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Product Substitutes and the Calculation of Patent Damages

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The courts in patent infringement cases award damages measured by lost profits or a reasonable royalty. If these damages are calculated correctly, they will restore to the patent owner the profits or royalties that would have been earned, but for the infringement of the patent. To establish lost profits, the patent holder must demonstrate that its sales and the sales of the infringer comprise the entire market. If there exist noninfringing substitutes, the court will likely find speculative any attempt to determine the percentage of the infringer's sales that would have been made by the patent holder, and the patent holder must establish damages based on a reasonable royalty.

The economic value of a patent depends fundamentally upon the nature and extent of noninfringing substitutes. If there are numerous noninfringing substitutes for a patented invention when it is priced at its incremental cost of production, competition from substitutes will limit the invention's price to incremental cost. In this competitive case, the invention has no economic value, and the patent holder's economic losses and reasonable royalty are zero. However, this is not the usual case, especially where the infringer believes it may be faced with litigation, since if the infringer is willing to gamble with the potential costs of litigation, it must believe that the infringed invention has economic value compared with noninfringing substitutes. At the other extreme is the monopoly case, in which there are no noninfringing substitutes and the patent holder sets a monopoly price, unrestrained by competition. Most patent infringement cases likely fall between the competitive and monopoly extremes, where competition from noninfringing substitutes is weak enough to allow the patent holder to raise price above cost or charge some royalty,

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but strong enough so the patent holder's optimal price or royalty is less than the monopoly price or royalty.

This suggests that the determination of patent damages, calculated by either lost profits or reasonable royalty, depends fundamentally upon the extent and nature of substitute products for the patented product. If there exist plentiful, close substitutes for the patented product, competition from these substitutes would restrain the patent holder's potential profits or the royalty he could charge. Conversely, in the absence of close substitutes, the patent holder's profits or royalty would be limited only by the nature of the demand for the invention and the cost of producing it, but not by competition.

Economists have studied intensively the determination of substitution and potential competition among products. In particular, the economic analysis of product substitutability plays a central role in merger and monopolization cases under Section 2 of the Sherman Act and Section 7 of the Clayton Act. Relevant market analysis for antitrust involves delineating product (and geographic) markets comprised of all economic substitutes for the complained product. In 1982, the U.S. Department of Justice released a fundamental revision to its 1968 merger guidelines (further revisions to the 1982 *Merger Guidelines* were released in 1984).[2] These revised guidelines (hereafter, *Merger Guidelines*) set forth the methodology employed by the U.S. Department of Justice to analyze the competitive effect of mergers. The *Merger Guidelines* have been widely accepted by economists and the courts, since they present an economically consistent, practical method for identifying substitute products. While the *Merger Guidelines* were developed for antitrust analysis, we suggest below that this method for identifying economic substitutes might be equally usefully employed for the analysis of substitutes in patent damage calculations.

While the courts in patent infringement cases have been reluctant to calculate lost-profits when there exist noninfringing substitutes for the patented product, the courts in antitrust cases routinely calculate damages from lost profits where the plaintiff assumes, for the purpose of calculating damages, that its product faces lawful competition from the defendant and other manufacturers of substitute products. We suggest that the methods accepted by the courts for calculating lost profits in antitrust cases could serve to establish a non-speculative

[2]The 1982 Merger Guidelines are reprinted at *CCH Trade Regulation Reports*, Par. 13,102. The 1984 Merger Guidelines are reprinted at *CCH Trade Regulation Reports*. Par. 13,103.

basis for lost profits in patent cases, even where the patent holder faces competition from noninfringing substitutes.

At the outset, there is one procedural difference between antitrust and patent cases that should be noted. Effective October 1982, a new U.S. Court of Appeals for the Federal Circuit significantly altered judicial review of litigation involving patent law issues. The Federal Circuit has assumed appellate jurisdiction of the Court of Customs and Patent Appeals (which was abolished). With the establishment of the Federal Circuit, any appeal of a district court case in which primary jurisdiction reflects patent law now automatically goes to the Federal Circuit (instead of to various appellate courts that ordinarily would hear district court appeals). This may produce more consistency in patent law by eliminating the possibility that appellate court will apply its own construction to the case. Another possible impact of the Federal Circuit is that the Supreme Court will no longer feel pressured to decide issues formerly raised by internal circuit differences.

I. Patent Damage Calculation: Lost Profits and Reasonable Royalties

The possession of a patented process or product confers a potential economic advantage upon its owner. If the patent is infringed, the patent owner may be deprived of profits that would otherwise have been obtained. Since these profits could have been generated either from (1) sales made by the patent holder or (2) royalties obtained from patent licensees, the courts permit a patent holder to advance a claim for both lost profits and reasonable royalties. If lost profits cannot be proven, the patent holder is entitled to a reasonable royalty. In the absence of an established royalty, the damage award will be based on a royalty that would have resulted from an arm's length negotiation between a willing buyer and seller at the start of the infringement period.

Lost profits in patent cases are calculated by comparing the plaintiff's actual economic condition with his economic condition in a hypothetical "but for" world without liability. In this "but for" world, the court assumes the infringing firm does not sell any units of the infringed product. The threshold question the court then considers is whether there exist noninfringing substitute products. If so, the courts have been reluctant to calculate the patent holder's profits by apportioning the infringer's sales and profits between the patent

holder and the noninfringing firms; instead, the courts have calculated damages using the reasonable royalty method.

There are two decisions that seem particularly important for determining damages in patent cases—*Panduit* and *Georgia-Pacific*.[3] *Panduit* sets forth four factors to be considered in determining whether a patent owner should be permitted to recover lost profits. *Georgia-Pacific* sets forth 15 factors to be considered in determining a reasonable royalty. As we shall see, possible competition from noninfringing substitutes plays a central role in both the *Panduit* and *Georgia-Pacific* criteria for establishing patent damages.

A. *Lost Profits*

According to *Panduit*, a patent owner must prove:

1. Demand for the patented product
2. Absence of acceptable noninfringing substitutes
3. Adequate manufacturing and marketing capacity to exploit demand
4. The actual profit that would have been obtained

The "demand" test requires the patent holder to establish sufficient consumer demand so the patent has some economic value. Economists recognize that demand is not a single quantity, but rather a schedule displaying the quantities that would be demanded at various prices. For patent damage analysis, the relationship between quantity demanded at various prices and the corresponding long-run incremental cost of production is the relevant relationship since the patented product will have an economic value only if price exceeds long-run incremental cost. However, the demand for the patented product cannot be determined independently of consideration of the existence of noninfringing substitutes. If there exist close substitutes for the patented product, the demand for the patented product will reflect competition between the patented product and its substitutes. Thus, before the demand test can be applied meaningfully, a product market must be delineated to determine if there exist noninfringing substitutes. If so, the analysis of demand should account for increasing substitution toward noninfringing alternatives as the patented product's price rises.

[3] *Panduit Corp. v. Stahlin Bros. Fiber Works. Inc.* 575F. 2d 1152 (Sixth Cir. 1978); *Georgia-Pacific v. U.S. Plywood Corp.* 318F.S. 1116 (S.D.N.Y. 1979); *modified and affirmed* 446F. 2d 295 (2d Cir. 1971).

The fourth criterion in the *Panduit* test also requires an analysis of competition between the patented product and possible substitutes. It is a basic conclusion of economics that industry profit rates depend, among other things, on the extent of competition in the market. The patented product's profitability, absent competition from the infringing product, depends *inter alia* on the amount of competition the patented product faces from noninfringing substitutes. For example, if there are numerous noninfringing close substitutes for the patented product and the patented product is being sold in a competitive market, the patent owner may earn only a competitive profit rate unless the patented product is cheaper to produce or viewed by consumers as markedly superior (if the latter, it may be incorrect to say that the patented product has numerous, close substitutes). Conversely, if there are no close substitutes for the patented product, the patent owner may be able to earn an above-normal profit. Thus, the economic determination of the profit rate that would have been earned absent the infringement will depend on an economic analysis of competition between the patented product and acceptable noninfringing substitutes.

Finally, *Panduit's* third criterion requires the patent holder to show possession of the manufacturing capacity and marketing skills necessary to exploit the total demand for the patented product.

Thus, with the exception of the third criterion, the four *Panduit* factors depend fundamentally upon the nature and extent of noninfringing substitutes for the patented product. If the court finds there exist acceptable, noninfringing substitutes, damages will be calculated based on a reasonable royalty. Even if there do not exist close substitutes at the patent holder's incremental cost, the existence of substitutes at higher prices may influence the court's determination of the patent holder's profit rate and expected sales.

The following example summarizes our view of the role of noninfringing substitutes in the *Panduit* standards for calculating lost profits. Suppose that during the period of infringement, the patented device was sold only by the patent holder and by the infringing company. To calculate the patent holder's profits lost to the infringer, the first step would be to identify all noninfringing close substitutes for the infringing product. Close substitutes are identified by determining whether substitution toward other products limits the profitability to the patent holder of raising prices from incremental cost to the monopoly profit-maximizing level. If no noninfringing alternatives exist, the question would then turn to whether the patent holder

had the manufacturing and marketing capacity to have made all infringer's sales of the patented item. We observe that this analysis would proceed along precisely the same lines that one would likely take in an antitrust case where the plaintiff advanced a claim for lost sales. Since the "but for" world would have involved a single seller rather than two sellers and since there are not close substitutes, the patent holder also would want to claim that sales would have been made at a monopoly rather than a competitive price. In making this claim, the patent holder will want to show that even at the monopoly price there are no close substitutes for the patented product. What this means is that the patent holder can be expected to advance a claim that includes both lost profits on lost sales and lost profits on actual sales, the latter reflecting the reduction in price below monopoly levels which resulted from infringement. We note that this kind of proof is similar to proof advanced in predatory pricing cases under the antitrust laws where the plaintiff may be expected to advance a claim of lost profits on sales lost to the alleged predator and lost profits on actual sales made at reduced prices. Finally, the patent holder must offer proof of the profits that would have been obtained. The type of proof advanced—including an analysis of the relationship between increased sales and incremental costs—is, once again, identical to proof that would be required in an antitrust case.

B. *Reasonable Royalties*

If the patent holder is unable to satisfy the four criteria associated with proof of lost profits, in many cases because there exist noninfringing substitutes, the patent holder is permitted to advance a claim for a reasonable royalty. The reasonable royalty may either be a conventional royalty for that firm or industry, or a hypothetical royalty that would have resulted from negotiations, prior to the onset of infringement, between patent owner and infringer. The process for determining a reasonable royalty is intended to put the infringing firm in the position of a hypothetical applicant engaged in an arms-length negotiation for a license. *Georgia-Pacific* delineates the following 15 criteria pertinent to the determination of a reasonable royalty.

1. The royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty
2. The rates paid by the licensee for the use of other patents comparable to the patent in suit

3. The nature and scope of the license, as exclusive or nonexclusive; or as restricted or nonrestricted in terms of territory or with respect to whom the manufactured product may be sold
4. The licensor's established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly
5. The commercial relationship between the licensor and licensee, such as, whether they are competitors in the same territory in the same line of business or whether they are inventor and promotor
6. The effect of selling the patented specialty in promoting sales of other products of the licensee, the existing value of the invention to the licensor as a generator of sales of his nonpatented items and the extent of such derivative or convoyed sales
7. The duration of the patent and the term of the license
8. The established profitability of the product made under the patent, its commercial success and its current popularity
9. The utility and advantages of the patent property over the old modes or devices, if any, that had been used for working out similar results
10. The nature of the patented invention, the character of the commercial embodiment of it as owned and produced by the licensor and the benefits to those who have used the invention
11. The extent to which the infringer has made use of the invention and any evidence probative of the value of that use
12. The portion of the profit or of the selling price that may be customary in the particular business, or in comparable buisnesses, to allow for the use of the invention or analogous inventions
13. The portion of the realizable profit that should be credited to the invention as distinguished from nonpatented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer
14. The opinion testimony of qualified experts
15. The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably

> and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee-who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention-would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license

It should be noted that the reasonable royalty negotiation is primarily backwardlooking; it will take into consideration knowledge available to the parties at the time the negotiation was to have occurred. The negotiation reflects subsequent developments only if they could have been anticipated by the negotiating parties. In order to identify information that the negotiators could have had in mind, it is often useful to look at annual reports, contemporaneous business projections, financial statements, other licensing agreements negotiated by the parties in connection with the patent at issue or other patents, and speeches and trade press that existed on or before the date of negotiation. In determining the appropriate royalty rate, it also is necessary to consider the cost of designing around the patent, since no competitor is likely to negotiate a royalty rate that produces payments substantially greater than the design-around cost. The patent holder will be willing to accept some royalty rate greater than zero since it will obtain no royalty at all if the potential infringer designs a noninfringing alternative. Finally, the negotiators also are likely to weigh the uncertainties associated with the market acceptance of a potentially noninfringing design. Other things equal, the greater the uncertainty at the time of negotiation, the higher the royalty rate.

The *Georgia-Pacific* criteria fall into four broad, functional categories. Criteria numbered 1, 2, 11, and 12 identify potential benchmarks for evaluating the reasonableness of the license. Essentially all the remaining criteria identify factors potentially affecting the economic value of the license. Criteria numbered 3, 6, 7, and 8 identify specific characteristics of the license or invention potentially affecting its economic value, as well as information on the patent's actual profitability. Criteria 4, 5, 9, and 10 pertain to the extent of possible competition facing the licensee. Criteria 4 and 5 pertain to possible competition between the licensor and licensees, while criteria 9 and 10 pertain to possible competition between the patented product and

noninfringing alternatives. Thus, as with the *Panduit* criteria, the nature of competition in the market for the patented product is recognized in the *Georgia-Pacific* factors for determining a reasonable royalty.

In conclusion, the courts have approached the measurement of patent damages through the determination of lost profits and reasonable royalties. Our analysis of the criteria adopted by the courts for determining lost profits and royalties shows the essential role of product substitutability in the determination of patent damages. Because of this central role for product substitutability, the measurement of patent damages may benefit from an examination of a recently developed methodology for identifying substitute products in antitrust litigation.

II. Identifying Noninfringing Substitutes

The *Merger Guidelines* of the Department of Justice are used by the Department to identify mergers that may substantially lessen competition. The starting point of the analysis under the *Guidelines* is to identify all close substitutes for the product of the merging firms, since competition from these products may constrain the pricing of the merged firm. Under the *Merger Guidelines*, the identification of substitutes begins by considering a hypothetical small but significant (say five percent) non-transitory price increase for the product whose substitutes we want to identify. If an economically significant group of consumers would switch their purchases from the now-higher-priced product to another product, that product is a substitute.

The Department of Justice is motivated in using this definition of substitute products by the economics of monopoly pricing which shows that monopoly pricing results in economic inefficiency. While the identification of substitutes for calculating patent damages involves a different economic question, the Department of Justice method for identifying economic substitutes is equally applicable. The only difference is that while the Department of Justice is interested in substitution effected by a small but significant price increase, for calculating patent damages we are interested in the extent of substitution for any price increase up to the price at which the monopoly patent holder would maximize his profits. The Department of Justice is concerned with whether competition from other products could restrain any significant price increases of the merged firm. If this competition were not forthcoming up to the threshold value chosen for the small but significant price increase, the Department may find

that the merged firms would likely raise prices by a significant amount, causing significant damage to consumers. However, the purpose for identifying substitutes in the measurement of patent damages is to determine how competition from other products would limit the patent owner's profitability, absent competition from the infringer. If the patent owner did not face competition from the infringer, it would raise the price until it reached the monopoly profit-maximizing level, or until substitution from noninfringing alternatives made uneconomic further increases in price.

In practice, one is unlikely to find specific calculations undertaken by the firm showing its expected profitability at different price levels. Under the *Merger Guidelines* the Department will give special weight to a number of factors in evaluating product substitution. These include the following:

a. Evidence of buyers' perceptions that products are or are not substitutes
b. Differences in price movements of the products in question that are not explainable by common or parallel changes in factors such as input cost or income
c. Similarities or differences between the products in question in customary usage, design or physical composition
d. Evidence of sellers' perceptions that the products in question are or are not substitutes, particularly if business decisions have been based on these perceptions

The *Merger Guidelines* method for identifying economic substitutes has been widely influential with economists because the *Guidelines* present a workable, economically consistent approach to identifying economic substitutes. An alternative approach to the *Guidelines* method is to estimate statistically the cross-elasticity of demand between the patented product and possible noninfringing substitutes, where the cross-elasticity of demand is defined as the percentage change in the price of the patented good.[4] If the two products are close substitutes, the cross-elasticity of demand will be a large, positive number. While the cross-elasticity of demand provides useful information on demand substitutability, experience suggests that the

[4]See Dorsey Baker, "Patent Damages - Quantifying the Award," this *Journal*, Vol. 69, No. 3, March 1987, for a discussion of the use of cross-elasticity of demand for measuring patent damages.

price and quantity data required for estimating the elasticity are rarely available.

III. Comparison With Damage Calculations in Antitrust Cases

As discussed above, in patent cases the courts have been reluctant to calculate damages based on lost profits if there exist noninfringing substitutes for the patented product. By contrast, in the calculation of lost-profit damages in antitrust cases the plaintiff is assumed to face lawful competition from the plaintiff and other firms selling substitutes for the complained product. For example, in predatory pricing cases the plaintiff will calculate damages assuming non-predatory competition from the defendant and other firms in the market. To calculate the profits that would have been earned, but for the unlawful competition, the antitrust plaintiff may use one of three methods:[5]

(1) profits during the period of unlawful conduct compared with profits before or after;
(2) the profits of comparable or benchmark firms;
(3) a projection of the market share plaintiff would have had in the absence of unlawful competition.

In antitrust cases the plaintiff can use these three methods to establish damages for lost sales or profits assuming lawful competition from the defendant and other producers of substitute products. The damage calculation is usually presented through expert testimony to provide a basis for the market share, sales, profits or other values used to measure damages. While these damages cannot be proven with certainty, information developed through discovery together with economic reasoning and analysis can provide a nonspeculative basis for the damage claim.

The first method identified above for establishing antitrust damages compares the plaintiff's profits during the period of unlawful conduct with the plaintiff's profits outside the period of unlawful conduct. This method would appear to have direct application in patent infringement cases. If the patent holder produced the patented product for a period prior to the infringement, the patent holder might use profits during this period as a benchmark against which to com-

[5]See, for example, Dolphin Tours v. Pacifico, 1985-II *Trade Cases*, Par. 66,810, pp. 64021-22.

pare profits during the period of infringement. Alternatively, if the patent holder had obtained to observe the patent holder's financial performance after the injunction, the post-injunction profit performance of the patent holder could represent a reasonable benchmark for comparing his profits during the infringement period. These benchmarks could be adjusted to reflect reasonably anticipated differences between profit performance during the benchmark and infringement periods.

An alternative benchmark that the patent holder might use for calculating lost profits is the profits of comparable firms. However, this may be a less useful benchmark for patent infringement cases since the novelty of the invention may make it difficult for the patent holder to identify a set of comparable firms. A comparison with comparable firms will likely be most compelling in an industry with a large number of firms, some of which have invented and successfully earned returns from inventions of comparable economic significance to the patent holder's invention.

Finally, the patent holder may be able to develop a non-speculative damage claim based on a projection of its share of the market, but for the infringer's sales. The central issue would be to determine that share of the infringer's sales that the patent holder would have made. If consumers view the products manufactured by the infringer and by the patent holder as essentially identical, the patent holder would make all the infringer's sales if the patent holder sold the product to those customers at the same price as the infringer. If the patent holder raises price, it may lose customers to substitute products. The patent holder may be able to obtain estimates of the rate at which consumers would switch to substitute products as price increases through consumer surveys, statistical analysis of past price changes, or qualitative comparisons between the patented product and its substitutes.

IV. Conclusion

In patent infringement cases, the plaintiff may calculate damages based on lost profit or a reasonable royalty. The criteria commonly accepted by the courts for determining lost profits or reasonable royalties reflect the courts' recognition that the economic value of inventions, hence potential lost profits or royalties, depends fundamentally upon the availability of substitutes for the patented product. Many economists have adopted the method for identifying substitute products set forth in the current *Merger Guidelines* of the U.S. Department

of Justice. While these *Guidelines* were designed for merger analysis, we suggest that, with a minor modification, they are equally useful for identifying substitute products in patent infringement cases.

In patent cases, the courts have been reluctant to determine lost profits where they are noninfringing substitutes for the patented product. In antitrust cases, the courts have used three methods for determining lost profits under the assumption that the plaintiff faces lawful competition from the defendant and, typically, other producers of substitute products. We suggest that two of these three methods might be usefully employed in patent cases to determine lost profits where the patented product faces competition from noninfringing substitutes.

The courts have based their damage calculations on reasonable royalty rather than lost profits when there are noninfringing substitutes because the courts have felt that the calculation of lost profits here would be speculative. Yet, to an economist, lost profits and lost royalties are closely related quantities. A patent holder can sell the invention itself, license the invention to others, or both. The production and marketing decision for exploiting the invention depends on the expected profitability of self-production compared with licensing. Under certain simplifying assumptions, the profit per unit that the patent holder would earn if it produced the product itself would exactly equal the per-unit license fee it would charge to license it for sale by another firm. Here, if the court can determine the royalty the patent holder would have charged licensees, the court can equally well determine the patent holder's lost profits. While lost profits and royalties are not always identical, the close relationship between lost profits and royalties suggests that if the courts can determine reasonable royalties, they should also be able to determine lost profits, even when the patented product has competition from substitutes. Expert testimony on the profitability of the invention and its likely share of the market could be used to provide a basis for the lost profits calculation.