

Exhibit D

ECONOMIC APPROACHES TO
INTELLECTUAL PROPERTY
POLICY, LITIGATION,
AND MANAGEMENT

ECONOMIC APPROACHES
TO INTELLECTUAL
PROPERTY POLICY,
LITIGATION, AND
MANAGEMENT

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II

The Basics of Intellectual Property Damages

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A Practical Guide to Damages

Gregory K. Leonard and Lauren J. Stiroh

A patent owner who is the victim of infringement is entitled to some compensation for the use of his patent by an unauthorized entity. The statutory floor for patent damages is a *reasonable royalty*.¹ The patent owner is entitled to recover more—the *lost profits* it sustained as a result of the infringement—if these lost profits exceed the reasonable royalty.² Properly calculated, damages in intellectual property disputes are guided by fundamental economic principles governing the value of the intellectual property at issue.³ In this chapter, we outline the basic economic principles that guide the determination of reasonable royalties or lost profits in intellectual property disputes. These principles provide the foundation for the remainder of this book. Many of the issues touched on here will be addressed in greater detail in later chapters.

Lost Profits Damages: Elements of Lost Profits

Lost profits are defined as the difference between the profits the plaintiff would have made *but for* the infringement and the profits the plaintiff actually made. Determining the profits that the plaintiff would have made but for the infringement requires an assessment of the economic outcomes that would have occurred absent the infringement. This exercise has aptly been termed constructing a *but-for world*, i.e., the world that would have existed absent the infringement.⁴ Constructing the but-for world is essentially equivalent to undoing the effects of the infringement.

¹ 35 U.S.C. § 284 (2004).

² *Id.*

³ This discussion will primarily be placed in the context of patent infringement litigation. Economic and legal principles governing trademark or copyright infringement are discussed in Chapter 6.

⁴ See, e.g., *Grain Processing Corp. v. American Maize-Products Co.*, 185 F.3d 1341 (Fed. Cir. 1999).

The profits that the plaintiff would have made absent the infringement comprise three primary elements: (1) the quantity of sales that the plaintiff would have made absent infringement (*but-for quantity*), (2) the price at which the plaintiff would have sold this quantity (*but-for price*), and (3) the costs that the plaintiff would have incurred producing and selling the but-for quantity (*but-for cost*). Each of these variables might have been different in the but-for world than in the actual world. Damages arise due to these differences.

Consider a hypothetical version of the market for DVD players at the time when the technology was first commercially introduced. For the purposes of this example, we assume that there were two companies, DigiDisc and InfrCorp, selling DVD players, with each company basing its player on its own proprietary format (much like the early days of the VCR market when the BetaMax and VHS formats competed with each other).⁵

Suppose that DigiDisc owns a patent covering the technology used in its DVD player that it believes is being infringed by InfrCorp's DVD player. Accordingly, DigiDisc brings a patent infringement suit against InfrCorp in which it is determined that InfrCorp's DVD player does, in fact, infringe DigiDisc's patent. Suppose it is further determined that InfrCorp had no feasible way of offering a noninfringing version of its DVD player. Thus, in the but-for world—the world where InfrCorp does not infringe DigiDisc's patent—InfrCorp would have had no product at all to offer to customers, and therefore DigiDisc would have been the only seller in the market.

Would it necessarily be reasonable to assume that in the but-for world DigiDisc would have made all of InfrCorp's infringing sales of DVD players? The answer is no, for several reasons. First, the DigiDisc and InfrCorp DVD players are *differentiated products*. This means that they were not perfectly interchangeable in the minds of purchasers. At least some purchasers of the InfrCorp DVD player would not automatically have purchased a DigiDisc DVD player if the InfrCorp DVD player were not available. One of the reasons for this is that (in our example) the catalogs of movies available on DVD during the period in question differed somewhat across the two formats—while both companies offered a good

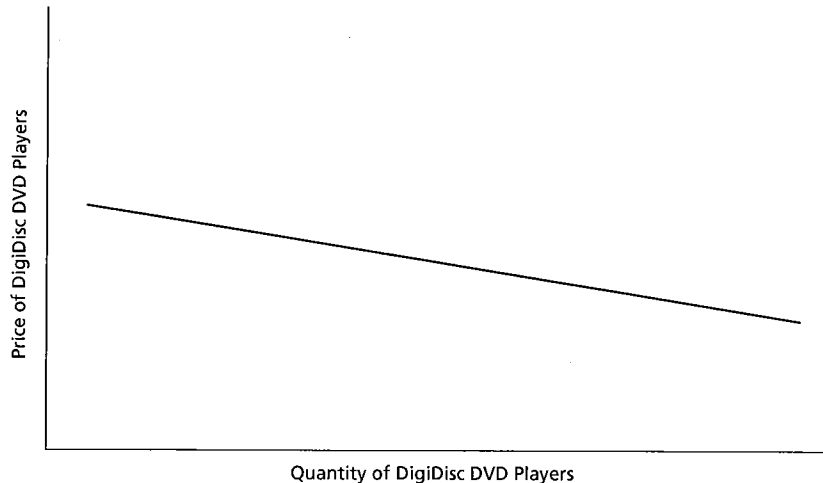
⁵ In this regard, our example does not correspond with the actual history of the DVD player market because the DVD manufacturers, in fact, standardized on a single format. However, the assumption of different formats facilitates the illustration of the key economic principles discussed below.

selection of general interest films, InfrCorp offered foreign and art films that were not offered by DigiDisc. Thus, some consumers who purchased an InfrCorp DVD player because of the foreign and art films available on that format may not have been willing to purchase a DigiDisc DVD player had the InfrCorp product not been available. They might have chosen to continue using their VHS tape players instead. Second, because of competition between DigiDisc and InfrCorp, the price of the DigiDisc DVD player might have been lower following infringement than it would have been in a world where DigiDisc did not face competition from InfrCorp. With a higher but-for price, overall consumer demand for DVD players would have been lower than it actually was.

To analyze what would have happened in the but-for world, we start by looking at the *demand curve* for the DigiDisc DVD player when InfrCorp was infringing. This demand curve, shown in Figure 1, reflects customers' demand for the DigiDisc product as a function of its price.

It is a fundamental principle in economics that demand curves slope downward: the higher the price, the lower the quantity demanded, and vice versa. The rate at which quantity demanded decreases when price increases depends on the price-sensitivity of consumers. The slope of the demand curve is an indication of that price-sensitivity. A steeper demand curve indicates less price-sensitivity (quantity demanded does not move

Figure 1. DigiDisc Demand Curve



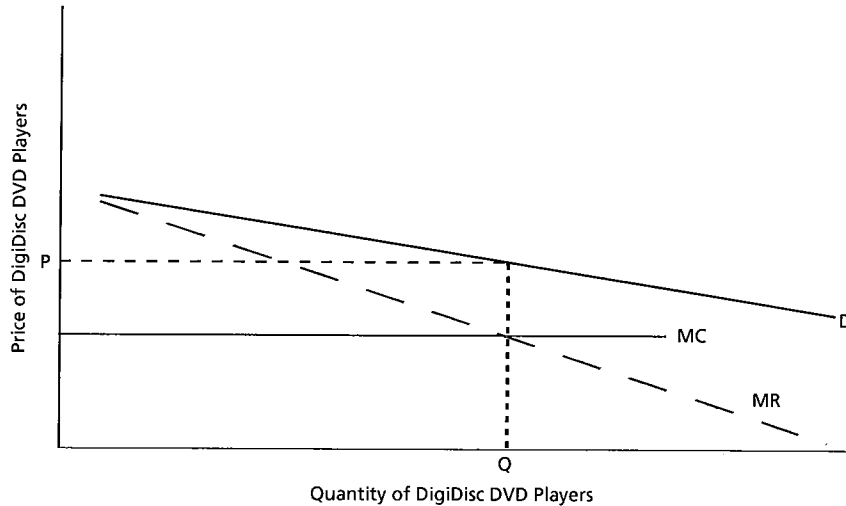
very much for a given price change), and a flatter demand curve indicates greater price-sensitivity (quantity demanded moves a lot for a given price change). Price-sensitivity, in turn, reflects in part the extent to which consumers view the DigiDisc product and the InfrCorp product as substitutes. Closer substitutability leads to greater price-sensitivity for DigiDisc because more consumers would be willing to switch to the InfrCorp DVD player in response to a price increase in the DigiDisc product.

When DigiDisc competed with InfrCorp for sales, DigiDisc would have chosen its price so as to maximize its profits given the demand curve in Figure 1. This is the demand curve “with infringement” (the demand curve faced by DigiDisc when InfrCorp infringed its patent). To find the profit-maximizing price, we add two curves to Figure 1 (see Figure 2). The first curve, that showing the marginal revenue (represented by the dotted line labeled MR), indicates the amount of additional revenue that DigiDisc would gain from selling an additional DVD player. Note that DigiDisc does not gain revenue equal to the price by selling an additional unit. This is because DigiDisc was already selling as many DVD players as customers wanted to buy at the old price and would have to lower its price to sell an additional unit. As a result, the marginal revenue curve lies below the demand curve and is also downward sloping. The second curve is the marginal cost curve, labeled MC. It shows the amount of additional cost DigiDisc would incur in order to sell an additional unit. This curve is horizontal which means that, in this example, the additional cost of producing one more unit is always the same no matter how many DVD players DigiDisc is already producing.⁶ Thus, DigiDisc faces a constant marginal cost of selling an additional unit.

DigiDisc’s profit-maximizing price is found by first determining where the marginal revenue curve intersects with the marginal cost curve. The DigiDisc quantity at this intersection (labeled Q) is the profit-maximizing quantity. The quantity Q maximizes profits because at this level of quantity the marginal revenue from selling an additional unit just equals the marginal cost. If quantity were any lower than Q, marginal revenue would exceed marginal cost (as can be seen by the fact that the curve MR lies above the curve MC for quantity less than Q), and profits could therefore be increased by selling an additional unit. If quantity were any

⁶ Note that this means we are implicitly assuming that DigiDisc’s increased demand for the inputs required to make and sell DVD players does not affect the prices of those inputs.

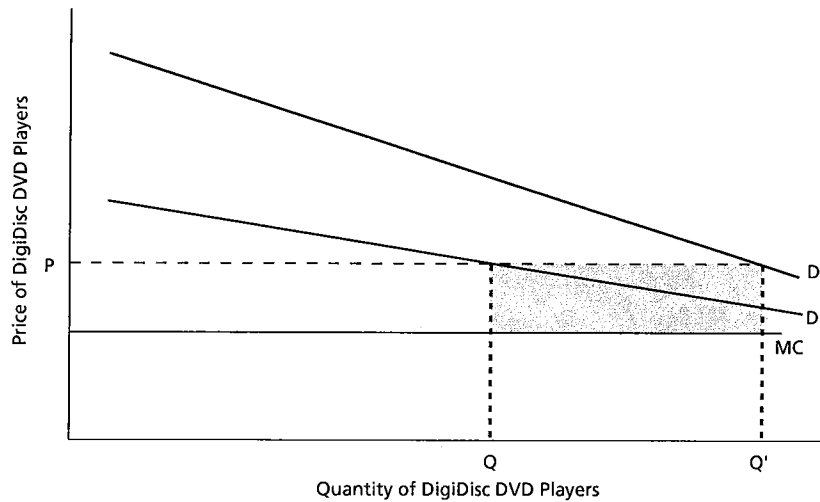
Figure 2. DigiDisc's Profit-Maximizing Price



higher than Q , the marginal revenue would be less than the marginal cost (as can be seen by the fact that the curve MR lies below the curve MC for quantity greater than Q), and therefore profits could be increased by reducing the quantity sold. DigiDisc's profit-maximizing price can be determined by reading the price off of the demand curve that corresponds to Q . This price is labeled P in Figure 2.

Now let us consider what happens in the but-for world where the InfrCorp DVD player would not have been available for purchase in the market. Without the InfrCorp product in the market, the demand curve for the DigiDisc DVD player would have been different from the demand curve with infringement (see Figure 1) in two respects. First, at any given price, the demand for the DigiDisc product would have been greater, which is represented by an outward shift in the demand curve. The reason for this is that since the InfrCorp DVD player would not be available in the but-for world, some of the consumers who purchased this product in the actual world would have instead purchased a close substitute product—the DigiDisc DVD player—in the but-for world. The amount by which the DigiDisc demand curve shifts out depends on the number of InfrCorp customers who would switch to DigiDisc at each price. The more switching, the greater would be the outward shift of the demand curve.

Figure 3. Lost Profits on Lost Sales

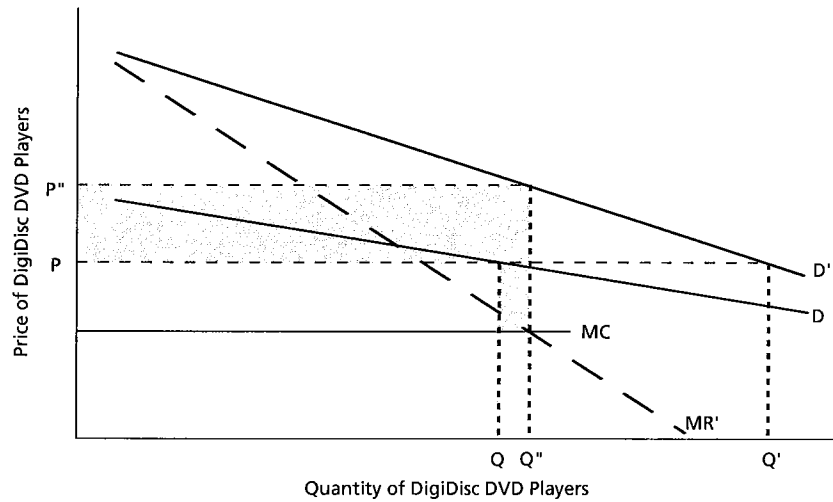


Second, the price-sensitivity of the demand for the DigiDisc product would be reduced because in the but-for world there would no longer be a close substitute product. Consumers of the DigiDisc product would not have the InfrCorp DVD player as a substitute to which they could turn if DigiDisc increased the price of its product. This decrease in price-sensitivity would lead to a steeper overall demand curve for DigiDisc than had existed when DigiDisc competed with InfrCorp (recall that the slope of the demand curve is related to price-sensitivity). As a result of these two effects, in the but-for world the demand curve for DigiDisc would change from the curve labeled D in Figure 3 to the curve labeled D'.

Assuming DigiDisc maintained the same price and experienced the same per-unit costs as it did when competing with InfrCorp, we can measure both the quantity of lost sales and the magnitude of lost profits sustained by DigiDisc. If DigiDisc charged the same price P in the but-for world as it charged in the actual world, DigiDisc would have sold Q' units, or (Q' - Q) more units than it sold in the actual world.⁷ The (Q' - Q) sales, shown in Figure 3, are often called *lost sales* because they are sales

⁷ As discussed further, one would have to check that DigiDisc had sufficient capacity to make these additional sales. "Capacity" in this context would encompass both DigiDisc's capability to manufacture (or have manufactured) the additional quantity as well as its ability to market and sell those additional units to InfrCorp's customers.

Figure 4. Lost Profits on Lost Sales and Price Erosion



lost to the plaintiff due to the infringement by the defendant. Profits on these lost sales are represented by the shaded area in Figure 3, which is equal to the lost sales multiplied by the per unit profit margin, or $(Q' - Q) \times (P - MC)$.⁸

In Figure 3, it is assumed that DigiDisc charged the same price P in the but-for world as it charged in the actual world. However, with the reduced competition from InfrCorp—as represented by the steeper (less elastic) demand curve D'—DigiDisc would have the incentive to increase its price above P. DigiDisc would choose the price where its but-for marginal revenue curve, represented by the dotted line labeled MR' in Figure 4, intersected its marginal cost, again represented by the horizontal line labeled MC. The resulting price would be P'', which is higher than P, the price DigiDisc charged in the actual world. The difference $(P'' - P)$ is referred to as the amount of *price erosion* caused by the infringement.

At price P'', DigiDisc would sell Q'' units, which is less than Q', the number of units DigiDisc could sell at P, the price with infringement. This is a consequence of the demand curve still exhibiting price-sensitiv-

⁸ This example assumes that the incremental cost required to make these sales consists solely of the marginal cost of production. As discussed further, an analysis of costs needs to be performed to determine whether any additional (traditionally fixed) costs would change with an increased level of sales.

ity in the but-for world (although less than in the actual world), so that a higher price (P'' versus P) reduces demand (to Q'' down from Q'). DigiDisc's total lost profits—taking into account both lost sales and price erosion—is represented by the lightly shaded area in Figure 4. The shaded area is equal to the increase in profit margin on existing sales plus the incremental profit on the additional sales, or $(P'' - P) \times Q + (P'' - MC) \times (Q'' - Q)$. Although DigiDisc would cause its sales to decrease from Q' to Q'' by raising its price from P to P'' , it would still make greater overall profits at this higher price: the increased profit margin on the retained unit sales more than makes up for the decrease in unit sales due to the higher price (put another way, the lightly shaded area in Figure 4 is larger than the shaded area in Figure 3).⁹

Construction of the But-For World

With an understanding of the economics of how and why infringement may cause a plaintiff to lose profits, we turn to the question of how one goes about measuring lost profits damages in practice. As discussed above, a lost profits damages analysis requires a reconstruction of the world as it would have existed had the infringement not occurred. This requires determining the actions that each party—the plaintiff, the defendant, other companies in the market, and customers—would have taken in this but-for world given the elimination of one of the products from the market. To perform this analysis, an economist starts with the presumption that each party would act in its best economic interest. Then, applying economic principles and case-specific facts, the economist determines for each party the likely actions that would have served to maximize its position in the but-for world.¹⁰

The Defendant's Actions in the But-For World

Determining the defendant's actions in the but-for world requires an assessment of the various alternatives available to it. Economic theory says that the defendant would have taken the course of action that would have

⁹ Note that DigiDisc's level of sales at P'' in the but-for world, Q'' , still exceeds its actual level of sales Q .

¹⁰ In some situations, as will be pointed out, the economic analysis may also necessarily be guided by legal principles. For example, based on purely economic reasoning, damages would include the profits on the additional sales of any of the plaintiff's products that would have been made in conjunction with the lost sales of the patented product. However, as discussed below, legal principles limit a plaintiff's ability to recover its lost profits on so-called "convoyed sales."

maximized its expected profits.¹¹ In some cases, the defendant might have had no economically feasible alternative other than to stay out of the market entirely. In other cases, however, the defendant might have been able to offer a noninfringing (albeit potentially inferior) alternative. For example, if prior to introducing the infringing product the defendant had sold a noninfringing product based on the prior art, it might have continued selling this product in the but-for world. Alternatively, if the defendant would have been able to redesign its product in a way that was noninfringing, it might have sold this redesigned product in the but-for world.¹²

In evaluating the defendant's potential strategies in the but-for world, the economist will generally consider each alternative strategy's costs, benefits, and technical feasibility during the period of infringement.¹³ Information regarding the defendant's own knowledge and assessment of these alternatives at the time may be helpful in this analysis, as may be input from technical experts. Information from the postinfringement period may be useful for determining what was known and feasible at the time, but one must be careful when using such information not to ascribe to a party more knowledge and capabilities than it actually had at the time.

Customers' Choices in the But-For World

Once the defendant's but-for strategy has been identified, the stage is set to analyze the actions customers would have taken in the but-for world. Customers who purchased the infringing product in the actual world would have had to make some other choice in the but-for world because

¹¹ The case law is consistent with this point. See, e.g., *Grain Processing*, supra note 4.

¹² This point relates to the first two of the so-called *Panduit* factors. In *Panduit Corp. v. Stahl Bros. Fibre Works Inc.*, 575 F.2d 1152 (6th Cir. 1978), the court identified four factors that a plaintiff must establish in order to be awarded lost profits. The first two factors are (1) demand for the patented product or feature and (2) absence of "acceptable" noninfringing substitutes. If there is no customer demand for the patented feature (as opposed to the rest of the product), and it would have been technically feasible to do so, the defendant would have had the incentive to introduce a noninfringing version of the product in the but-for world by simply dropping the patented feature. By doing so, the defendant could likely have made the same level of sales in the but-for world as it actually had because, by assumption, consumers did not care about the patented feature. Similarly, if the defendant could have offered an "acceptable" noninfringing substitute (which we take to mean a nearly perfect substitute for the infringing product from the point of view of consumers), again the defendant would likely have made the same level of sales in the but-for world as it actually did because consumers would have viewed the noninfringing substitute as being virtually identical to the infringing product. In either case, there would be no lost profits for the plaintiff.

¹³ As *Grain Processing* (supra note 4) indicates, a noninfringing alternative must have been "available" to the defendant during the period of infringement.

the infringing product would not have been available to them. The set of potential choices for these customers would include purchasing an alternative noninfringing product within the market in question or not making any purchase within this market at all. The questions to be answered regarding customers, then, are as follows: To which other products would these customers have turned in the but-for world? How many customers would have turned to each product? How many customers would have chosen to forego purchasing any product within the market?

As our stylized example above illustrated, the answers to these questions depend on the extent to which noninfringing products are *economic substitutes* for the infringing product from the point of view of customers. Product A is a substitute for Product B if the demand for Product A increases when the price of Product B increases. This increase in demand for Product A occurs because some of the customers who would have otherwise purchased Product B decide that Product A is now more attractive given that Product B's price has increased. Economists measure the extent to which consumers view two products as substitutes using the *cross-price elasticity of demand*. The cross-price elasticity of demand for Product A with respect to Product B's price is defined as the percentage change in the demand for Product A that would result from a 1 percent increase in Product B's price. A large cross-price elasticity between two products indicates that customers view them as close substitutes.

A product's *own-price elasticity of demand* measures the extent to which the demand for the product is sensitive to its own price. It is defined as the percentage change in demand for the product that would result from a 1 percent change in the product's price. The larger a product's own-price elasticity of demand, the more price-sensitive are the product's customers, and thus the more likely they are to switch away from the product in response to a price increase. In our stylized example, the price-sensitivity of the demand for the DigiDisc DVD player—and, accordingly, its own-price elasticity of demand—was smaller in the but-for world than in the actual world, and this was reflected in the steeper but-for demand curve.

The own-price elasticity of demand for a product is related to the cross-price elasticities of demand between that product and substitute products. A product's own-price elasticity will tend to be larger the closer are the substitutes for the product because an increase in the product's price will lead more customers to switch to close substitutes. A product's own-price elasticity of demand will also be larger when more substitute

products exist. Thus, it is theoretically possible that a product may have a large own-price elasticity of demand even though it has no close substitutes because it has many relatively distant substitutes.

It is common in a patent infringement case to define a “market” consisting of the set of close substitute products.¹⁴ Less close substitute products are typically excluded from the defined market. For this reason, the own-price effect for a product inside the market often will exceed the cross-price effects of that product on other products inside the market. This is an indication that a price increase for the product would lead some customers to switch to products outside the defined market.

We now turn to answering the question of how customers would have behaved in the but-for world. If the infringing product were not available, it is likely that some customers who purchased that product in the actual world would have switched to substitute noninfringing products. In other words, the demands for the noninfringing products would have increased. In our stylized example, the absence of the infringing InfrCorp product led to an outward shift in the demand curve for the DigiDisc DVD player (a greater demand for the DigiDisc player at every price).

A greater fraction of the infringing sales would flow to those noninfringing products that were the closest substitutes for the infringing product—those noninfringing products that had the largest cross-price elasticities of demand with the infringing product.¹⁵ If the own-price elasticity of demand for the infringing product is sufficiently large relative to the cross-price elasticities between the infringing product and the noninfringing products being analyzed, some of the infringing sales would flow outside of the set of noninfringing products being analyzed. Thus, the key to understanding customer behavior in the but-for world is understanding the own- and cross-price elasticities of demand.

The Plaintiff in the But-For World

The Plaintiff's But-For Price

Given the but-for choices of the defendant and the but-for customer demands for the noninfringing products, the plaintiff and other remain-

¹⁴ A detailed discussion of defining markets in patent infringement cases and antitrust cases is addressed in Chapter 18. Here, we merely note that the term *market* is a term of art with specific meaning in antitrust and patent infringement contexts.

¹⁵ To an economist, the question of “causation” (i.e., Did the defendant’s infringement cause the plaintiff’s lost profits?) is largely resolved by establishing that the plaintiff’s product is a substitute for the infringing product.

ing competitors may have chosen to change aspects of their competitive strategies. In particular, the plaintiff may have charged a different price than the one it charged in the actual world.¹⁶ Without the competition from the infringing product, the plaintiff (and other remaining competitors) might have found it profitable to increase its price to customers.¹⁷

Referring to our example, the absence of the infringing InfrCorp product led to a rotation in the demand curve for the DigiDisc product, making the but-for demand curve D' steeper than the actual demand curve D . The steeper demand curve meant that the demand for the DigiDisc product in the but-for world was less price-sensitive (i.e., had a smaller own-price elasticity) than the demand for the DigiDisc player in the actual world. This would allow DigiDisc to raise its price in the but-for world to P' above the price P that it charged in the actual world.

A company's decision regarding pricing is constrained by the price-sensitivity of its customer demand. Thus, as a general matter, if demand becomes less price-sensitive (due, for example, to the removal of a significant competitor from the market), the pricing constraint is reduced and the company generally would have the incentive to increase its price. Applying this principle to the context of a patent infringement case, the plaintiff would generally have the incentive to charge a higher price in the but-for world.¹⁸

However, there is an offsetting effect that must be taken into account. If the plaintiff increased its price, customer demand would decrease—again as a result of price-sensitivity. In our stylized example, the effect on quantity demanded of DigiDisc charging a higher price was represented by the

¹⁶ Other aspects of the plaintiff's competitive strategy that might have changed in the but-for world include the amount of advertising and promotion of the product and the positioning of the product (i.e., the set of characteristics and features possessed by the product).

¹⁷ An argument is sometimes made that the infringer did not "cause" the price erosion in cases where the plaintiff, not the infringer, was the first to lower its prices. However, if the only reason that the plaintiff started the price erosion was because it faced competition from the infringer, then one could reasonably conclude that the defendant did, in fact, "cause" the ensuing price reductions. A showing that the plaintiff's price would have been higher in the but-for world satisfies the fourth *Panduit* factor, which requires that the plaintiff prove the amount of (additional) profit it would have made but for the infringement.

¹⁸ One exception to the general principle that entry by a new product leads to lower prices might be the case of generic entry in the pharmaceutical industry. Branded drugs have sometimes increased their prices in response to generic entry. The reason is that only price-insensitive customers remain with the branded product after generic entry (all the price-sensitive customers switch to the generic). Thus, the elasticity of demand faced by the branded product actually falls in magnitude, and the branded drug firm has the incentive to increase its price.

movement from Q' to Q'' when the price of the DigiDisc DVD player increased from P to P'' .¹⁹ Although the plaintiff's customers might exhibit reduced price-sensitivity in the but-for world (which allows the plaintiff to increase its price profitably), they would still exhibit some price-sensitivity and therefore decrease their demand for the plaintiff's product somewhat.

The amount of demand adjustment depends on the relevant own-price elasticity of demand.²⁰ Several methods exist that may allow the elasticity of demand to be estimated in a given situation. First, if the necessary data are available, the relevant demand curve can be estimated using econometric methods. Second, the occurrence of a "natural experiment," such as an increase in price due to some exogenous factor such as a cost increase, may provide the opportunity to observe the sensitivity of demand to a price change. Third, the relevant elasticity of demand can be inferred from product gross margins and appropriate economic theory.²¹ Fourth, results from a consumer survey may provide the necessary information to determine the sensitivity of demand to price. In any specific case, other methods may be available.

The Plaintiff's Capacity

To have made additional sales in the but-for world, the plaintiff would have required sufficient excess capacity or the ability to expand capacity to accommodate the increase in sales.²² "Capacity" in this context encompasses all aspects of bringing a product to market, including manufacturing, sales, and distribution. If capacity constraints in any of these areas would have been binding in the but-for world, either the plaintiff's lost sales would be limited to its excess capacity in the bottleneck area, or the plaintiff must demonstrate that it could have profitably expanded capacity sufficiently to make the lost sales. In the latter case, the costs associated

¹⁹ Note that this is a movement along the DigiDisc demand curve D' , while the removal of the InfrCorp product from the market resulted in an outward shift and rotation in the DigiDisc demand curve from D to D' .

²⁰ If the plaintiff's product would be the only noninfringing product to increase its price in the but-for world, its demand elasticity is the appropriate one to use. If, however, the prices of all other noninfringing products would increase in line with the plaintiff, the overall market demand elasticity is the appropriate one to use. In the latter case, the demand adjustment for the plaintiff would be smaller because the substitute noninfringing products have higher prices as well, a fact that would blunt consumer switching to these products.

²¹ For example, under a commonly used model of pricing in differentiated product industries, the gross margin is equal to the inverse of the absolute value of the own-price elasticity. Thus, given the gross margin, one can solve for the elasticity.

²² The issue of sufficient capacity is the third *Panduit* factor.

with making the necessary capacity expansion must be accounted for in calculating the incremental profit on the lost sales. For example, suppose a defendant made infringing sales in a geographic area where the plaintiff did not operate. If the plaintiff seeks lost profits related to this geographic area, it would have to account for the incremental costs (and, perhaps, time) required to operate in that area. Such costs might include additions to the plaintiff's sales force, extensions to its distribution network, and so on.

The Plaintiff's Convoyed Sales

In some situations, the sales of one product are driven by the sales of another product. For example, sales at the Apple iTunes music store are driven, in part, by sales of iPods. The more iPods that Apple sells, the greater are its sales at iTunes. The iPod and iTunes example is one in which the two products work together—they are functional *complements*. In other situations, two products might have little functional relationship, but the sales of one product nevertheless lead to sales of the other product. Milk and other grocery products are an example. Milk is sometimes used by supermarkets as a “loss leader” to generate store traffic and thus sales of other grocery products. This again is an example of complementarity. In the law, the term *convoyed sales* is used to describe sales that are driven by sales of the plaintiff's patented product.²³

When the sales of the patented product drive the sales of a second product, the loss of sales of the patented product would cause a loss in sales of the second product as well. Accordingly, infringement may cause the plaintiff to lose sales not only of the product that competes with the infringing product, but also of any complementary products the plaintiff sells. The law allows recovery of profits lost on such convoyed sales under certain conditions. Specifically, the convoyed product and the patented product must function as a “single unit.”²⁴ The iPod-iTunes example would appear to pass this test, while the milk-other groceries example generally would not.²⁵ This distinction is a legal one, not an economic one.

²³ By “patented product,” we mean the product that incorporates the patented technology.

²⁴ See *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538 (Fed. Cir. 1995).

²⁵ iTunes also provides an example of a convoyed product or service for which sales continue into the future after the purchase of the “primary” product (in this case the iPod). In this situation, past infringement may cause the plaintiff to continue to lose profits on the convoyed product after trial. From an economics perspective, a damages award should include the present discounted value of future damages, as long as the future damages are not speculative. See Chapter 11 for a discussion of the appropriate discount rate to use in calculating present discounted value.

The Plaintiff's Incremental Costs

Once the plaintiff's lost sales have been determined, the plaintiff's profits on those lost sales can be calculated as the difference between the revenues on the lost sales and the *incremental costs* required to make the lost sales.²⁶

Methods for Determining Lost Profits

There are a variety of approaches for determining the amount of lost profits. Which method is appropriate in a given situation depends on whether the plaintiff is claiming lost sales alone, price erosion in addition to lost sales, lost profits on convoyed sales, or some combination of these losses. The discussion below is illustrative of the most frequently used methods for determining lost profits. It is not meant to be exhaustive—other approaches may be appropriate in a given situation.

Share-Based Approaches for Determining Lost Sales

An approach to determining the plaintiff's lost sales commonly used in patent infringement cases is to assume that the plaintiff would have made a fraction of the infringing sales proportional to its share of the appropriately defined market.²⁷ This *market share approach* is straightforward to apply, and the necessary information on market shares is typically available.

The market share approach relies on three assumptions. The first assumption is that the defendant would have completely removed the infringing product from the market in the but-for world. The second assumption is that all of the infringing sales would have stayed within the market. This is a reasonable assumption to make if the products in the market are nearly homogenous (very close substitutes). In that case, the customers of the infringing product would readily switch to another product within the market in the but-for world because they would view the products as nearly equivalent. Alternatively, the assumption that all of the infringing sales would have stayed within the market is reasonable if the overall market elasticity of demand is nearly zero. An elasticity of demand near zero means that customers view the products in the market

²⁶ A showing of incremental profit on the lost sales satisfies the fourth *Panduit* factor. The economic principles of calculating incremental cost are addressed in Chapter 12.

²⁷ This principle was used by the court in *State Industries Inc. v. Mor-Flo Industries Inc.*, 883 F.2d 1573 (Fed. Cir. 1989), and subsequent cases, as discussed in Chapter 4. Under this approach, if the infringer's share of the market is x and the plaintiff's share of the market is s , the plaintiff would get a fraction of the infringing sales equal to $s/(1-x)$.

ECONOMIC APPROACHES TO INTELLECTUAL PROPERTY POLICY,
LITIGATION, AND MANAGEMENT

as necessities (must haves), regardless of whether they were equivalent or not, and would readily switch to a competing product if the product that they initially chose were unavailable. This condition may hold, for example, for products used in a medical procedure for which there are no substitutes outside the market. If neither of these two conditions holds, some of the infringing sales would likely go outside the market.²⁸ In this case, the market share approach would likely fail to provide a reliable basis for calculating the plaintiff's lost sales.

The third assumption made under the market share approach is that the market shares provide a good indication of the closeness of substitution (i.e., the cross-price elasticities) between products in the market. This assumption would likely be violated if the overall market was broken into segments, where two products within the same segment were much closer substitutes for each other than they were for the products in other segments.²⁹ Segmentation typically occurs based on product attributes. For example, imported beers such as Heineken are perceived to be in a different segment within the beer market than "popular price" beers such as Old Milwaukee. Consumers of Heineken are substantially more likely to switch to another "high end" beer than they are to Old Milwaukee. As a result, Heineken competes less closely with Old Milwaukee than would be indicated by its overall market share. As another example, the toothpaste market is segmented along several characteristics such as tartar control and whitening properties. Consumers of a tartar control and whitening toothpaste would likely switch in greater numbers to other tartar control and whitening toothpastes than would be reflected by these products' overall market shares because these products are closer substitutes for each other than they are for products outside the tartar control and whitening segment.

If the assumptions of the market share approach are sufficiently inconsistent with the economic reality of the marketplace at issue, a different approach must be used. One such approach is the *segment share approach*. This approach seeks to address the situation where the market is segmented and where products within the same segment compete more

²⁸ This phenomenon is sometimes referred to as "market expansion by the infringer," which is another way of saying that the infringer brought sales into the market that would otherwise not have been made by any product in the market.

²⁹ This issue arose in *BIC Leisure Prods. Inc. v. Windsurfing Intl. Inc.*, 1 F.3d 1214 (Fed. Cir. 1995), and *Crystal Semiconductor Corp. v. Tritech Microelectronics Intl. Inc.*, 246 F.3d 1336 (Fed. Cir. 2001). These cases are discussed in more detail in Chapter 4.

closely with each other than they do with products in other segments. The plaintiff's lost sales are based on its share of the segment of the market in which the infringing product competes, rather than on the plaintiff's share of the overall market as is done in the market share approach.³⁰ Note though, that if the plaintiff's product and the infringer's product are in different segments, the plaintiff is deemed to have zero lost sales.

While the segment share approach partially addresses the second assumption of the market share approach—that competition between products is completely characterized by their market shares—it makes a similar assumption that competition within the segment is completely characterized by segment shares. Again, the validity of this assumption also needs to be evaluated. In addition, similar to the first assumption of the market share approach, the segment share approach assumes that no infringing sales would leave the segment in the but-for world. This assumption requires either that the products within the segment are nearly perfect substitutes or the segment own-price elasticity of demand is nearly zero.³¹

The Before-After Approach

In some situations, data will be available on the plaintiff's sales, prices, and profits from a time period before the infringer entered the market with the infringing product as well as from the time period after the infringer entered. In that case, it may be possible to estimate the effect of infringement on the plaintiff's sales, prices, and profits by performing a comparison of the preinfringement period to the postinfringement period.³² If, for example, the plaintiff's sales decreased by 15 percent after the infringement, it might be reasonable to conclude that this decrease was caused by the infringement and that the plaintiff would have maintained its level of sales in the but-for world. As another example, a decrease in the plaintiff's price that was observed after the entry of the infringing product might provide an estimate of the amount of price erosion the plaintiff sustained as a result of the infringement.

³⁰ This approach was used in *BIC Leisure* and *Crystal Semiconductor*.

³¹ The second condition is less likely to hold in the case of a segment than in the case of a market because a segment own-price elasticity is typically higher than the corresponding market own-price elasticity. For example, the own-price elasticity for imported beers is greater in magnitude than the own-price elasticity for all beers.

³² In a situation where the plaintiff's sales, prices, or profits are growing or declining over time, it may be appropriate to perform the before-after analysis based on trends rather than levels of sales, prices, or profits.

In performing this type of before-after analysis, one must be mindful of the possibility that some other economic factor was at least partially responsible for the observed changes in the plaintiff's sales, prices, or profits. For example, if the plaintiff's costs of producing the product decreased at approximately the same time as the entry of the infringing product, at least part of the observed price decrease might be due to the plaintiff's passing on part of the cost decrease as opposed to competition from the infringing product driving down the price.³³ If such factors may be important, econometric methods can be used to control for them and thereby isolate the effect of the infringement on the price or sales of the plaintiff.

Customer Surveys

Surveys can be used to assess the likely choices of customers in the event that the infringing product or product feature was not available to them. For example, a sample of customers of the infringing product could be asked to which alternative toothpaste product they would turn (if any) if the infringing toothpaste product was not on the shelf when they went into the store. Customer surveys can be used to determine customers' cross-price elasticities of demand between products, their willingness to pay for certain attributes of a product (including the patented feature), and the degree to which they purchase certain products together. Customer surveys can therefore be used to determine the effects of the infringement on the plaintiff's sales, prices, and profits.³⁴

In performing a consumer survey, one must take care in the design of the survey questionnaire to ensure that the respondents' answers to questions regarding hypothetical purchasing situations reliably reflect what they would do in actual purchasing situations. In addition, the sample of respondents must be chosen using scientific sampling methods to ensure that the survey results can be reliably projected to the relevant population of consumers.

Merger Simulation Techniques

Merger simulation techniques were developed by economists to help assess the likely competitive effects of mergers. A simulation approach

³³ A basic principle of economics is that firms set their prices on the basis of marginal cost, demand conditions, and the nature of strategic interaction with competitors.

³⁴ The use of surveys in intellectual property cases is discussed in more detail in Chapter 8.

can also be used to evaluate the lost sales, price erosion, and lost profits sustained by a plaintiff in a patent infringement case.³⁵ Specifically, the but-for world can be simulated based on, among other inputs, the own- and cross-price elasticities of demand between the products. The effects of the infringement on the plaintiff's sales, prices, and profits can be determined by comparing the outcomes in the simulated but-for world to the outcomes in the actual world.

For example, consider a case where the plaintiff was claiming lost sales but no price erosion. A but-for world could be simulated by removing the infringing product from the market and asking what customers of the infringing product would have done based on the own- and cross-price elasticities of demand assuming that the prices of the remaining products would have remained at their actual levels. (This is what was done in Figure 3.) Alternatively, consider a case where a plaintiff was claiming both lost sales and price erosion. In that case, the but-for world could be simulated by removing the infringing product from the market and allowing the plaintiff and other remaining competitors to change their prices in a profit-maximizing fashion. (This is what was done in Figure 4.) Note that a properly specified simulation will take into account the quantity-reducing effects of the plaintiff charging a higher price in the but-for world.

A similar analysis can be performed to simulate the but-for world in situations where it would have been economically feasible for the infringer to offer its product after having removed the infringing feature. Specifically, the demand for the various products and the prices charged by the various suppliers can be simulated under the but-for scenario that the infringer's product would have lacked the patented feature. Damages can be calculated by comparison of the but-for world outcomes to the actual outcomes.

A simulation of the but-for world requires detailed knowledge of the structure of demand for the set of products with which the infringing product competes. Consequently, a simulation approach may have somewhat greater data requirements than other methods. For example, transactions data or customer survey data may be required to econometrically estimate the structure of demand.

³⁵ This approach is discussed in more detail in Chapter 7.

*Approaches to Determining Plaintiff's Capacity to
Make Additional Sales*

As discussed above, the plaintiff must demonstrate that it would have had sufficient excess capacity in the but-for world to make the claimed lost sales. An analysis of the plaintiff's manufacturing capacity might involve determining the amount of excess manufacturing plant capacity and comparing it to the level of potential lost sales. An analysis of the plaintiff's selling capacity might involve checking that the sales force was of sufficient size to call on the customers of the defendant.³⁶ An analysis of the plaintiff's distribution capacity might involve seeing whether the plaintiff sold through the same channels of distribution as the defendant. This list is not meant to be exhaustive; other analyses may be required in a given situation.

*Approaches to Determining the Extent of Lost Profits
on Convoyed Sales*

To determine the amount of lost convoyed sales, one can examine the way in which the two products are marketed. As a simple example, if one unit of the convoyed product is typically packaged with one unit of the patented product, one could reasonably infer that the lost unit sales of the convoyed product equals the lost unit sales of the patented product. In other situations, it may be possible to analyze statistically the relationship between sales of the patented product and sales of the convoyed product and use this relationship to estimate the likely amount of convoyed sales that were lost in conjunction with the lost sales of the patented product. An assessment of causation is important as well. One should demonstrate to a reasonable degree of certainty that sales of the patented product drive the sales of the allegedly infringing product and not vice versa.

Once the amount of lost convoyed sales is determined, it is necessary to determine the incremental profit on these lost sales. This can be done in a manner similar to that described above for the patented product.

³⁶ One may also want to analyze the extent of the overlap in the customer lists of the plaintiff and defendant. If they are selling to essentially the same customers, in general there would be little question that the plaintiff had sufficient selling capacity to make the defendant's sales. If, on the other hand, they are selling to different customers, one might undertake further investigation, e.g., as to whether the plaintiff's existing sales force called on the defendant's customers.

Summary

We have outlined the economics of how and why infringement may lead to a decrease in profits for the plaintiff. The underlying economic principles provide the basis for the reconstruction of the but-for world that is necessary to calculate lost profits damages. We have discussed practical methods used by economists to determine lost profits in patent infringement cases. Below, we turn to a discussion of determining a reasonable royalty to compensate the patent owner for infringement of its patent.

Reasonable Royalty

An economist's contribution to an intellectual property case is the application of economic principles to a particular valuation problem. In intellectual property, the typical valuation problem is to determine a fair value that compensates the patent owner for the infringement (use) of its patent by an unauthorized entity. As stated at the outset of this chapter, the federal patent statute describes two approaches to determining patent damage awards: lost profits and reasonable royalties.³⁷ Where lost profits are damages equal to the amount of additional profit that the patent owner would have received had infringement not occurred, a reasonable royalty is computed on sales that the patent holder would not have made. In some cases, a plaintiff may seek reasonable royalty damages on all sales made by the defendant, while in others the plaintiff may seek lost profits damages on sales it can prove it would have made itself but for infringement and reasonable royalty damages on the remaining sales.

The legal requirements for obtaining lost profits are generally more rigorous than the requirements to establish damages from foregone royalty payments. As discussed above, to be awarded lost profits, the patent owner needs to prove that the infringement *caused* the claimed lost profits and prove the amount of damages. In contrast, to prove the fact of damage and obtain damages in the form of a reasonable royalty, the patent

³⁷ 35 U.S.C. § 284. See also *Lam Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1065 (Fed. Cir. 1983). The law also allows a patent owner to obtain its "established" royalty on infringing sales. An *established* royalty has been defined as a royalty "paid by such a number of persons as to indicate a general acquiescence in its reasonableness by those who have occasion to use the invention" (where general acquiescence implies a willing licensor and licensee). See *Panduit*, 575 F.2d at 1164, n. 11, 197 U.S.P.Q. at 736i, n. 11 (6th Cir. 1978).

owner needs only to establish validity and infringement, which needs to be done in the liability phase of the case in any event. If the patent at issue is found to be valid, enforceable, and infringed, the patent owner is entitled to compensation for the infringement of its patent. Such compensation shall be “in no event less than a reasonable royalty for the use made of the invention by the infringer.”³⁸ The reasonable royalty is the outcome of a hypothesized arm’s-length negotiation between the patent owner and the infringer. The hypothetical negotiation is a reconstruction of a negotiation between a willing licensor (the plaintiff)³⁹ and a willing licensee (the defendant) wherein the two parties would have arrived at some royalty agreement. As a legal matter, the negotiation is hypothesized to take place on the eve of first infringement wherein the parties assume that the patent is valid and infringed.⁴⁰

The higher bar set for showing the fact of damages from lost profits generally encourages a more scientific approach to determining damages from lost profits than from a reasonable royalty. There is, however, a clear link between the factors that make a royalty reasonable and the factors that influence lost profits. A reasonable royalty is one that imitates the royalty bargain in market-based (as opposed to court-ordered) negotiations. A market-based royalty will be influenced by the same economic factors that go into determining lost profits: namely price, costs, volume (quantity produced and sold), and the presence of alternatives. This means that the same scientific principles that are applied to determining lost profits should also be applied to royalty determination.

Methods of Royalty Determination

In addition to a market-based approach, there are a number of other methods for determining royalties that analysts use, some of which are not rooted in scientific principles and are, therefore, not what we would call “reasonable,” from an economics point of view. We classify royalty determination methods into four categories according to whether they are based on market factors, comparables, industry averages, or a rule of thumb (Figure 5).

³⁸ 35 U.S.C. § 284.

³⁹ But see *Rite-Hite* 56 F.3d. 1538, at 1554 n. 13: “this is an inaccurate, and even absurd, characterization when, as here, the patentee does not wish to grant a license.”

⁴⁰ See *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), modified on other grounds, 446 F.2d 295 (2d Cir.), cert. denied, 404 U.S. 870 (1971).

Figure 5. Methods of Royalty Determination

1. Market-Based Method	Reasonable
2. Comparables Method	Can Be Reasonable
3. Industry Averages Method	Reasonable Only with Luck
4. Rule of Thumb Method	Unreasonable

Market-Based Method

Market-based methods mimic market forces: factors that affect a licensing negotiation in the “real world” (i.e., outside of a courtroom) are considered in determining a market-based royalty in a hypothetical negotiation.

In goods markets, we think of buyers and sellers, each acting individually, coming to terms that collectively determine the price that will clear the market of the quantity proffered at that price. Patent licensing fees or royalties are the prices set in technology market transactions. Unlike many goods market transactions, technology market transactions are idiosyncratic because patents (or bundles of patents) are highly heterogeneous. The value of any one of those transactions will depend upon its profit-enhancing prospects for a given licensee, the cost to the specific licensor of granting the license, and the alternatives available to both parties. The value of the technology will also depend upon the number of times it has been sold, or licensed. In some cases, the value is diminished by the creation of additional user-licensees; in other cases, its value may be enhanced.

Market-based royalty determination methods must take explicit account of the idiosyncrasies of the particular patent being licensed, the parties to the negotiation, the alternatives to the technology at issue, and the timing of the hypothetical negotiation. If the resulting royalty would have been acceptable by rational parties in a real-world licensing negotiation, the resulting royalty is “reasonable.”

Comparables Method

The second commonly used method to determine royalty damages is to compare the hypothetical license in question to a preexisting comparable license that was negotiated in the market. The value of this method (and whether it is reasonable) depends on the quality of the comparable. A poorly chosen comparable—one that bears little or no resemblance to the products, market conditions, or competitive relationship of the litigating parties—is of little value. On the other hand, if there are insufficient data

to use the market-based method, a comparable chosen with care can be more informative than a poorly estimated market-based royalty. Thus, this method may yield a reasonable royalty.

Industry Averages Method

The third method used for royalty determination is to use an industry average. We label this method “reasonable only with luck.” As we will explain further, there may be no reason to expect that the particular patent being litigated will be representative (in other words, equal to the average) of other patents in the industry. If we use an average or typical value for the royalty, we may incorrectly value the technology more often than we will properly value it.⁴¹

The distribution of patent values is highly skewed, which means that the mathematical “average” is not a reliable indicator of the value of any particular patent. Most patents are worth very little. The holy grail of inventive activity is the blockbuster patent that generates millions of dollars in profits for the patent owner. A problem with using industry averages to determine a reasonable royalty is that the industry averages will mix together the value of a one-of-a-kind blockbuster patent with the lower-value patents. The average value overestimates “typical” patents and underestimates the value of a blockbuster (Figure 6).

If the patent in question is a blockbuster patent it should be awarded a high royalty. If it is a run-of-the-mill patent, it should be awarded a much lower royalty. A blockbuster patent that has no close substitutes may be worth virtually all of the profits associated with the invention. A run-of-the-mill patent that has close substitutes may be worth only a small fraction of the profits, if it is worth anything at all. There is no justification for awarding a middle value if the patent falls into one of the two categories.

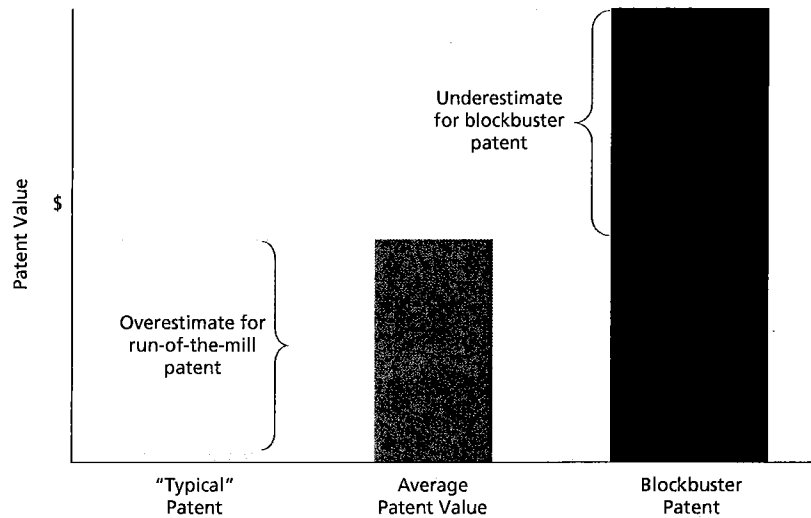
Rule of Thumb Method

Finally, the fourth method, which we are labeling unambiguously “unreasonable,” is the 25 percent rule.⁴² This rule can take many forms (and

⁴¹ Of course, we acknowledge that one cannot let the perfect be the enemy of the good. If no other data were available, industry average royalty rates may provide the best market data to be had.

⁴² For a description of this method of royalty determination see R. Goldscheider, *Technology Management Handbook* (New York: C. Boardman Co., 1984). See also R. Goldscheider, John Jarosz, and Carla Mulhern, “Use of the 25% Rule in Valuing IP,” *les Nouvelles* (December 2002), for a discussion of how the authors feel the 25 percent rule has been misapplied by courts or economists.

Figure 6. What is Wrong with Using Industry Averages?



may be 33 percent or some other share), but the general category of unreasonable royalty methods is to take an arbitrary share of the operating profits associated with the allegedly infringing products and assert that that is the royalty to which the patent owner is entitled. The 25 percent rule takes no account of the importance of the patent to the profits of the product sold, the potential availability of close substitutes or equally effective noninfringing alternatives, or any of the other idiosyncrasies of the patent at issue that would have affected a real-world negotiation.⁴³

For example, a royalty based on 25 percent of profits is unreasonable if the prospective licensee can obtain near identical profits by turning to the next-best alternative. A 25-percent-of-profits royalty may also be unreasonable if the patent owner earns a substantial margin on every sale and is in a position to serve the entire market if the infringer were kept out of the market.

The fundamental principle of a market-based approach to royalty determination is that the resulting royalty must consider the value of the

⁴³ See Chapter 5 for a further discussion of the potential pitfalls in using this rule-of-thumb method of determining patent value.

patent to both parties to the negotiation. Only by doing so do we ensure that the royalty is connected to the underlying value of the patented technology. The same cannot be said of rules of thumb and industry standard profit splits. The reason is simple: for an invention to be patentable it must be novel. It therefore makes little sense to assume that the value of a unique invention could be approximated by the value of some other, by definition, different, invention even if it is used or applied in the same industry.

The Market-Based Royalty Range

So how does the market determine the value of a patent? In the real world, royalties are the outcome of a negotiation between the patent owner and the licensee. The key element of a market-based negotiation is that both sides win—or expect to win at the time they sign the licensing agreement. Since the hypothetical negotiation in a patent damages context is designed to mimic a real-world bargain between a licensee and a licensor, the outcome of that negotiation (i.e., the reasonable royalty) must be one in which both sides benefit from the bargain. If it were otherwise (i.e., if either party *expected* to be worse off for having negotiated the license), the license would simply never materialize. One of the parties would have walked away from the negotiating table and not signed the licensing agreement.

The Hypothetical Negotiation

The first step in determining a reasonable royalty is to establish a bargaining range, or, the range of royalties over which both sides can benefit from having completed the transaction. The hypothetical negotiation is like any other bargaining transaction. Economics tells us that the outcome of such transactions depends on the costs and benefits to each party entering into the agreement as well as on their relative bargaining strengths. The costs and benefits dictate the range of feasible outcomes whereby both parties can benefit from the licensing agreement, while the relative bargaining power dictates which party gets more of the benefit of the agreement. Since both parties must ultimately agree on the outcome, the benefits of the hypothesized agreement must outweigh the costs for each party.

An agreement will be reached only if there exists a royalty that compensates the patent owner for the costs it incurs from licensing its patent to a competitor but still affords the licensee some of the benefits

of using the patented technology. The royalty that exactly compensates the patent owner for its costs of licensing represents the *minimum* royalty that the patentee would be willing to accept. The licensor would not grant any license that leaves it with lower profits than could be earned by refusing to grant a license and being the sole practitioner of the patent or maintaining the option of granting an exclusive license to a third party. At the other end of the spectrum, the licensee will not accept any royalty that leaves it with lower profits than could be earned by designing around the patent or adopting a noninfringing alternative technology, if available.⁴⁴ The value of the benefits to the licensee from using the patented technology compared to the next-best alternative represents the *maximum* royalty that the licensee would be willing to pay. If the maximum amount exceeds the minimum that the patent owner would be willing to accept, the difference between these two amounts represents the negotiating range for the royalty associated with the license. Royalties within this range can leave both parties better off for having negotiated the license than either party would be by walking away from the bargaining table.⁴⁵

The emphasis on the value of the invention to both sides of the transaction means that the negotiation is rooted in the economics of the product and market at issue. A royalty that reflects the value of the invention to both parties and leaves no party worse off (in expectation) for having signed the agreement is a “reasonable royalty” (Figure 7).

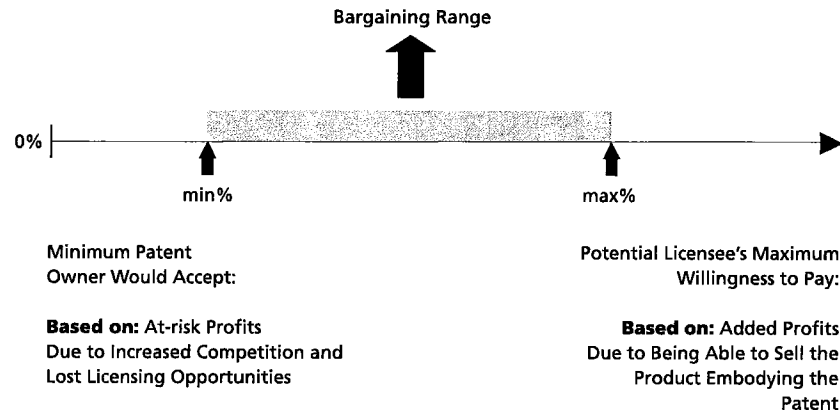
Willingness to Accept

The minimum of the bargaining range is the lowest royalty that makes the patent owner better off for having licensed his technology. The minimum royalty must compensate the patent owner for any costs it stands to incur by granting the license. The minimum could be quite low—at or near zero—if the two parties operate in different markets or locales or if the patent owner is seeking a reasonable royalty on sales made by the licensee that the patent owner would not have made. Alternatively, the minimum

⁴⁴ See *Grain Processing*, supra note 4.

⁴⁵ It may well be the case that the licensor’s minimum willingness to accept exceeds the licensee’s maximum willingness to pay. This can happen when the patent owner is a more efficient producer of products embodying its technology or when the patent owner stands to earn a substantial volume of ancillary profits on products sold with products embodying the patented feature that are not offered by the licensee. When no bargaining range exists, the patent owner may be better off seeking lost profits as compensation for infringement.

Figure 7. The Bargaining Range in a Hypothetical Negotiation



could be relatively high—up to or greater than the patent owner’s own profit margin—if every sale made by the licensee represents a lost sale of the patented product and any ancillary products.

The costs to the patent owner include, generally, the profits that the patent owner would lose on its competing products, as well as any perceived costs of facing a stronger competitor in the overall market. These at-risk profits could take the form of profits on sales lost to the licensee, reduced profits on retained sales due to price erosion caused by competition with the licensee, profits on lost sales of related products, profits associated with foregone economies of scale, profits from foregone royalties from other licensees, and profits on lost future sales of follow-on or upgrade products to customers lost to the infringer, among other things.⁴⁶ The minimum of the bargaining range could be affected by other licenses that the patent owner has signed or hopes to sign with other competitors. For example, if the patent owner has signed licenses containing “Most Favored Nation” clauses, then agreeing to a royalty lower than the rates specified in those other licenses may force the patent

⁴⁶ One must take care to avoid “double counting” lost profits. The determination of a reasonable royalty should only consider those costs to the licensor that are not explicitly accounted for elsewhere. If there is a lost profits calculation and the royalty under consideration is being determined for sales that the patent owner would not have made, then the factors already accounted for in the lost profits calculation should not again be considered in the royalty determination.

owner to lower the royalty offered to other licensees and lose royalty revenue from these parties.

Granting a license could deprive the patent owner of some of the benefits associated with holding the patent because it would confer a competitive advantage on the licensee. If the patent owner sells products that embody the patented technology, granting a license may adversely affect its profitability because the licensee may now be better able to compete with the patent owner. Even if the patent owner does not manufacture a product embodying its own patent, if the patent owner sells products that nonetheless compete with the prospective licensee's products, the patent owner stands to lose profits as a result of licensing a competitor.⁴⁷ The problem then is to identify and evaluate the costs to the patent owner from granting the license. The scientific approach to royalty determination requires quantifying these costs with the same rigor that one would use to quantify lost profits.

Willingness to Pay

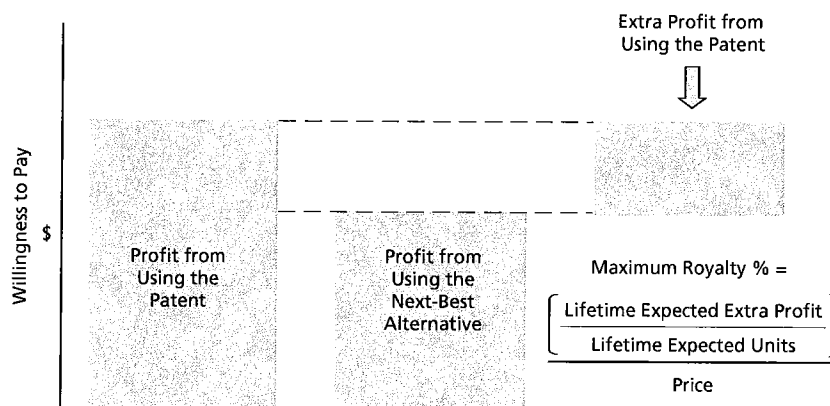
The benefits to the licensee are those that accrue from using the patented technology; they might include lower costs, higher sales, or some combination of the two. The maximum willingness of the licensee to pay for the right to practice the technology depends on the lifetime profits from using the invention compared to the lifetime profits of the next-best alternative.⁴⁸ The lower the perceived benefits of being able to practice the patent, the lower will be the maximum royalty the licensee would be willing to pay (Figure 8).

The licensee's willingness to pay for the patent at issue is primarily driven by the profits flowing from the patent relative to the next-best alternative. Most important in making this determination are the full economic costs of avoiding the patent. The patent can be avoided by abandoning the infringing features or product lines and focusing on sales of other products, incorporating a noninfringing alternative into the accused product lines, or designing around the patent. Thus, a fundamental determinant of the value of the patent to the licensee is the availability of noninfringing alternatives.

⁴⁷ See *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538 (Fed. Cir. 1995).

⁴⁸ Where the lifetime may be truncated to the date the patent expires, or the economic life of the product embodying the technology, which could be shorter than the statutory life, such as in industries marked by rapid technological progress.

Figure 8. Infringer's Maximum Willingness to Pay



This means that a necessary step in determining a reasonable royalty is to evaluate the options available to the licensee and, if possible, to determine the cost (in both time and dollars) of designing around the patent. If, for example, it would cost the licensee \$1,000 and take only a week to redesign its products without the infringing feature, *and* if the resulting noninfringing product would achieve essentially the same market acceptance as the product incorporating the infringing feature, then the most the licensee would be willing to pay is a royalty that cost him, in present value terms, no more than \$1,000 over the lifetime of the patent. In comparison, if the alternative product were inferior to the infringing product (in the sense that the patented technology allowed for lower production costs or a higher selling price), then these added "costs" of switching to the alternative (the foregone benefits provided by the patented technology) would serve to increase the maximum royalty the licensee would be willing to pay.

Moreover, if there are no clear alternatives to the patented feature, and abandoning the patented technology means abandoning the product line, then the costs of avoiding the patent would be closer to the entire profits generated by sales of the products embodying the patent. In a situation such as this, the licensee would be willing to pay a significantly higher royalty because there are fewer options.

In determining the licensee's maximum willingness to pay, the analyst measures both the costs of avoiding the patent and the benefits (in terms

of additional profits) of attaining a right to use the patented technology. If the proposed royalty exceeds the full economic costs of turning to an alternative technology, the licensee will be better off refusing the license. The maximum royalty, therefore, is the royalty that is precisely equal to the sum of the design around costs plus any foregone profits from switching to the next-best alternative.

The Timing of the Negotiation

One additional consideration that can affect the endpoints of the bargaining range is the timing of the hypothetical negotiation. By legal convention, the hypothetical negotiation is supposed to take place “on the eve” of first infringement.⁴⁹ This generally is taken to mean the later of the date of first infringing sale (or other “use”) or the date that the patent issued. In situations where there are substantial set-up costs or where the licensee has been manufacturing and selling the infringing product prior to any patent being issued, this timing of the negotiation can lead to substantially higher royalties than would have been realized had the negotiation taken place prior to any sunk costs being incurred by the defendant.

By making investments that are (1) sunk costs and (2) specific to the patented technology, the licensee may become locked into using the patented technology. Sunk costs are costs that cannot be recovered if the licensee were later to switch away from the patented technology. Before sunk costs are incurred, the licensee would consider them in assessing the patented technology versus the next-best alternative. After the sunk costs are incurred, however, because they could not be recovered, the licensee would not consider them in its assessment. Thus, after the sunk costs are incurred, on a going-forward basis the patented technology looks more profitable relative to the next-best alternative than it did prior to incurring those sunk costs.

Sunk costs can lock a licensee into using a particular technology by making switching to alternatives impractical or excessively costly. Consider the following simple example. Suppose that after making a sunk cost investment of \$15, the licensee could make a profit of \$20 from the product incorporating the patented technology. The net profit for the licensee before any costs are sunk would therefore be \$5. The next-best

⁴⁹ See e.g., *Georgia-Pacific*, 318 F. Supp. 1116, 1120, or *Ajinomoto Co. Inc. v. Archer-Daniels-Midland Co.*, 1998 WL 151411 (D. Del., Mar. 13, 1998) (No. 95-218-SLR).

alternative would have to offer a net profit of at least \$5 to get the licensee to switch. Now consider what happens once the investment is sunk and cannot be recovered. At that point, the licensee would recognize that if it went forward with the patented technology, its net profit (from that point forward) would be \$20. Now, the next-best alternative would have to offer a net profit of at least \$20 to get the licensee to switch. Thus, sinking costs can lock the licensee into the patented technology, not in a literal sense, but rather as a matter of economic rationality.

Technology-specific sunk costs might include, for example, the costs of installing manufacturing facilities or specialized equipment that could not be used or sold if the accused infringer were to avoid the patent at issue by switching to an alternative technology, or the costs of designing the product to the specifications of the patented technology. If the same facilities, equipment, or design can be used to produce the next-best alternative, then the sunk costs would not create any lock-in. On the other hand, if switching to the next-best alternative requires investing in additional facilities or equipment, then these additional costs of switching must be considered in calculating the profitability associated with switching to the next-best alternative.

Technology-specific sunk investments allow for the possibility of *hold-up* in the negotiating process. In such a situation, the patent owner can seek higher royalties than he would have been able to negotiate had the sunk investments not been made. The hold-up value is attributable only to the timing of the negotiation and does not reflect the inherent value of the patented technology to the prospective licensee. One way of avoiding the potential for hold-up to affect the royalty negotiation is to consider the “eve of first infringement” to refer to the date prior to any investments being made that lock the licensee into using the particular technology at issue, even if that date is prior to the patent actually being granted. In this case, the parties would be negotiating future royalties payable once the patent is granted (and by assumption is valid, enforceable, and infringed). While this approach can effectively eliminate the potential for hold-up, current case law may not provide for sufficient flexibility to allow the separation of hold-up value and patent value in this way.⁵⁰

⁵⁰ If, however, the date of first infringing use occurs while the development costs are still in the process of being incurred, then there may be a legal justification for moving the negotiation date to a point in time that reduces (but may not eliminate) the hold-up problem.

The Final Reasonable Royalty

The difference between the patent owner's minimum willingness to accept and the infringer's maximum willingness to pay represents the *bargaining range* for the negotiation.⁵¹ Royalty terms within this range leave both parties better off for having negotiated a license than either party would be by walking away from the bargaining table without having traded the property right at issue. Where within the range of feasible outcomes the final agreed-upon royalty is likely to fall depends upon the relative bargaining strengths of the two parties.

Bargaining Power

Bargaining power can be thought of as the ability of one negotiator to "hurt" the other party by walking away from the negotiating table. Suppose, for example, that the parties were to consider a royalty at, or very near, the minimum of the bargaining range. At this price, the licensee has the most to gain by entering into an agreement, but the patent owner has very little to lose by walking away from the bargaining table and refusing to grant a license. The patent owner would be in essentially the same position by refusing to grant a license as it would be by agreeing to license the technology at issue at this low price. Thus, the patent owner has little incentive to agree to a price at the minimum of the bargaining range.

Similarly, the licensee has little incentive to agree to a price at the maximum of the bargaining range. If the patent owner were to try to force a price at the upper end of the bargaining range, the licensee would have little to lose by walking away from the bargaining table (because such a royalty leaves it without any additional profits from licensing the technology), but the patent owner risks giving up all of the benefits of reaching an agreement at this price. For these reasons, one typically would not expect to see an agreement struck precisely at either end of the bargaining range, but rather somewhere in the middle of the range.

At the midpoint of the bargaining range, each party can hurt the other party equally by walking away from the negotiating table. The midpoint of

⁵¹ As mentioned above, it may be the case that the minimum the patent owner is willing to accept exceeds the maximum that the licensee would be willing to pay. In this case, there does not exist a bargaining range as defined in this Section. If there is no positive bargaining range, then an economist might consider other factors such as what the bargaining range might look like if the licensee were an equally efficient or similarly situated competitor to the patent owner. By doing so, an economist can ensure that the patent owner is not penalized for the possibly inefficient use made of its invention by the prospective licensee.

the bargaining range allows both parties to share equally in the benefits of reaching an agreement and is therefore a useful starting place for considering other factors that affect the relative bargaining strengths of the two parties to the negotiation.

The Georgia-Pacific Factors

The United States Court of Appeals for the Federal Circuit (CAFC) encourages lower courts to consider 15 factors described in *Georgia-Pacific Corp. v. United States Plywood Corp.* (*Georgia-Pacific factors*) in determining a reasonable royalty.⁵² These factors are listed in Figure 9. Many of the *Georgia-Pacific* factors are, or can be, subsumed in the scientific determination of the bargaining range described above. In particular, the final *Georgia-Pacific* factor (factor 15), states directly that a reasonable royalty is one that a willing licensor and willing licensee would have agreed upon had they been voluntarily trying to reach an agreement. This is at the heart of the method one employs to determine the bargaining range. The remaining *Georgia-Pacific* factors can either be taken into account explicitly when determining the endpoints of the bargaining range, or may be used to analyze the relative bargaining strengths of the two parties to determine whether the final agreed-upon royalty would fall above or below the midpoint of the range.

The impact of each factor on the final royalty or on the endpoints of the negotiation depends on the particular circumstances of the patent, industry, and parties at issue. Not every factor will be relevant or economically meaningful in every negotiation. Below we discuss *Georgia-Pacific* factors 1 through 13 and some of the ways that each could affect either the bargaining range or the bargaining power of the parties to the hypothetical negotiation. Our discussion is not meant to be exhaustive.

1. **Royalties received by the patent owner for the patent in suit:**

If a preestablished arm's-length royalty for the patent in suit lies within the bargaining range established for the parties to the litigation, then that royalty will be a logical starting place for determining the final royalty. Other *Georgia-Pacific* factors can then be considered to determine whether the idiosyncrasies of the particular license at issue suggests a royalty above or below the estab-

⁵² See, for example, *Dow Chemical Co. v. Mee Industries Inc.*, 341 F.3d 1370 (Fed. Cir. 2003).

Figure 9. The Georgia-Pacific Factors

1. Royalties received for the patent tending to prove an established royalty
2. Rates paid for comparable patents
3. Nature and scope of the license
4. Licensor's established policy and marketing program
5. Commercial relationship between the licensor and licensee
6. Effect on sales of other products of the licensee
7. Duration of the patent and term of the license
8. Established profitability of the products made under the patent
9. Advantages of the patent over old modes or devices
10. Benefits of the patent to users
11. Infringer's use of the patent
12. Customary profit split
13. Portion of the profit credited to the patented invention
14. The opinion of qualified experts
15. The amount that would be agreed upon by a willing licensor and a willing licensee

lished royalty.⁵³ The patent owner may be unwilling to accept a royalty less than the preestablished royalty if doing so would trigger costly renegotiations with established licensees. Similarly, the patent owner may be unwilling to accept a royalty less than a preestablished royalty if it stands to lose royalty revenue from established licensees that compete for sales with the prospective licensee. On the other hand, if the licensee can access markets not accessible to the patent owner or established licensees, then the patent owner may be willing to grant a discount to the prospective licensee in anticipation of broadening the sales base for products embodying the patent. As mentioned above, one needs to consider the comparability of prior licensees to the prospective licensee in the hypothetical negotiation to determine how much weight to place on preestablished royalties.

2. **Royalties paid by the prospective licensee for comparable patents:** This factor explicitly asks the expert to consider industry practices or use of comparables to help determine the final

⁵³ Note that according to *Panduit*, "where an established royalty rate for the patented invention is shown to exist, the rate will usually be adopted as the best measure of reasonable and entire compensation." See *Panduit*, 575 F.2d at 1164, n. 11, 197 U.S.P.Q. at 7361, n. 11.

reasonable royalty.⁵⁴ While, as described above, industry practices in general may not yield meaningful information about the value of a particular invention, a review of the licensee's past licensing practices may provide useful information on the prospective licensee's ability to exert bargaining power over other patent owners in arm's-length negotiations.

3. **The nature and the scope of the license:** This factor can be important in determining the comparability of other royalties considered under factors 1 and 2. A nonexclusive license is typically less valuable than an exclusive license, and therefore, consideration of this *Georgia-Pacific* factor can lead to a final royalty that is lower than established or "comparable" royalties described in exclusive licenses.
4. **The licensor's established licensing policy:** A licensor with an established policy of refusing to grant licenses to a competitor may be able to receive a higher royalty than a licensor that routinely licenses its patents. This stems in part from the fact that the license under consideration could be more valuable to the prospective licensee if there are fewer manufacturers in the industry with a right to practice the patent. This factor should be considered in determining the licensee's maximum willingness to pay for the patent at issue.
5. **The commercial relationship between the licensor and licensee:** All else being equal, a patent owner would be willing to accept a lower royalty from a licensee with which it does not compete than from a licensee that is a direct competitor to the patent owner. Licensing a competitor licensee enhances the potential for the patent owner to lose sales and profits as a result of granting the license. As with factor 3, this *Georgia-Pacific* factor can be important in weighing the comparability of prior licenses. One would expect the hypothetical negotiation to yield a higher royalty than prior licenses, if prior licenses were granted to noncompeting licensees.

⁵⁴ We mentioned earlier that the use of industry averages or rules of thumb lead to reasonable royalties "only with luck." The key point is that these royalty shortcuts should be considered only after one has established the reasonable royalty range and typically should not be the first and only consideration in determining a reasonable royalty.

6. **The effect of selling the patent in promoting sales of other products of the licensee:** The additional profits from sales of noninfringing products that the licensor and licensee stand to make by practicing the patent at issue can be explicitly considered in determining the licensee's maximum willingness to pay and the licensor's minimum willingness to accept for the patent. However, to the extent that data permitting a calculation of the expected profits from increased sales of noninfringing products are not available, consideration of this *Georgia-Pacific* factor would increase the bargaining power of the patent owner.
7. **The duration of the patent:** The longer the time frame over which a licensee will have to pay royalties for the use of the patent at issue, the greater will be the incentive for the licensee to attempt to invent around the patent. Thus, for long-lived patents, a patent owner may be willing to settle for a lower running royalty rate than it would be willing to accept on short-lived patents, in order to discourage technological leap-frogging of the invention at issue. However, in industries characterized by rapid technological progress, the life-cycle of the products at issue, as opposed to the patent at issue, may be the greater determinant of the final royalty, and the parties may agree to a higher royalty rate because they expect the economic life of the patent to be short-lived.
8. **The commercial success of products embodying the patent:** This factor should be considered in determining a prospective licensee's maximum willingness to pay for the patent. The higher the incremental sales and profits attributable to the patented technology or features, the more a licensee would be willing to pay for the right to practice the patent. However, if the maximum of the bargaining range is explicitly tied to the profits that the licensee could earn by practicing the patent, then this factor should not also play a role in determining bargaining power.
9. **The advantages of the patent over old modes or devices:** "Old modes or devices" represent potential noninfringing alternatives to the patent at issue. If the patent at issue is a minimal advance over prior art, then the patent will not command a substantial royalty, even if products embodying the patent are profitable for the licensee. As discussed above, if the licensee can earn substantially the same profits by employing an older technology, then the profits from sales are not rightly attributable to the invention at

issue. To the extent that sufficient data are available, this factor can be incorporated directly into determining the licensee's maximum willingness to pay and need not be considered separately in determining bargaining power. If data are unavailable, then one should allow the bargaining power of the patent owner to rise or fall with the advantages of the patent over old modes or devices.

10. **The nature of the patented invention and benefits to those who have used the invention:** As with factors 8 and 9, this factor affects the licensee's willingness to pay for the invention. If the invention is a cost-saving invention, the most the licensee will pay for the invention is approximately the resulting cost savings. The cost-saving characteristics of the invention should be explicitly considered in determining the upper end of the bargaining range and should not also then be considered to affect bargaining power within that range. If the invention is a demand-enhancing invention, then the increased sales and profits attributed to the invention will have been considered under factor 8.
11. **The use made of the invention by the infringer:** This factor can also be explicitly considered in establishing the bargaining range for the hypothetical negotiation. The licensee would be willing to pay more for a patent that it uses extensively and from which it derives significant profits and would be less willing to pay for a patent that it uses infrequently. If data do not allow an explicit determination of the upper end of the bargaining range, then this factor can be considered in determining how the final reasonable royalty should compare to other royalties received by the patent owner or paid by the licensee.
12. **The portion of the profit that may be customary for the use of the invention:** Factor 12 encourages the expert to consider whether there are established rules of thumb for determining patent value in the industry at issue. As noted above, industry rules of thumb are not related to the value of a particular license to a particular licensee. However, to the extent that consideration of this factor yields a royalty *within* the established bargaining range, then this factor establishes a focal point on which the parties may settle as the final royalty. In particular, the parties may be willing to be guided by industry norms if they are likely to be engaged in repeated negotiations in the future and are equally likely to be the licensor as licensee in these future negotiations.

13. **The portion of the profit that should be credited to the invention:** Econometric and other methods exist that allow an expert to establish the value that consumers place on the specific attributes of the patent as opposed to other attributes of the final product. If data do not exist to allow an explicit accounting of the portion of the total value attributed to the patented feature, then this factor may be considered in determining where within an established bargaining range the final royalty will fall. If the invention is a “blocking patent,” such that the product cannot be sold at all without infringing the patent at issue, then even if the product incorporates other features, the licensee’s maximum willingness to pay is based on the entire profit earned on the product.

To summarize, consideration of the *Georgia-Pacific* factors is consistent with the market-based royalty method described in this chapter as a means to establish a reasonable royalty. Data permitting, many of the *Georgia-Pacific* factors will be explicitly taken into consideration in determining the boundaries of the hypothetical negotiation. Those factors that are not readily quantifiable can be considered in weighing the bargaining power of the negotiating parties. Factors that favor the patent owner weigh in favor of a final royalty at the upper end of the bargaining range, while factors favoring the licensee weigh in favor of a final royalty in the lower end of the bargaining range. Where the final royalty will fall depends on the specific characteristics of the technology at issue and the parties to the litigation.

Departures from a Market-Based Negotiation

While the primary thesis of this chapter is that a reasonable royalty is one that is market-based, we do of course have to acknowledge that there are considerable differences between an unencumbered market-based royalty negotiation and the hypothetical negotiation envisioned by the courts. In constructing hypothetical negotiations, damages experts are required to assume that the negotiations take place on the eve of first infringement, that both sides are willing to enter into the transaction, and that the patent in suit is valid and infringed (and is acknowledged to be so by the litigating parties). These assumptions are, of course, contrary to fact when the parties have resorted to litigation.

In all likelihood, there was no negotiation on the eve of first infringement. The parties are decidedly unwilling participants in the hypothetical negotiation (if they were willing participants, there would not have been a

lawsuit). And in real-world royalty negotiations, the parties may not know with certainty whether the patent is valid or infringed. This uncertainty could affect the real-world royalty negotiation in a way that would not occur in the hypothetical version of the negotiation.

Moreover, there is no guarantee that there will exist a bargaining range that would yield a reasonable royalty as we have defined it. In some cases, the foregone profits of the patent owner are greater than the profits gained by the alleged infringer. In those cases, there would be no royalty that a licensor and licensee would willingly agree on, were they not bound by law to do so. In these situations, a reward of lost profits (or the patent owner's minimum willingness to accept) rather than a reasonable royalty may be necessary to compensate the patent owner for infringement.

These differences between the hypothetical negotiation and a real-world bargaining transaction can represent a departure from the "make-whole" standard employed as the basis for determining economic damages. If the final reasonable royalty resulting from an assessment of a hypothetical negotiation is less than the lost profits of the patent owner, the patent owner is not made whole for the infringement it suffered. In addition, if the final royalty is precisely equal to the patent owner's established royalty from other arm's-length licenses, the patent owner is not made whole for the fact that the royalty payments it receives in compensation for past damages do not compensate for the time, costs, and risks involved in litigating the patent at issue—costs and risks that were presumably saved in negotiating preexisting licenses for the technology at issue. Therefore, we note that while the courts consider a reasonable royalty adequate to compensate for infringement, it may not always be the case that the reasonable royalty fully compensates the patent owner for the damages it incurred.

Conclusion

There are a variety of techniques for estimating patent damages, not all of which are scientific or reliable. The focus of this chapter has been to provide an overview of the methods of determining patent damages that are rooted in economic theory and are scientifically defensible. Estimates of damages from lost profits consider the interplay between price, cost, quantity, and competition. The same economic variables that determine lost profits also come into play in determining a reasonable royalty for an infringed patent. Both lost profits and reasonable royalty damage calculations should be built on scientific analyses of patent value. Without a

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rigorous analysis of factors that determine the value of a patent, the damage figure associated with infringement of that patent is no better than unfounded speculation and thus not appropriately the subject of expert opinion.