietary Rts. 2, 4-5 (1997). Kalos and Putnam use the following example to illustrate this argument. Suppose that, at the time of infringement, the defendant would have agreed to license the patent for \$1,000,000 discounted to reflect an 80% probability of validity and a 70% probability of infringement. Assuming that the latter two probabilities are independent, the resulting license fee to which the parties would have agreed would have been \$560,000 (that is,  $\$1,000,000 \times 0.7 \times 0.8$ ). The patent owner’s expected payoff prior to trial, however, must also be discounted to reflect the uncertainty surrounding validity and infringement. For example, if the patent owner’s pretrial estimation of the probabilities of validity and infringement are the same as the estimated probabilities of these events at the time of infringement, the patent owner’s expected payoff is only 56% of her best estimate of the damages she is likely to be awarded. Thus, if she is entitled to recover \$1,000,000 in the event that she prevails at trial, and has a 56% chance of prevailing at trial, she should be indifferent between licensing the patent ex post and recovering damages ex ante. If instead she were entitled to recover only \$560,000 in the event she prevailed at trial, her expected payoff from litigating would be only \$313,600 ( $\$560,000 \times 0.7 \times 0.8$ ). She would, in other words, be worse off as a result of the infringement.
- 201 Fromson, 853 F.2d at 1575-76, 7 U.S.P.Q.2d at 1613 (stating that the reasonable royalty approach “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,” such as whether the patented invention will meet with commercial success) (citing Sinclair Refining Co. v. Jenkins Petroleum Co., 289 U.S. 689, 698-99, 17 U.S.P.Q. (BNA) 522, 525-26 (1933)). See also Studiengesellschaft Kohle GmbH v. Dart Indus., 862 F.2d 1564, 1571-72, 229 U.S.P.Q. (BNA) 525, 527 (Fed. Cir. 1988). But see TWM Mfg. Corp. v. Dura Corp., 789 F.2d 895, 899, 9 U.S.P.Q.2d (BNA) 1273, 1280 (Fed. Cir. 1986) (stating that evidence of infringer’s actual profits is admissible, but that correct focus is “the date when the infringement began”); Hanson, 718 F.2d at 1081, 219 U.S.P.Q. at 684 (stating that infringer’s profit “is to be determined not on the basis of a hindsight evaluation of what actually happened, but on the basis of what the parties to the hypothetical license negotiations would have considered at the time of negotiations”). As Janicke notes, courts have declined to apply this principle in reverse, that is, to reduce the amount of the royalty based upon the infringer’s lower-than-expected earnings. Janicke, supra note 70, at 726.
- 202 Edward F. Sherry & David W. Teece, Some Economic Aspects of Intellectual Property Damages, 573 PLI/Pat 399, 426-28 (1999).
- 203 To illustrate, suppose that the would-be infringer expects that there is a 50% chance he could earn \$1,000,000 in profit from the use of the patented device, and a 50% chance that he will earn only \$100,000. His expected profit is therefore \$550,000 and a reasonable royalty is (let us say) half that, or \$275,000. If he knows at the time of his proposed use that his use will be detected and that he will have to pay \$275,000 in damages in the event that he is found liable for infringement, he is no better off choosing to infringe over choosing to pay the license fee. If instead he knows, at the time of his proposed use, that his use will be detected and that he will have to pay damages equal to half of the profits he has earned from the patent, he still is no better off choosing to infringe over choosing to pay the license fee. His expected damages in this latter instance, at the time he must make his decision, are still \$275,000.
- 204 Sherry & Teece, supra note 202, at 426-28.
- 205 Maxwell v. J. Baker, Inc., 86 F.3d 1098, 1109, 139 U.S.P.Q.2d (BNA) 1001, 1008 (Fed. Cir. 1996); Fromson, 853 F.2d at 1574-75, 7 U.S.P.Q.2d at 1612-13; Panduit, 575 F.2d at 1158, 197 U.S.P.Q. at 732; Sherry & Teece, supra note 202, at 418.
- 206 Maxwell, 86 F.3d at 1109-10, 39 U.S.P.Q.2d at 1108.
- 207 Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1580-81, 38 U.S.P.Q.2d (BNA) 1288, 1293-94 (Fed. Cir. 1996) (reversing addition of “kicker” for litigation and other expenses, and reserving enhanced damages and attorneys’ fees to cases of willful infringement). But see Maxwell, 86 F.3d at 1110 & n.4, 39 U.S.P.Q.2d at 1109 n.4 (affirming award interpreted as consisting of a “minimum” reasonable royalty plus an additional amount to compensate the plaintiff for her actual damages); King Instrument, 65 F.3d at 951 n.6, 36 U.S.P.Q.2d at 1136 n.6 (suggesting that “discretionary awards of greater than a reasonable royalty” sometimes may be warranted, so as to provide adequate compensation and to deter infringement) (citing Stickle v. Heublein, Inc., 716 F.2d 1550, 1563, 219 U.S.P.Q. (BNA) 377, 387 (Fed. Cir. 1983)); Skenyon et al., supra note 24, § 3:5, at 3-13 (characterizing Mahurkar as “simply wrong” and contrary to Stickle).
- 208 Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1554 n.13, 35 U.S.P.Q.2d (BNA) 1065, 1076 n.13 (Fed. Cir. 1995) (en banc)

(describing “willing licensor/willing licensee” negotiation” as “inaccurate, and even absurd when, as here, the patentee does not wish to grant a license”); *Fromson v. Western Litho Plate & Supply Co.*, 853 F.2d 1568, 1575-76, 7 U.S.P.Q.2d (BNA) 1606, 1613 (Fed. Cir. 1988) (describing the methodology as encompassing an element of fantasy, inasmuch as “it requires a court to imagine what warring parties would have agreed to as willing negotiators,” even though defendant has in fact chosen “to infringe the patent and risk litigation”); *Panduit*, 575 F.2d at 1158, 197 U.S.P.Q. at 731 (stating that setting royalties after infringement is never “the equivalent of ordinary royalty negotiations among truly ‘willing’ patent owners and licensees,” because “[t]hat view would constitute a pretense that the infringement never happened”). A number of commentators have made the same or similar points. E.g., Schlicher, *supra* note 54, § 9.04[3], at 9-36 (arguing that referring to patentee and infringer as “licensor” and “licensee” “predisposes the law to assume that, if the patent owner and infringer had discussed the matter at the time the infringement began, a license would likely have been agreed to,” and that this assumption is untrue “if under actual market conditions the owner would have found some other mode of exploitation more profitable”); Conley, *supra* note 73, at 381; Janicke, *supra* note 70, at 723-24.

209 As noted above, as in antitrust litigation the plaintiff who can prove the fact of injury is held to a somewhat lesser standard in proving the amount of that injury. Nevertheless, there are bound to be cases in which the patent owner’s proof of the amount of her lost profit fails even this minimal standard.

Another situation in which one might award the patentee a reasonable royalty below the amount of her lost profit is when that lost profit is, for some reason, not legally cognizable. Critics of King Instrument, for example, argue that a patentee who does not “work” the patent should not recover her lost profit on sales of unpatented goods, even in the presence of a causal connection between the infringement and those lost sales. In such a case, the patentee’s lost profit probably would exceed the amount of a reasonable royalty.

210 See Schlicher, *supra* note 54, § 9.04[5], at 9-45 to -46 (arguing that courts should abandon bargaining model when there would have been no gains from licensing); Skenyon et al., *supra* note 24, § 1:11, at 1-18 to -19 (suggesting that there are two definitions of reasonable royalties: the actual rate to which the parties would have agreed, and an award of compensatory damages that sometimes bears little relationship to this amount).

211 For example, in *State Indus., Inc. v. Mor-Flo Indus. Inc.*, 883 F.2d 1573, 1580-81, 12 U.S.P.Q.2d (BNA) 1026, 1031-32 (Fed. Cir. 1989), the court approved a 3% royalty despite evidence that the infringer’s “net profit margin was 2.1% for the seventeen months preceding issuance of the patent” (that is, for a period of time during which the defendant used the plaintiff’s invention lawfully), stating that “[t]here is no rule that a royalty be no higher than the infringer’s net profit margin.” *Id.* Of course, an agreement to pay a royalty in excess of the expected profit directly attributable to the invention also might make sense in light of expected collateral benefits, such as increasing market share. See *Radio Steel & Mfg. Co. v. MTD Prods., Inc.*, 788 F.2d 1554, 1557, 229 U.S.P.Q. (BNA) 431, 433 (Fed. Cir. 1986) (suggesting that “infringing wheelbarrows might have been utilized as loss-leaders at various times during the period of infringement.”); 7 Chisum § 20.03[b][iv], at 20-220 to -221.

212 *Fonar Corp. v. Gen. Elec. Co.*, 107 F.3d 1543, 1552-53, 41 U.S.P.Q.2d (BNA) 1801, 1807-09 (Fed. Cir. 1997); *Fromson*, 853 F.2d at 1578, 7 U.S.P.Q.2d at 1615.

213 *Slimfold Mfg. Co. v. Kinkead Indus.*, 932 F.2d 1453, 1458-59, 18 U.S.P.Q.2d (BNA) 1842, 1847 (Fed. Cir. 1991); *Procter & Gamble Co. v. Paragon Trade Brands, Inc.*, 989 F. Supp. 547, 612-13 (D. Del. 1997); 7 Chisum § 20.03[3][b][vii].

214 *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 262, 201 U.S.P.Q. (BNA) 1, 4 (1979) (stating that the goals of the patent system are to “foster and reward invention;” to promote “disclosure of inventions, to stimulate further innovation and to permit the public to practice the invention once the patent expires;” and to “assure that ideas in the public domain remain there for the free use of the public.”)

215 See, e.g., Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 Va. L. Rev. 305, 308 (1992) (proposing, as a complementary theory, that many features of the patent system can be viewed as efforts to reduce rent dissipation); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & Econ. 265, 267-71 (1977) (introducing the “prospect theory” of patents); A. Samuel Oddi, *Un-Unified Economic Theories of Patents-The Not-Quite-Holy Grail*, 71 Notre Dame L. Rev. 267, 273-89 (1996) (comparing various theoretical justifications for patents); Julie Turner, Note, *The Nonmanufacturing Patent Owner: Toward a Theory of Efficient Infringement*, 86 Cal. L. Rev. 179, 186-93 (1998) (arguing that the patent system promotes innovation-“the work necessary to bring an invention to market, including refinements, marketing and investment in capital goods” - rather than the mere invention of new products).

- 216 See, e.g., Stephen Breyer, *The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs*, 84 *Harv. L. Rev.* 281, 299-302 (1970) (arguing that first-mover advantage may be sufficient to induce production and dissemination of copyrighted works).
- 217 Trade secret law confers a limited set of rights in secret information that provides its possessor with an actual or potential competitive advantage. See, *Unif. Trade Secrets Act* § 1 (1979). Secrecy is costly, however, and in some cases—for example, when the product embodying the secret can be purchased on the open market and is easy to reverse-engineer—impossible to maintain. See *Restatement (Third) of Unfair Competition*, § 39 cmt. f; § 43 cmts. b & d (1995). Secrecy also conflicts with the goal of public disclosure of innovation, which itself may be a tool for encouraging further innovation.
- 218 For contractual liability to arise, of course, there would have to be a contractual relationship between the inventor and the would-be user—a condition that often will not arise.
- 219 See, e.g., Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 *J.L. & Econ.* 525 (2001) (arguing that system under which inventors could choose between obtaining a patent and a reward would be preferable to one offering patent protection alone).
- 220 Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 *J. Legal Stud.* 247, 248-49 & n.3 (1994).
- 221 *Id.*
- 222 Blair & Cotter, *supra* note 29, at 1332.
- 223 *Id.* at 1332-33. Much recent patent literature has addressed the issue of “cumulative innovation.” See, e.g., Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 *Colum. L. Rev.* 839, 884-97 (1990); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 *J. Econ. Perspectives* 29 (1991).
- 224 Grady & Alexander, *supra* note 215, at 308-09; Kitch, *supra* note 215, at 276.
- 225 *Id.*
- 226 Blair & Cotter, *supra* note 29, at 1332.
- 227 Cotter, *supra* note 57, at 29-34.
- 228 The concept of present and future values is explained quite clearly in Eugene Brigham & Joel Houston, *Fundamentals of Financial Management* 206-39 (1998).
- 229 *Id.*
- 230 For a brief examination of investment criteria under uncertainty, see Roger D. Blair & Lawrence W. Kenny, *Microeconomics for Managerial Decisionmaking* 219-21 (1982).
- 231 When future profits and/or the costs of the inventive effort are subject to uncertainty, the decision criterion is expressed in terms of expected values. Thus, if

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- <sup>232</sup> For some early insights, see Kenneth J. Arrow, *Economic Welfare And The Allocation Of Resources For Invention*, In *The Rate And Direction Of Economic Activity: Economic and Social Factors* 609 (1962), and George J. Stigler, *The Economics of Information*, 69 *J. Pol. Econ.* 213 (1961). There is now a voluminous literature on the economics of information.
- <sup>233</sup> In short, too few ideas will be produced if ownership cannot be protected. See Arrow, *supra* note 232, at 615. In principle, this is no different for any other product (corn, shoes, automobiles). One would have little incentive to produce anything except for immediate consumption if others were free to take it.
- <sup>234</sup> Blair & Cotter, *supra* note 18, at 1614.
- <sup>235</sup> *Id.* at 1615-16. Cf. Mark Shankerman & Suzanne Scotchmer, *Damages and Injunctions in Protecting Proprietary Research Tools*, Working Paper No. E00-288, at 4-5 (discussing advantages and disadvantages of liability and property rules with respect to intellectual property rights), available at < <http://haas.berkeley.edu/groups/iber/wps/econwp/html>>.
- <sup>236</sup> The validity of this presumption, however, will depend upon the policymaker's ability to choose the correct scope and duration of protection. It is important to note that the patent system does not tailor the term of protection for different types of inventions. Even if all inventors were equally risk-averse, this one-size-fits-all approach would mean that some inventors may receive more protection than is necessary to induce invention, and others less.
- <sup>237</sup> Blair & Cotter, *supra* note 18, at 1635-36.
- <sup>238</sup> *Id.*
- <sup>239</sup> See 35 U.S.C. §284; Blair & Cotter, *supra* note 18, at 1595-96 & n. 45.
- <sup>240</sup> Blair & Cotter, *supra* note 18, at 1636. Courts sometimes describe the reasonable royalty as "a device in aid of justice," rather than as a reconstruction of the actual royalty the parties would have agreed to absent an infringement. E.g., *Tektronix, Inc. v. United States*, 552 F.2d 343, 349, 193 U.S.P.Q. (BNA) 385, 391. (Ct. Cl. 1977) (quoting *Cincinnati Car Co. v. New York Rapid Transit Corp.*, 66 F.2d 592, 595, 19 U.S.P.Q. (BNA) 40,43 (2d Cir. 1933)). In some cases, however, it is probably better to view the "reasonable royalty" as, in effect, a rough attempt to award compensation for the patent owner's lost profit in cases in which that profit cannot be proven with precision.
- <sup>241</sup> A difficulty inherent to this enterprise is that of separating out the effect of the infringement from other factors that may have influenced the patentee's financial performance, such as managerial mishaps and changed market conditions. For a discussion of analogous problems that arise in the context of antitrust litigation, see Roger D. Blair & William H. Page, "Speculative" Antitrust Damages, 70 *Wash. L. Rev.* 423 (1995) (discussing, among other things, difficulties inherent to both "before and after" and "yardstick" approaches). See also Stewart, *supra* note 115, at 325-28 (discussing method for estimate but-for profits in patent litigation, in context of market share damages); Werden et al., *supra* note 37, at 323-27 (proposing method for estimating but-for profits in patent litigation using logit demand function).
- <sup>242</sup> In fact, patent litigation is said to be the most expensive type of litigation that exists, outpacing even other likely candidates such as antitrust. Blair & Cotter, *supra* note 18, at 1639 n.187 and sources cited therein.
- <sup>243</sup> This suggestion involves a moral hazard problem of sorts. Suppose that the patentee believes that the probability of winning the infringement litigation is 0.6. Then an extra dollar spent on, say, an expert witness only costs 60¢ in an expectations sense. This could lead to an overinvestment on the patentee's part. But if the full costs of litigation are not recovered, the patentee will be worse off due to infringement and the incentive to invent will be reduced. Cf. John J. Donohue III, *Opting for the British Rule, or If Posner and Shavell Can't Remember the Coase Theorem, Who Will?*, 104 *Harv. L. Rev.* 1093 (1991) (arguing that, if transaction

costs were zero, either the American or the British rule would be efficient).

244 35 U.S.C. § 284 (1994 & Supp. V 1999).

245 *Amsted Indus. v. Buckeye Steel Castings Co.*, 23 F.3d 374, 375-79, 30 U.S.P.Q.2d (BNA) 1470, 1471-74 (Fed. Cir. 1994) (holding that, in general, a court may award the prevailing party in a patent infringement suit her expert witness fees pursuant only to 28 U.S.C. §§ 1821(b) and 1920, which limit recovery to \$40 per day); *American Safety Table Co. v. Schreiber*, 415 F.2d 373, 380, 163 U.S.P.Q. (BNA) 129, 133 (2d Cir. 1969) (approving inclusion of master's fee as costs); *Sarkes Tarzian, Inc. v. Philco Corp.*, 351 F.2d 557, 560-61, 147 U.S.P.Q. (BNA) 172, 175 (7th Cir. 1965) (characterizing an award of costs for triplicate depositions as "excessive," but nevertheless affirming it as not "a clear abuse of discretion"). See also Skenyon et al., *supra* note 24, § 1:16, at 1-27 (noting that, "[w]ith the exception of expert witness fees, little significant case law has developed relating to 'the assessment of costs in patent cases'"). Note also that § 284 does not authorize the awarding of costs to the prevailing defendant. With respect to defendants, courts instead resort to Rule 54 of the Federal Rule of Civil Procedure. See Fed. R. Civ. P. 54(d) (stating that costs other than attorney fees "shall be allowed as of course to the prevailing party unless the court otherwise directs"); 10 Charles A. Wright et al., *Federal Practice and Procedure: Civil*, § 2670, at 259 (3d ed. 1998) (stating that when courts award costs pursuant to Rule 54(d), they typically include docket fees and other items listed in 28 U.S.C. § 1920); Skenyon et al., *supra* note 24, § 1:16, at 1-26 to -27.

246 See, e.g., *Alyeska Pipeline Serv. Co. v. Wilderness Soc'y*, 421 U.S. 240, 245 (1975) (noting the "general 'American rule' that the prevailing party may not recover attorneys' fees as costs or otherwise," subject to certain exceptions).

247 35 U.S.C. § 285 (1994).

248 E.g., *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 455, 227 U.S.P.Q. (BNA) 293, 298 (Fed. Cir. 1985) (stating that "exceptional circumstances" justifying an award of attorney's fees may include the patentee's fraud or inequitable conduct in procuring the patent, "willful infringement, misconduct during litigation, vexatious or unjustified litigation, or a frivolous suit").

249 Suppose, for example, that a patentee suffered a reduction in profit of \$1,000,000 in 1995 but did not receive payment until 2000. At an interest rate of, say, 10 percent, the value of \$1,000,000 five years later is  $(\$1,000,000)(1.10)^5$ , which is \$1,610,510. Without an award of compound interest, the patentee would be woefully undercompensated.

250 *General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 654-57, 217 U.S.P.Q. (BNA) 1185 at 1188-89 (1983).

251 35 U.S.C. § 284 (1994 & Supp. V 1999).

252 E.g., *Devex Corp. v. General Motors Corp.*, 577 F. Supp. 429, 430-34 (D. Del. 1983) (awarding postjudgment interest on costs). See also 28 U.S.C. § 1961(a) (2001) (stating that "[i]nterest shall be allowed on any money judgment in a civil case recovered in a district court," and that it "shall be calculated from the date of the entry of the judgment, at a rate equal to the weekly average 1-year constant maturity Treasury yield, as published by the Board of Governors of the Federal Reserve System, for the calendar week preceding the date of the judgement"); 28 U.S.C. § 1961(b) (stating that "[i]nterest shall be computed daily to the date of payment... and shall be compounded annually"). In cases involving judgments entered in the United States Court of Federal Claims against the United States, the prevailing plaintiff is entitled to interest at the overpayment rate used for tax claims against the United States. 28 U.S.C. § 1961(c)(3).

253 For example, suppose damages of \$100,000 per year were to extend into the future for three years. At a discount rate of, say, 15 percent, the present value of that flow of future profits would be  $\$100,000/(1.15) + \$100,000/(1.15)^2 + \$100,000/(1.15)^3$  or \$228,323. This, of course, is much less than the simple sum of \$300,000.

254 *Blair & Cotter*, *supra* note 18, at 1621-22. By authorizing courts to increase damages up to three times the amount of the actual harm in cases of willful infringement, the Patent Act roughly carries out this policy. See *supra* note 22 and accompanying text. *Blair & Cotter*, *supra* note 18, at 1639-41. But see Richard Craswell, *Deterrence and Damages: The Multiplier Principle and Its*

Alternatives, 97 Mich. L. Rev. 2185, 2238 (1999) (arguing that multipliers may not be necessary to achieve optimal deterrence in cases in which defendants can control their degree of culpability).

255 Total revenue is price times quantity. Since price is given by  $P = 100 - 0.1Q$ , total revenue will be  $P \times Q = (100 - 0.1Q)Q$ . Total cost, in this example, is average cost (i.e., per unit cost) times quantity or  $TC = 40Q$ .

256 Marginal revenue is defined to be the change in total revenue due to a change in quantity:  $dTR/dQ = 100 - 0.2Q$ . Marginal cost is the change in total cost due to a change in quantity produced:  $dTC/dQ$ , which is \$40 by assumption. Since  $\pi = TR - TC$ ,  $d\pi/dQ = dTR/dQ - dTC/dQ$ . Profit will be maximized when the increment in profit is zero:  $d\pi/dQ = 0$ , which requires that  $dTR/dQ - dTC/dQ = 0$  or marginal revenue equal to marginal cost.

257 The Cournot duopoly model was first proposed in Augustin A. Cournot, *Recherches sur les Principes Mathématiques de la Théorie des Richesses*, ch.VII (1838). Despite its age, the Cournot model has proved to be durable. Modern treatments are available in standard textbooks. See, e.g., Dennis W. Carlton & Jeffrey M. Perloff, *Modern Industrial Organization* 153-193 (3d ed. 2000).

258 The demand curve is  $P = 100 - 0.1Q$  and the patentee will produce 300 units. Thus, the demand facing the entrant is the residual:  
 $P = 100 - 0.1(300 + Q_i)$   
where  $Q_i$  represents the infringing entrant's output. Algebra yields  
 $P = 100 - 0.1(300) - 0.1Q_i$   
or  
 $P = 70 - 0.1Q_i$ .

259 For the infringer,  
 $\pi_i = (70 - 0.1Q_i)Q_i - 40Q_i$   
and

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260 For the infringing entrant,

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261 Of course, if it were possible for courts to correctly apply the restitutionary recovery in every case that warranted it, rational would-be infringers would always be deterred from infringing, and there would be no need to worry about restitutionary damages undercompensating the patentee. In our view, however, the real world's inevitable departures from the assumptions of perfect enforcement and rationality counsel in favor of a remedy that will leave the patent owner no worse off in the event that infringement is not deterred. Blair & Cotter, *supra* note 18, at 1635.

262 To solve (8) and (9) simultaneously, substitute the right-hand side of (9) into (8). Algebraic manipulation provides an optimal value for  $Q_e$ . Substituting this value into (9) provides the optimal value for  $Q_i$ .

263 Werden et al., *supra* note 37, at 317 (classifying components of patentee's loss). For an excellent attempt to calculate damages in a case in which price erosion likely had occurred, see Judge Easterbrook's opinion in *In re Mahurkar Double Lumen Hemodialysis Catheter Patent Litigation*, 831 F. Supp. 1354, 1392-93, 28 U.S.P.Q.2d (BNA) 1801, 1831-32 (N.D. Ill. 1993), *aff'd*, 71 F.3d 1573, 37 U.S.P.Q.2d (BNA) 1138 (Fed. Cir. 1995).

264 The Bertrand duopoly model was presented by Joseph Bertrand in a book review of Cournot's work published in 67 *Journal des Savants* 499 (1883). Modern treatments are found in standard textbooks. E.g., Jeffrey M. Perloff, *Microeconomics* 460-70 (1999).

265 Edward H. Chamberlin, *The Theory of Monopolistic Competition* 46-55 (8th ed. 1962).

266 For discussion of some of the practical difficulties of implementing this principle see sources cited supra note 241.

267 *Jurgens v. CBK, Ltd.*, 80 F.3d 1566, 1570 n.2, 38 U.S.P.Q.2d (BNA) 1397, 1400 n.2 (Fed. Cir. 1996) (citing *Hilton Davis Chem. Co. v. Warner-Jenkinson Co.*, 62 F.3d 1512, 1527, 35 U.S.P.Q.2d (BNA) 1641, 1653 (Fed. Cir. 1995) (en banc), rev'd on other grounds, 520 U.S. 17, 41 U.S.P.Q.2d (BNA) 1865 (1997)). There has been little scholarly investigation of the utility of the strict liability standard in patent law, as opposed to an intent or negligence-based standard.

268 *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 489-90, 181 U.S.P.Q. (BNA) 673, 681 (1974) (noting that trade secret law differs from patent law in that, inter alia, independent discovery is a defense in an action for trade secret misappropriation). Although an independent discovery defense might reduce the incentive to be first to invent, it would increase the incentive to be the second to invent, which under the current system is negative because the second inventor's costs of invention bear no fruit. On the other hand, by increasing the payoff to the first to invent, the current rule may encourage speedier invention, which is a social good. Whether society is better off without an independent discovery defense therefore may depend on whether the benefits from speedy invention outweigh the costs of duplicative effort by those who lose the patent race. See *Merges & Nelson*, supra note 223, at 877-78 (arguing that the benefits of speed outweigh the costs of duplication). See also Stephen M. Maurer & Suzanne Scotchmer, *The Independent-Invention Defense in Intellectual Property* (arguing that, under certain assumptions, the recognition of an independent discovery defense in patent law would increase social welfare, because it would limit patent owner's reward to an amount commensurate with the cost of research and development), available at <http://socrates.berkeley.edu/~scotch/>. Note that independent discovery is a defense in copyright law. E.g., *Sheldon v. Metro-Goldwyn Pictures Corp.*, 81 F.2d 49, 54, 28 U.S.P.Q.2d (BNA) 330, 335 (2d Cir. 1936) (L. Hand, J.) (noting that, "if by some magic a man who had never known it were to compose anew Keats's Ode on a Grecian Urn, he would be an 'author,' and, if he copyrighted it, others might not copy that poem, though they might of course copy Keats's," because the latter is in the public domain). There has been little discussion of the rationale for this difference, although one might posit two interrelated reasons. The first is that independent, noninfringing creation of identical, or nearly identical, copies of existing copyrighted works—which could then compete against the originals—is probably rare. R. Anthony Reese, Note, *Reflections on the Intellectual Commons: Two Perspectives on Copyright Duration and Reversion*, 47 *Stan. L. Rev.* 707, 719 (1995) (noting that if Shakespeare had never lived, we would not have Hamlet; but that if Newton had never lived, someone else would have invented calculus) (quoting Bradley Efron, *Campus Rep.* (Stanford University, Palo Alto, Cal.), May 2, 1984, at 5-6, quoted in Paul Goldstein, *Infringement of Copyright in Computer Programs*, 47 *U. Pitt. L. Rev.* 1119, 1123 (1986)). The difference matters little if the issue rarely arises in real life. A second reason is that independent creation of works that are substantially similar, though not identical, to existing works probably is relatively common and that copyrighted works themselves vastly outnumber patented inventions. Roger D. Blair & Thomas F. Cotter, *An Economic Analysis of Seller and User Liability in Intellectual Property Law*, 68 *U. Cin. L. Rev.* 1, 31-32 (1999). To confer upon the copyright owner the right to enjoin the use of substantially similar, independently-created works would have a chilling effect on speech. *Id.* at 32-36 (proposing similar rationale for lesser scope of copyright rights). See also Richard A. Posner, *Antitrust in the New Economy*, SF63 ALI-ABA 115, 119 (2000) (suggesting that copyright's weaker protection may justify its longer term). For a discussion of the patent/trade secret dichotomy, see David Friedman et al., *Some Economics of Trade Secret Law*, 5 *J. Econ. Persp.* 61, 65 (1991) (arguing that trade secret law is, in general, a useful supplement to the patent system; and that the independent discovery defense in trade secret law (1) avoids some duplicative effort by permitting the second discoverer of an invention protected only as a trade secret to obtain a patent, and (2) discourages races to invent, when the cost of invention is falling rapidly).

269 In the above example, both A's and B's expected profits are net of costs. In addition, they should be viewed as the amount which both A and B expect to earn in excess of the amount that they could earn from the use of alternative technologies.

270 Implicitly, this equation assumes that if A litigates she will win and will be compensated for all losses she has suffered as a result of the infringement. A more realistic model would discount the expected return in light of the possibility that litigation might be unsuccessful; and that even if it is successful, in the sense that the plaintiff wins, the damages award may not fully compensate the patentee for her loss. These additions, however, would not alter the conclusions presented above.

271 More realistically, the more one spends on providing notice (or conducting a search), the more likely it is that the notice will be effective (or the search accurate). A's decision regarding how much, if any, to spend on providing notice will depend in part on A's taste for risk. The same is true for B's decision regarding how much to spend on searching.

272 To the extent that the infringer has an inventory of infringing goods that an injunction renders worthless, the cost of that inventory

is sunk--it cannot be recovered. This is properly deducted from the profits received, because those costs were incurred as part of a continuing pattern of infringement.

273 If B is more efficient, he should be liable only for a reasonable royalty less than or equal to his expected profits attributable to the invention. In this case,  $(\pi_b - d)$  will be greater than or equal to zero. B will be less likely to search than when he expects his potential competitor A to be more efficient.

274 This result is not general; it depends upon the specific numerical values assumed for the variables. At bottom, all that we are saying is that if B's cost of searching is too high, there is no point in either searching or inventing. If B has the burden of searching, his expected return if he searches will always be higher than his expected return if he does not, so in this sense it does not matter what the values are in the equation denoting B's payoff in the absence of a search. (B also does not know in advance what the value of  $d$  is. In our equation, we stipulate that it is \$10,000, but this is not information that B would have.) The key point is that if his expected return if he searches is zero or less, he will be deterred from inventing. This may be undesirable, because (in our hypothetical) B is the latecomer only half the time, and A's cost of putting B on notice is less than B's cost of searching.

275 More than  $L_b' > \pi_b'$  is required for a search to occur;  $L_b' - \pi_b'$  must exceed a multiple of  $c_b$  where the multiplier is  $1/r$ , which exceeds 1 since  $0 < r < 1$ . On the facts assumed above, the left-hand term is negative, so B will not search.

276 A more realistic model might also include B's cost of having to switch from one technology to another in the event he is found to infringe. This cost, however, is present even if A can obtain only injunctive relief.

277 Omission from a "substantial number" of articles constitutes noncompliance. See 7 Chisum § 20.03[7][c][iii], at 20-624.

278 *Bandag, Inc. v. Gerrard Tire Co.*, 704 F.2d 1578, 1581, 217 U.S.P.Q. (BNA) 977, 979 (Fed. Cir. 1983).

279 *Nike*, 138 F.3d at 1446, 46 U.S.P.Q.2d at 1009 ("In determining whether the patentee marked its products sufficiently to comply with the constructive notice requirement, the focus is not on what the infringer actually knew, but on whether the patentee's actions were sufficient, in the circumstances, to provide notice in rem."); *Amsted Indus. v. Buckeye Steel Castings Co.*, 24 F.3d 178, 187, 30 U.S.P.Q.2d (BNA) 1462, 1469 (Fed. Cir. 1994) ("For purposes of section 287(a), notice must be of 'the infringement,' not merely notice of the patent's existence or ownership. Actual notice requires the affirmative communication of a specific charge of infringement by a specific accused product or device.").

280 The rule might reduce administrative costs to some extent, however, if it is easier to prove whether actual notice was given than to prove whether the defendant had actual knowledge.

281 Jessica S. Siegel, Comment, *The Patent Marking & Notice Statute: Invitation to Infringe or Protection for the Unwary?*, 36 *Hous. L. Rev.* 583, 605-06 (1999).

282 *King Instrument*, 65 F.3d 941, 36 U.S.P.Q.2d 1129.

283 In addition, as Judge Nies observed in dissent, this result provides the nonmanufacturing patent owner with an advantage the manufacturing patent owner does not have. *King Instrument*, 65 F.3d at 959, 36 U.S.P.Q.2d at 1143 (Nies, J., dissenting). See also *Rite-Hite*, 56 F.3d at 1570-71, 35 U.S.P.Q.2d at 1090-91 (Nies, J., dissenting) (arguing that awarding damages for "foreseeable" lost profits on sales of goods covered by another patent is inconsistent with § 287). *Rite-Hite* is distinguishable, however, in that the patentee was marketing some goods under the patent at issue.

284 Under current law, the patent term begins on the date the patent issues and expires 20 years after the date on which the patent application was filed. See 35 U.S.C. § 154(a)(2) (1994).

285 Pre-invention searches, however, are probably not very common.

286 Ayres & Klemperer, *supra* note 33, at 1028-31.

287 *Id.* at 1028-31.

288 *Id.* at 986-87.

289 *Id.* at 994-1001.

290 Economists refer to this as an allocative welfare loss, because the monopolist allocates too few resources to the production of the monopolized good, i.e., it produces too little output from society's perspective. For an excellent textbook treatment, see Walter Nicholson, *Microeconomic Theory* 548-57 (7th ed. 1998).

291 Ayres & Klemperer, *supra* note 33, at 994-1001.

292 *Id.* at 1028-31.

293 *Id.* at 1029.

294 Absent infringement, the social welfare loss is \$4,500 (= (70- 40) (300)). If the infringement results in the Cournot price and output, the social welfare loss falls to (60- 40)(200) = \$2,000. Thus, infringement reduces the welfare loss by \$2,500.

295 Ayers & Klemperer, *supra* note 33, at 1029.

296 *Id.* at 1031.

297 *Id.* at 1030. The problem with this analysis is fairly obvious. The authors assume that the adverse effect on the incentive to invent is immaterial and, therefore, that the gain in social welfare is essentially free; but the adverse effect may not actually be immaterial.

298 *Id.* at 1030.

299 If we let  $f$  represent the fraction of the lost profit that is recoverable by the patentee, the value of  $f$  that leaves a would-be infringer indifferent between infringing or not is that value that makes the damages award just equal to the profit from infringing:

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where  $\pi_i$  is profit lost by the patentee and  $\pi_i$  is the infringer's profit. Solving the equation for  $f$  yields  $f = \pi_i / \pi_i$ . In our example,  $\pi_i =$  \$4,000 and  $\pi_i$  is \$5,000; thus, the critical value for  $f$  is 0.80. If  $f$  exceeds 0.80, infringement will not occur.

300 Blair & Cotter, *supra* note 18, at 1363 n.187 (citing sources).

301 Ayres & Klemperer, *supra* note 33, at 998 (presenting a heuristic example in which a 25% reduction from the monopoly price reduces the patent owner's payout by only 16%).

302 A producer who is less efficient than the patentee, for example, in the sense that his marginal cost curve lies above that of the patentee, may not have an incentive to infringe and pay damages unless the damages are considerably lower than 100%. On the other hand, when an infringing producer is more efficient than the patentee, the latter is better off seeking a reasonable royalty, which should exceed the amount the patentee could have earned by manufacturing the product herself. To induce limited infringement in this context would require setting the reasonable royalty at some percentage of the amount the parties would have agreed to *ex ante*. Given the difficulty of accurately estimating this amount to begin with, an award of some hypothetical optimal percentage of the full royalty only compounds the uncertainty.

303 We assume that such a rule would be adopted in advance and that it would apply to all cases, rather than being reconfigured on a case-by-case basis.

304 Cf. Senate Subcomm. on Patents, Trademarks, and Copyrights of the Senate Comm. on the Judiciary, 85th Cong., *An Economic Review of the Patent System* 55 (Comm. Print 1958) (prepared by Fritz Machlup) (arguing that, in the absence of a patent system, the empirical evidence is insufficient to warrant creation of one; but that, in the presence of such a system, the evidence is insufficient to warrant its abolition).

305 Ayres & Klemperer, *supra* note 33, at 1016-19. Ayres and Klemperer nevertheless argue that their basic observation--that small reductions in price cause disproportionately large gains in social welfare--holds, even when market forces constrain the patent owner from earning a full-blown monopoly profit. *Id.* Whether a substantial (20% or more) decrease in potential damages, however, would have an effect upon an oligopolistic patent owner's *ex ante* incentives is less clear.

306 4 Fowler V. Harper et al., *The Law of Torts*, § 20.2, at 89 n.1 (2d ed. 1986); Prosser & Keeton on the Law of Torts, § 42, at 272-73 (W. Page Keeton gen. ed., 5th ed. 1984).

307 E.g., *Department of Transp. v. Anglin*, 502 So. 2d 896, 897-900 (Fla. 1987).

308 E.g., *Allegheny Gen. Hosp. v. Philip Morris, Inc.*, 228 F.3d 429, 445 (3d Cir. 2000) (applying Pennsylvania law).

309 *Id.*

310 E.g., *Susnis v. Radfar*, 739 N.E.2d 960, 967 (Ill. App. 2000).

311 E.g., *Morden v. Continental AG*, 611 N.W.2d 659, 676 (Wis. 2000).

312 4 Harper et al., *supra* note 306, §20.4, at 131 (noting that "the policies actually involved often fail to get explicit treatment"); Prosser, *supra* note 306, § 42, at 273 (describing doctrine as encompassing "more or less undefined considerations").

313 William M. Landes & Richard A. Posner, *Causation in Tort Law: An Economic Approach*, 12 *J. Legal Stud.* 109, 119-20, 125-33 (1983); Steven Shavell, *An Analysis of Causation and the Scope of Liability in the Law of Torts*, 9 *J. Legal Stud.* 463, 481, 490-93 (1980). See also Guido Calabresi, *Concerning Cause and the Law of Torts: An Essay for Harry Kalven, Jr.*, 43 *U. Chi. L. Rev.* 69, 98-100 (1975) (discussing proximate cause limitations relating to foreseeability of type of damage).

314 Landes & Posner, *supra* note 313, at 119-23, 125-34; Shavell, *supra* note 313, at 484, 490-93. For example, in *Berry v. Sugar Notch Borough*, 43 A. 240 (1899), a motorman was injured when a tree fell onto the roof of the trolley that the motorman was running at excessive speed. In his subsequent action against the municipality that was responsible for maintaining the tree, the defendant asserted that the cause of the accident was the motorman's excessive speed. Although the motorman's speed was a

but-for cause of his injury, speed did not increase the ex ante probability that of being injured by a falling tree. Landes & Posner, supra note 313, at 119; Shavell, supra note 313, at 482. Similarly, in the famous case of *Palsgraf v. Long Island R.R. Co.*, 162 N.E. 99 (N.Y. 1928), a railroad conductor caused a passenger to drop a package containing fireworks; the package exploded, allegedly causing a scale at the other end of the platform to fall and injure Ms. Palsgraf. Landes and Posner argue that holding the railroad liable “would have had no appreciable effect on the railroad’s level of care, because the costs of identifying such a state of the world would have exceeded the benefits to the railroad from taking precautions against its occurrence.” Landes & Posner, supra note 313, at 128. Cf. Shavell, supra note 313, at 491-92; Calabresi, supra note 313, at 93-94. Other considerations that may weigh in favor of cutting off liability include a very low probability that a particular class of damages will be substantial (again, because liability will not affect the defendant’s ex ante behavior) and high administrative costs of determining whether the alleged injury has occurred (and if so, its magnitude). Landes & Posner, supra note 313, at 124-29. By contrast, in a case in which the defendant causes an automobile accident by driving with his eyes closed, holding the defendant liable as the proximate cause of the injury makes sense because the defendant’s failure to take the appropriate safety step does materially increase the probability of an accident (even though the risk of any one particular person being injured in a specific way may be small). *Id.* at 127-28. Note that courts sometimes resort to other doctrines, such as duty, to accomplish the same purpose. Prosser, supra note 306, § 42, at 273-74. *Palsgraf* itself is such a case. *Palsgraf*, 162 N.E. at 101.

315 Rite-Hite, 56 F.3d 1538, 355 U.S.P.Q.2d 1065; *King Instrument*, 65 F.3d 941, 36 U.S.P.Q.2d 1129.

316 *Paper Converting*, 745 F.2d 11, 223 U.S.P.Q. 591; *Rite-Hite*, 56 F.3d 1538, 35 U.S.P.Q.2d 1065.

317 By contrast, consider the Federal Circuit’s hypothetical case of an inventor who suffers a heart attack when he learns that his invention has been infringed. *Rite-Hite*, 56 F.3d at 1546. See also *King Instrument*, 65 F.3d at 948 n.3 (using similar example). The court stated that proximate cause would bar recovery for this loss. *Rite-Hite*, 56 F.3d at 1546; *King Instrument*, 65 F.3d at 948 n.3. This result is correct under the economic framework described above. An act of infringement does not materially increase the net risk of others’ suffering from the effects of ill health, relative to the risk caused by other business decisions (including lawful competitive acts). Nor does it seem likely that refusing to use patent law as a vehicle for compensating this loss would have any effect on the ex ante incentive to invent and disclose. The *Rite-Hite* majority also suggested that a “loss in value of shares of common stock of a patentee corporation caused indirectly by infringement” is not compensable. *Rite-Hite*, 56 F.3d at 1546. This result is justifiable in light of the administrative difficulty that would follow from attempting to unravel the extent to which an act of infringement affected the stock price, and of avoiding a duplicative recovery.

318 The consequences will include injunctive relief and, possibly, damages, if the patentee files suit and wins. They also will include litigation costs, regardless of whether the patentee or the user prevails in court. In considering the next best alternative, the design-around cost is particularly pertinent to this analysis and should cap any reasonable royalty. *Grain Processing Corp. v. American Maize-Products Co.*, 185 F.3d 1341, 1349-54, 51 U.S.P.Q.2D (BNA) 1556, 1561-66 (Fed. Cir. 1999).

319 John W. Schlicher, *Measuring Patent Damages by the Market Value of Inventions-The Grain Processing, Rite-Hite, and Aro Rules*, 82 *J. Pat. & Trademark Off. Soc’y* 503, 527-29 (2000).

320 *Id.* at 528.

321 *Id.*

322 *Id.* As Schlicher notes, the result is easier to intuit when we consider the case in which the user starts by selling 50 units of the unpatented Model A for \$100 each, which reduces the patentee’s sales from 100 to 50 units (at \$100 each). Clearly there is no liability in this instance, because the user is not infringing. Now assume that the user switches to the patented Model B, in the false hope that it will sell more. (It doesn’t, because it has no advantage, price or otherwise, over Model A.) The result is exactly the same as when the user sold the unpatented Model A: namely, each party sells 50 units at \$100 each. *Id.* Schlicher concludes that “awarding damages equal to the patent owner’s lost profits in selling A seems more clearly to be a pure windfall to the patent owner, and too large a compensation for the valueless B invention.” *Id.*

323 *Id.* at 527.

324 Id.

325 Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc., 429 U.S. 477, 489 (1977) (holding that antitrust plaintiff must demonstrate “antitrust injury,” meaning “injury of the type the antitrust laws were intended to prevent,” and not merely competitive harm). In Rite-Hite, Judge Nies advocated use of the antitrust injury analogue, although she concluded that the lost profits at issue were not injuries of the type the patent laws were intended to prevent. Rite-Hite, 56 F.3d at 1559-60, 1574-75 (Nies, J., dissenting).

326 Rite-Hite, 56 F.3d 1538, 355 U.S.P.Q.2d 1065; King Instrument, 65 F.3d 941, 36 U.S.P.Q.2d 1129.

327 Alternatively, suppose that machine X is unpatented, but that Alice nevertheless finds it to be a more marketable product than the product covered by her patent, X'. Alice therefore neither makes, uses, nor sells product X'. Bruce-perhaps because he is more efficient at making X' than is Alice-infringes by making and selling X'. To the extent that X and X' are substitutes, Bruce's sales of X' reduce the quantity of X that Alice can sell. Should Alice be able to recover lost profits on her lost sales of X? Although King suggests that the answer is yes, this result is more difficult to reconcile with a but-for causation standard. But for the infringement Bruce most likely would have made, used, or sold the unpatented alternative X, unless X is protected by some other form of intellectual property protection, such as trade secrets. Unless Alice can prove that she would have lost fewer sales of X under this scenario, she should not recover any lost profits.

328 Turner, supra note 215. Although Turner's principal focus is on whether courts should award the nonmanufacturing patent owner injunctive relief or damages only, she acknowledges that her reasoning, if adopted, would overrule Rite-Hite. Id. at 207.

329 Rabowsky, supra note 58. Rabowsky would affirm the result in Rite-Hite (but not King), on the ground that the plaintiff in the former case was marketing some products under the infringed patent. Id. at 303 (agreeing with the district court in Rite-Hite that this result is necessary in order to avoid a potential “whipsaw” problem).

330 Id. at 324; Turner, supra note 215, at 182-83 . See also Joseph Rossman & Barkev S. Sanders, The Patent Utilization Study, in Nurturing New Ideas: Legal Rights and Economic Roles 106, 135 (1969) (cited in Rabowsky at 324 n.218). These reasons are interrelated factors that lead the patentee to decide that commercialization will not be profitable. The price reflects the value to the buyer as well as the cost to the producer.

331 Turner, supra note 215, at 183.

332 Id.

333 Id.

334 Id. See also Rabowsky, supra note 58, at 324.

335 Of course, it is possible that the parties would not reach an agreement due to stubbornness or mistake, even in the absence of overvaluation (reason (4)) or concerns about potential competition (reason (5)). Nevertheless, there is a range of royalties that would make both parties better off and that reasonable parties would have agreed to, even if these did not.

336 Rite-Hite, 56 F.3d 1538, 355 U.S.P.Q.2d 1065; King Instrument, 65 F.3d 941, 36 U.S.P.Q.2d 1129.

337 Rabowsky, supra note 58, at 315-17, 328; Turner, supra note 215, at 179-86, 206-09.

- 338 Rabowsky, *supra* note 58, at 315-17, 328. For theoretical analysis of when preemptive patenting is possible and when it is not, see Drew Fudenberg et al., *Preemption, Leapfrogging and Competition in Patent Races*, 22 *Eur. Econ. Rev.* 3 (1983); Richard J. Gilbert & David M.G. Newbery, *Preemptive Patenting and the Persistence of Monopoly*, 72 *Am. Econ. Rev.* 514 (1982); Richard J. Gilbert, *Patents, Sleeping Patents, and Entry Deterrence*, in *Strategy, Predation, and Antitrust Analysis* 205 (Steven C. Salop, ed., 1981); Jennifer F. Reinganum, *Uncertain Innovation and the Persistence of Monopoly*, 73 *Am. Econ. Rev.* 741 (1983); Stephen Salant, *Preemptive Patenting and the Persistence of Monopoly: Comment*, 74 *Am. Econ. Rev.* 247 (1984); and John Vickers, *Pre-Emptive Patenting, Joint Ventures, and the Persistence of Oligopoly*, 3 *Int'l J. Indus. Org.* 261 (1985).
- 339 See John M. Blair, *Economic Concentration* ch.10 (1972); Eugene Crew, *Foreword: Symposium on Antitrust and the Suppression of Technology in the United States and Europe: Is There a Remedy?*, 66 *Antitrust L.J.* 415, 416-17 (1998) (arguing that technology suppression is a real problem); Turner, *supra* note 215, at 179-81. The view among mainstream economists, however, is that preemptive patenting is uncommon. See F.M. Scherer, *Industrial Market Structure and Economic Performance* 452 (2d ed. 1980) (suggesting that preemptive patenting exists, but that it is not as widespread as commonly believed); Gilbert, *supra* note 338, at 211, 239-57, 269 (describing preemptive patenting as “exceptional,” and noting the difficulty of either proving or disproving the incidence of preemptive patenting by empirical evidence); Gilbert & Newbery, *supra* note 338, at 514 (stating that “the complexities of research and development limit preemptive patenting to exceptional circumstances”); Rabowsky, *supra* note 58, at 324 & n.218 (extrapolating from Rossman & Sanders that “the deliberate nonuse of patents as part of a scheme to exclude competition occurs at a rate of, at most (and probably substantially less than), ten percent”); Reinganum, *supra* note 338, at 746 (suggesting that preemptive patenting is even less common than suggested by Gilbert & Newbery).
- 340 Gilbert & Newbery, *supra* note 338, at 522-25; Richard J. Gilbert & Steven C. Sunshine, *Incorporating Dynamic Efficiency Concerns in Merger Analysis: The Use of Innovation Markets*, 63 *Antitrust L.J.* 569, 578 (1995). The intuition behind this condition is that, as the number of potential entrants increases, the likelihood that one or more of them will discover either a way to “invent around” the patent, or a patentable opportunity that has escaped the notice of the patent owner, also increases, thus reducing the probability that the preemptive patenting strategy will succeed. Gilbert & Newbery, *supra* note 338, at 523-24. Salant also argues that preemptive patenting will not occur as long as transaction costs are sufficiently low for the dominant firm and its rival(s) to negotiate an assignment or licensing of patent rights. Salant, *supra* note 338, at 247-50. If correct, this suggests that even when the number of potential competitors is small, preemptive patenting will be rare because in such cases transaction costs are likely to be small, *ceteris paribus*, relative to the costs that would arise in an industry characterized by a large number of potential competitors.
- 341 Gilbert & Sunshine, *supra* note 340, at 578; Reinganum, *supra* note 338, at 745-46. As Reinganum observes, the intuition behind this condition is that when the inventive process is stochastic [i.e., random] the incumbent firm continues to receive flow profits during the time preceding innovation. This period is of random length but is stochastically shorter the greater the firms’ investments in R & D. Since a successful incumbent merely “replaces himself” (albeit with a more profitable product), the incumbent firm has a lower marginal incentive to invest in R & D than does the challenger. Reinganum, *supra* note 338, at 741. See also *id.* at 745-46. Similarly, Fudenberg et al. show that when the R & D process is stochastic and occurs in multiple stages, or when firms have imperfect information about their competitors’ R & D activities, even a monopolist with a head start in a patent race may be unable to prevent a latecomer from “leapfrogging” into first place in the race. Fudenberg et al., *supra* note 338, at 10-21. As a general rule, one would expect that the patent owner would not suppress a technology that is superior (lower-cost) than the one she is marketing, because she could earn more from the exploitation of the superior technology. Karp and Perloff, however, have shown that the patent owner may be better off leaving idle a superior technology if, *inter alia*, consumers are unaware that the superior technology exists. Larry S. Karp & Jeffrey M. Perloff, *The Optimal Suppression of a Low-Cost Technology by a Durable-Good Monopoly*, 27 *Rand J. Econ.* 346 (1996). For the latter condition to hold, however, the superior technology would have to remain secret, thus ruling out the possibility of patenting it. Theory therefore suggests that preemptive patenting is unlikely to occur when the suppressed technology is superior to the technology currently in use.
- 342 Rabowsky, *supra* note 58, at 328.
- 343 Turner, *supra* note 215, at 195-96; Rabowsky, *supra* note 58, at 323-29.
- 344 Turner, *supra* note 215, at 186-89.

345 Survey evidence has tended to show that firms often rank other factors, including secrecy and the first-mover advantage, as being more important than patents as reasons for conducting research and development. F.M. Scherer et al., *Patents and the Corporation: A Report on Industrial Technology Under Changing Public Policy* 118 (2d ed. 1959), cited in Turner, *supra* note 215, at 187; C.T. Taylor & Z.A. Silbertson, *The Economic Impact of the Patent System* ch.9 (1973); Wesley M. Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)*, NBER Working Paper No. 7552 (Feb. 2000), at 9-11 & figures 1-4, available at <http://www.nber.org/papers/w7552.pdf>; Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 3 *Brookings Papers on Econ. Activity* 783, 794-95 (1987); Edwin Mansfield et al., *Imitation Costs and Patents: An Empirical Study*, 91 *Econ. J.* 907, 915 (1981). This evidence also shows, however, that patents are relatively more important in some industries than others. Cohen et al., *supra*, at 9 (noting that patents are relatively effective mechanisms for allowing creators to appropriate the value of their inventions in some industries (including medical equipment, drugs, and special purpose machinery); and that patents are “reported to be effective for more than 50% of product innovations” in the first two of these industries, though not the most effective mechanisms); Levin et al., *supra*, at 796-97.

346 Thus, even if one believes, *contra* Turner, that patents do provide a significant incentive to invent, in the context of preemptive patenting it may be socially optimal to confer that incentive upon the potential competitor, rather than upon the monopolist. This assumes, however, that the would-be preemptive patentee’s assumption, that someone else was about to invent and patent the new technology was correct. If the patentee is wrong, and if denying her a patent (or limiting the enforceability of her patent) reduces her incentive to invent, then society loses out because no one invents and discloses the new technology. It also assumes that one can readily distinguish preemptive patenting from other situations in which the patent owner decides not to commercialize her patent. This too is a questionable assumption.

347 Turner, *supra* note 215, at 189-91; Rabowsky, *supra* note 58, at 311-13.

348 Turner, *supra* note 215, at 191.

349 *Id.*; Rabowsky, *supra* note 58, at 312-13. Moreover, as Professor Kitch has observed, the disclosure induced by the patent system may be less important than is commonly thought, since patent law requires only the disclosure of how to make and use the invention as of the time the patent application is filed; it does not require the disclosure of newer, better ways that the inventor or her assignee may discover. Kitch, *supra* note 215, at 287-88. See also Rabowsky, *supra* note 58, at 312-13; Turner, *supra* note 215, at 190. But see Cohen et al., *supra* note 345, at figures 5-6 (presenting survey evidence suggesting that concerns over disclosure are a leading reason firms cite for not patenting). To the extent this critique is valid, it calls into question the strength of the disclosure rationale altogether, or at the very least suggests that the benefits of disclosing a technology that the patentee then refuses to market may be overestimated. On the other hand, as Kitch observes, the disclosure mandated by the patent system provides a framework within which firms may decide whether to license a technology. See Kitch, *supra* note 215, at 277-78. Perhaps this disclosure is valuable even if no firm ultimately decides to use the technology.

350 Rabowsky, *supra* note 58, at 311-14; Turner, *supra* note 215, at 191-94.

351 Rabowsky, *supra* note 58, at 314-15 (citing Kitch, *supra* note 215); Turner, *supra* note 215, at 194-95.

352 The empirical evidence in support of the prospect theory is thin. See Merges & Nelson, *supra* note 223 (presenting historical evidence contrary to the prospect theory). But see Grady & Alexander, *supra* note 215 (arguing that evidence is consistent with a modified version of the theory).

353 Rabowsky, *supra* note 58, at 314-15; Turner, *supra* note 215, at 194-95.

354 Rabowsky, *supra* note 58, at 313-14; Turner, *supra* note 215, at 182 n.13.

355 For example, in *Special Equipment Co. v. Coe*, 324 U.S. 370, 64 U.S.P.Q. (BNA) 525 (1945), the Court reversed a judgment holding that nonuse of one patent in order to protect another invalidates the unused patent, reasoning that if the rule were otherwise inventors would have an incentive to keep the invention secret. The Court declined, however, to address the issue of whether “the

courts on equitable principles should decline to enjoin patent infringements... when it appears that the patentee or inventor intends to make no use of the invention,” finding no evidence in the record that the plaintiff had such an intention. *Id.* at 379-80. Although Coe leaves open the possibility that a court might refuse to enjoin an infringement (and award only damages) where the patentee has no intention of using or licensing the patent, there is little authority affirmatively supporting such a rule. The one exception is a rule, in force in one form or another from 1832 to 1870, which required alien holders of U.S. patents to market their inventions within the United States within a specified period of time from the date of issuance of the patent. See Act of July 13, 1832, ch. 703, 4 Stat. 577, § 1 (permitting resident aliens to obtain U.S. patents subject to the condition, *inter alia*, that they work their patents within one year of issuance), repealed by Patent Act of 1836, ch. 357, 5 Stat. 117, § 21; Patent Act of 1836, ch. 357, 5 Stat. 117, § 15 (recognizing, as a defense to a claim of patent infringement asserted by an alien patentee, failure to work the patent within eighteen months of issuance), repealed by Patent Act of 1870, ch. 230, 16 Stat. 198). Turner concedes this point, although she notes one modern decision in which a court has refused to award injunctive relief on these facts. Turner, *supra* note 215, at 208 (citing *Allied Research Products v. Heatbath Corp.*, 300 F. Supp. 656, 657 (N.D. Ill. 1969)). She also notes another more recent case in which the Federal Circuit has stated in dicta that entitlement to injunctive relief is “discretionary.” *Id.* (citing *Kearns v. Chrysler Corp.*, 32 F.3d 1541, 1551, 31 U.S.P.Q.2d (BNA) 1733, 1746 (Fed. Cir. 1994)). See also *Hartford-Empire Co. v. United States*, 323 U.S. 386, 432, 64 U.S.P.Q. (BNA) 18, 38 (1945) (stating that patent owner “has no obligation either to use [the patent] or to grant its use to others”); *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 422-30 (1908).

356 35 U.S.C. § 271(d)(4) (1994) (stating that “[n]o patent owner otherwise entitled to relief for infringement... shall be denied relief or deemed guilty of misuse... by reason of his having... refused to license or use any rights to the patent”). When a defendant successfully asserts the defense of patent misuse, the patent becomes unenforceable as against that defendant. *E.g.*, *C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1372, 48 U.S.P.Q.2d (BNA) 1225, 1249 (Fed. Cir. 1998).

357 *In re Indep. Servs. Org. Antitrust Litig.*, 203 F.3d 1322, 1325-27, 53 U.S.P.Q.2d (BNA) 1852, 1854-56 (Fed. Cir. 2000) (holding that the refusal to sell or license a patented product does not violate the antitrust laws), cert. denied, 121 S. Ct. 1077 (2001). But see *Image Tech. Servs. v. Eastman Kodak Co.*, 125 F.3d 1195, 1218, 44 U.S.P.Q.2d (BNA) 1065, 1081 (9th Cir. 1997) (holding that a refusal to license may violate the antitrust laws if, among other things, the refusal lacks a valid business justification).

358 Yee Wah Chin, *Unilateral Technology Suppression: Appropriate Antitrust and Patent Law Remedies*, 66 *Antitrust L.J.* 441, 444-46 (1998); Joel M. Cohen & Arthur J. Burke, *An Overview of the Antitrust Analysis of Suppression of Technology*, 66 *Antitrust L.J.* 421, 428-31 (1998).

359 Turner, *supra* note 215, at 196-209. For more on property and liability rules, see Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 *Harv. L. Rev.* 1089, 1092 (1972) (explaining the difference between the two); Blair & Cotter, *supra* note 18, at 1615-16 (discussing why property rules may be generally preferable in intellectual property law).

360 Following Kaplow and Shavell, Turner argues that awarding injunctive relief in cases involving harmful externalities is inefficient; and, finding such externalities present in the case of the nonmanufacturing patent owner, she would limit the latter to recover under a liability rule. Turner, *supra* note 215, at 196-204 (citing Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 *Harv. L. Rev.* 713 (1996)).

361 *Id.* at 182 n.13, 208.

362 *Id.* at 208 (stating that the “nonmanufacturing patent owner’s remedy would be limited to actual lost profits or a reasonable royalty”).

363 Rabowsky, *supra* note 58, at 316-17, 328.

364 Turner appears to recognize this argument, but finds it “uncertain.” Turner, *supra* note 215, at 191.

365 An ideal system would try to discern which rule gives rise to more useful disclosure, but in the absence of empirical evidence as to the effect of the two rules this is a difficult matter to predict *a priori*.

- 366 At least one of those conditions, however—the existence of market power in the market served by technology 1—is likely to be met in cases in which the patent owner can prove lost profits. Under *Panduit* and subsequent cases, the owner of multiple, potentially substitutable patents will be able to prove lost profits only when its ownership of these patents confers some degree of market power, since otherwise the existence of adequate noninfringing alternatives would entitle her only to a reasonable royalty.
- 367 In this regard, allowing a patent on technology 2 regardless of its commercialization might provide an incentive to invent and disclose, if the firm does not expect others to duplicate that technology independently. In the case of preemptive patenting, the firm generally assumes that someone else will duplicate unless the preemptive patentee acts first.
- 368 Rabowsky notes that a large number of patents are not commercialized for benign reasons, Rabowsky, *supra* note 58, at 282-83. Of those patents that wind up in litigation, nearly half are invalidated. John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 *AIPLA Q.J.* 185, 205-07 (1998).
- 369 Turner thinks it would be relatively easy to distinguish between patent owners who fail to commercialize for reasons (1) through (4) from those who fail for reason (5). Turner, *supra* note 215, at 209 (suggesting that courts should “look[ ] to whether the patent owner is taking reasonable and diligent steps toward commercializing the patented technology”). Neither she nor Rabowsky, however, addresses the issue of distinguishing preemptive from nonpreemptive nonmanufacturing patent owners. This latter distinction might prove particularly difficult. See Gilbert & Newbery, *supra* note 338, at 525 (stating that “[p]reemption would be very hard to identify in any practical situation because it is difficult to distinguish product development that is the result of superior foresight and technological capabilities from development that is motivated by entry deterrence”).
- 370 Blair & Cotter, *supra* note 18, at 1615-16. As a general matter, the principal reason for avoiding compulsory licensing is that the parties (patent owner and would-be user) are typically in a better position than is the government to determine the value of intellectual property rights. *Id.*
- 371 E.g., I Stephen P. Ladas, *Patents, Trademarks, and Related Rights: National and International Protection*, §§ 247-48 (1975) (discussing compulsory licensing and working requirements). But see I Frederick Abbott et al., *The International Intellectual Property System: Commentary and Materials* 717 (1999) (noting that “developing countries have rarely invoked the use of compulsory licenses”); Gilbert, *supra* note 339, at 248-51 (noting that, from 1959-1968, compulsory licensing was rare even in countries that, in theory, permitted it). International treaties on intellectual property rights, however, limit the ability of member nations (including the United States) to impose working and compulsory license requirements. For example, the Paris Convention permits member nations to grant compulsory licenses to prevent “abuses... for example, failure to work,” but prohibits applying for a compulsory license on the ground of failure to work until four years from the date of filing the patent application or three years from the date of issue, whichever is later. Paris Convention for the Protection of Industrial Property, Mar. 20, 1883, art. 5.A.2 & 4. Moreover, the TRIPs Agreement states that “patents shall be available and patent rights enjoyable without discrimination as to... whether products are imported or locally produced,” Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, art. 27.1 [hereinafter TRIPs Agreement]. Most commentators read this provision as permitting a patent owner to satisfy a domestic working requirement by importing the invention into the country. See Charles R. McManis, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 *Wash. U. L.Q.* 255, 266 & n.59 (1998); J.H. Reichman, *Universal Minimum Standards of Intellectual Property Protection Under the TRIPs Component of the WTO Agreement*, 29 *Int’l Law.* 345, 352 (1995). But see Michael Halewood, *Regulating Patent Holders: Local Working Requirements and Compulsory Licenses at International Law*, 35 *Osgoode Hall L.J.* 243, 250-60 (1997) (disputing this interpretation). TRIPs also curtails, although it does not eliminate, the ability of member nations to impose compulsory licensing. TRIPs art. 31. See also Reichman, *supra*, at 355-56 (noting that “considerable effort has been made to discredit the nonworking of foreign patents locally as a sufficient basis for triggering” compulsory licenses”). Cf. Halewood, *supra*, at 263-71 (arguing that nations may continue to impose compulsory licensing as a remedy for failure to work).
- 372 For a classic statement of the argument within the context of international intellectual property law, see Edith Tilton Penrose, *The Economics of the International Patent System* (1951) (arguing that working requirements and compulsory licensing benefit developing countries), reprinted in I Abbott et al., *supra* note 371, at 261-62.
- 373 This analysis is contained in all standard microeconomics texts. E.g., Jeffrey M. Perloff, *Microeconomics* 15 (1999).

374 That is, if  $\partial Q_A / \partial P_B < 0$ .

375 Perloff, supra note 373, at 59-61.

376 More precisely, the cross-elasticity of demand is

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377 Perloff, supra note 373, at 89.

378 Rite-Hite, 56 F.3d at 1550, 35 U.S.P.Q.2d at 1073.

379 That is, if  $\epsilon_{A,B} = \Delta Q_A / \Delta P_B \times P_B / Q_A$ , then  $\Delta Q_A / -15 \times 70 / 100 = -1$ .  $\Delta Q_A = -1500 / 70 = 21.43$ .

380 Unless the patentee has market power in the market for unpatented good A, her profits on sales of good A would equal the normal rate of return.

381 That is, the patentee now sells 2/3 of the quantity demanded of good B (300 units out of 450 total), as well as 2/3 of the quantity demanded of good A (80.96 out of 121.43). The infringer sells 1/3 of the quantity demanded of both goods (150 units of good B and 40.48 units of good A).

382 That is,  $-1 = (\Delta Q_A / -10) \times (70 / 100)$  leads to a value of  $\Delta Q_A = 14.3$ .

383 That is,  $-1 = (\Delta Q_A / -30) \times (70 / 100)$  leads to a value of  $\Delta Q_A = 42.9$ .

384 In this case, goods A and B are by assumption not complements in consumption. The “one stop shopping” phenomenon, however, indicates transactional complementarity, which would not be obvious from a functionality perspective.

385 Blair & Cotter, supra note 18, at 1640-41.

386 Rite-Hite, 56 F.3d at 1550, 35 U.S.P.Q.2d at 1073.

387 For example, suppose that a patentee were limited to recovering lost profits only on the patented good. A potential infringer may expect to earn, say, \$1,000 by infringing on patented good A and an additional \$1,000 on collateral sales of B that he would not otherwise have made. If the damages suffered by the patentee due to lost profits on good A are less than \$2,000, say, \$1,500, there is an incentive for infringement. The potential infringer will net \$500 if he earns \$2,000 by infringing, but must only pay \$1,500 in damages.

388 By definition, the patentee makes complementary sales according to a tying arrangement if she agrees to sell patented good A only on the condition that the buyer also purchase some other good B. In that event, good A is said to be the tying good, while good B is deemed to be the tied good. Under some circumstances, tying arrangements violate § 1 of the Sherman Act, which holds in relevant part that “[e]very contract, combination..., or conspiracy, in restraint of trade... is declared to be illegal.” 15 U.S.C. § 1 (1994). The term “bundling” is used when two products are sold as a package, at a price below the price charged for both goods separately. Ronald W. Davis, Pricing with Strings Attached: At Sea in Concord Boat and Lepage’s, 14 Antitrust 69, 69 (Summ. 2000). In some cases, bundling may constitute the offense of monopolization under § 2 of the Sherman Act. Id. Technically, bundling might be at issue when the patentee seeks to recover lost profits on sales of a unitary product that incorporates a patented component.

389 Jeffrey J. Keyes et al., *Tying, Exclusive Dealing, and Franchising Issues*, 1117 *PLI/Corp.* 9, 43 (1999) (discerning “general rule... that where two products normally are sold together as a matter of customary market practices, or because most buyers find it convenient to buy the combination from one source at a time, the courts will not condemn the seller who refuses to split up the package when the buyer demands it, and will instead conclude that there is only a single product made up of multiple parts”) (citations omitted).

390 Alan J. Meese, *Tying Meets the New Institutional Economics: Farewell to the Chimera of Forcing*, 146 *U. Pa. L. Rev.* 1, 44-49, 61-66 (1997) (noting alleged procompetitive benefits of tying include price discrimination and quality control, and arguing in addition that some forms of tying reduce transaction costs); Michael D. Whinston, *Tying, Foreclosure, and Exclusion*, 80 *Am. Econ. Rev.* 837, 838 (1990) (noting that advocates of tying “point to a number of socially beneficial, or at worst ambiguous, alternative explanations for tying,” including “price discrimination, achieving economies of joint sales, protection of goodwill, risk sharing, and cheating on a cartel price”). But see Louis Kaplow, *Extension of Monopoly Power Through Leverage*, 85 *Colum. L. Rev.* 515, 539-55 (1985) (questioning alternative explanations).

391 The extent to which current law recognizes the potentially procompetitive benefits of tying as a defense remains unclear. Herbert Hovenkamp, *Federal Antitrust Policy: The Law of Competition and Its Practice*, § 10.1, at 392-93 (2d ed. 1999) (noting that courts condemn only those tie-ins that have “anticompetitive effects,” but that the meaning of “anticompetitive effects” differs from circuit to circuit); Meese, *supra* note 390, at 3-4.

392 Analysis typically focuses on two parties: the buyer who wishes to purchase good A but whom the monopolist coerces into buying good B as well; and rival sellers of good B who appear to be foreclosed from selling those goods to customers who want to buy good A and, therefore, must buy good B from the monopolist. The coerced buyer’s complaint is that the monopolist overcharges him for the tied product. To illustrate the flaw in this reasoning, consider first the situation in which the monopolist sets a profit maximizing price for good A and allows her customers to purchase good B at the competitive price. If she imposes a tying requirement that involves an overcharge on the tied good, she will have to reduce the price of the tying good below the profit-maximizing level. In that event, the net harm is equal to the overcharge on good B less the price reduction on good A. In many, if not all, cases, this will be a wash and there will be no net injury to the coerced buyers.

With respect to foreclosed rivals, the price of the patented tying good is usually below the price that would be charged absent the tying contract while the price of the tied good is raised above the competitive level. Arguably, the tying contract excludes the seller’s rivals in the tied good market from selling to the buyers of the tying good. For example, when IBM tied its cards to its machine leases, rival manufacturers of paper cards were foreclosed from selling to IBM’s lessees. *International Bus. Machs. Corp. v. United States*, 298 U.S. 131 (1936). But were they injured in any meaningful sense? IBM raised the price of a card above the competitive level and presumably reduced the rental rate on its patented machine. The foreclosed rivals could not base their damages calculations on IBM’s card prices because those prices would have been lower absent the tying contract. It would be perverse to use the antitrust laws to claim lost profits based on overcharges made possible by the tying contract. Absent the presumably illegal contract, IBM’s lessees would have been paying competitive prices for the cards. Thus, foreclosed rivals must base their damages calculations on competitive prices. This, of course, makes the claim for lost profits due to being foreclosed from sales to IBM’s lessees much smaller.

There is another consideration as well. Presumably, all competent paper companies could have made the cards for the IBM machines and, therefore, they could have sold their cards to IBM for resale to their lessees. (Although IBM argued that it had to tie cards to the leases to guarantee the card quality and smooth functioning of the machines, the court rejected this argument due to the alternative of issuing precise specifications for the cards. *International Bus. Machs. Corp. v. United States*, 13 *F. Supp.* 11, 18 (S.D.N.Y. 1935), *aff’d*, 298 U.S. 131 (1936)). In this way, the paper companies would not have been foreclosed although they would have had to sell to IBM rather than to IBM’s lessees. The volume of business, however, would have been the same. For its part, IBM should have had no real interest in producing its own cards unless it could do so more efficiently than the paper companies.

For further discussion of the difficulty of leveraging when the market for the tied product is competitive see Robert H. Bork, *The Antitrust Paradox: A Policy at War with Itself* 365-81 (1976); Aaron Director & Edward H. Levi, *Law and the Future: Trade Regulation*, 51 *Nw. U. L. Rev.* 281 (1956); Ward S. Bowman, *Tying Arrangements and the Leverage Problem*, 67 *Yale L.J.* 19 (1957). But see Kaplow, *supra* note 390, at 525-39 (questioning this analysis).

393 Meese, *supra* note 390, at 32-33.

394 The economic analysis generally focuses on two effects. The first is that, under some conditions, the monopolist may be able to deter entry into the market for the tied good by precommitting to a strategy of intense competition in the event that a rival were to

enter that market. See Roger D. Blair & David L. Kaserman, A Note on Dual Input Monopoly and Tying, 10 Economics Letters 494 (1982); Whinston, *supra* note 390. The second is that the monopolist may be able to strategically price the bundle in such a way as to deter entry into the market for either good A or B. Debra J. Aron & Steven S. Wildman, Economic Theories of Tying and Foreclosure Applied-and Not Applied-in Microsoft, 14 Antitrust 48 (Fall 1999); Barry Nalebuff, Bundling, Nov. 22, 1999, available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=185193](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=185193).

Even in these instances, however, it is not clear that the foreclosed firms will have an effective damages remedy under the antitrust laws. Assume that the patented good, over which the patentee has monopoly power, is sold to a downstream industry. The downstream purchasers employ the patented product as an intermediate input in production. Suppose a complementary input is supplied by an imperfectly competitive industry at noncompetitive prices. These noncompetitive prices cause the demand for the patentee's product to be lower. This, of course, provides a profit incentive for the patentee to begin supplying the complementary input. If the patentee elects to use a tying arrangement, its imperfectly competitive rivals would also be foreclosed from this book of business. If they claim damages, the question is what price should be used for the damage calculations. Antitrust policy would not be furthered if the foreclosed firms could use noncompetitive prices for the damage calculations. This would serve to protect monopoly profits rather than promote competition. If the foreclosed firms are required to use competitive prices, their damages--if any--will not amount to much.

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Nalebuff, *supra* note 394, at 24-27.