

PATENT DAMAGES : DYNAMIC MODELS FOR DYNAMIC MARKETS

INTRODUCTION

Economics is providing increasingly sophisticated tools to model the dynamic interactions of competitors. In the antitrust context, these types of models have found extensive use in the analysis of horizontal merger impacts. To date, such models have not found widespread application to the analysis of intellectual property infringement, even though the situations are analogous. A particularly powerful tool emerging from the field of economics is a dynamic model capable of predicting investment, pricing, and share results when competitors maximize profits over a long-term horizon. The Brattle Group applied this model to the analysis of “but-for” browser share issues in the recently settled case of Netscape v. Microsoft. This powerful approach also has broad potential to analyze similarly complex dynamic issues in the context of intellectual property disputes.

Accepted methods for calculating patent infringement damages ignore the dynamic nature of many markets. Particularly in markets such as biotechnology, telecommunications, and software, where network or first-mover effects can make patents most valuable, decisions made by a firm in one period will induce responses from other firms that will affect competitive outcomes now and in the future. A correct analysis of patent infringement damages must consider these potential complexities.

The current standard for calculating lost profits damages is the “market share” rule. This simplified framework set forth in 1989 in *State Industries v. Mor-Flo*¹ specified how to divide infringing sales between the patent holder and the producers of non-infringing substitutes. The decision by the Court of Appeals for the Federal Circuit in *Crystal Semiconductor v. Tritech Microelectronics*² highlighted one of the major drawbacks of the market share rule – the inability to deal with the price erosion that can occur as infringing competitors enter a market. More important, the *Crystal* decision opened the door for moving beyond the market share rule by inviting the application of more sophisticated methods of economic analysis.

One available approach is to employ the tools of merger analysis, which have been used for years to quantify the potential market impacts of horizontal mergers. Merger analysis can be used to model the “but-for” world in patent infringement; however, by construction, this type of analysis does not capture intertemporal effects – such as network effects – that can play key roles in many patent infringement cases. We provide a simple example to demonstrate how a firm’s ability to leverage network effects can render damage estimates from merger analysis incomplete and inaccurate. We further discuss a family of dynamic models that capture the relationships between prices, quantities, market shares, and investments over time to calculate the true economic impact of infringement on the patent holder.

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SIMPLIFICATION COMES WITH A HIGH PRICE

The prerequisites to a lost profits claim were introduced in *Panduit Corp. v. Stablin Bros. Fibre Works*³ in 1978. In *Panduit*, the court outlined four conditions, often termed the “Panduit Factors,” that must be met for a patent holder to be eligible for lost profits damages. To make a lost profits claim, the patent holder must prove (1) demand for the patented product, (2) absence of acceptable non-infringing substitutes, (3) manufacturing and marketing capability to exploit the demand, and (4) the amount of profit that would have been realized but-for the alleged infringement.

In *State Industries v. Mor-Flo*, the market share rule gained acceptance as a method for calculating lost profits. The “market share rule” uses the patent holder’s share of the non-infringing market to determine the percentage of the infringer’s sales that would have been captured by the patent holder absent infringement.

For example, Figure 1 shows a hypothetical market with three firms: a patent holder with a 30 percent market share, a patent infringer with a 60 percent market share, and a producer of non-infringing substitutes with a 10 percent market share. Figure 2 shows the but-for world according to the market share rule. Based on the market share rule, in the but-for world the patent holder would be awarded lost profits on three-fourths of the infringer’s sales, because its share of the non-infringing sales is 75 percent.⁴

Though simple to calculate, the damage estimates from the market share rule generally will not be accurate. This methodology assumes that the relative market shares of the patent holder and the non-infringing substitute provider are unaffected by the infringer’s actions. This assumption is unlikely to stand rigorous economic scrutiny. Furthermore, infringement often creates price erosion damages, an issue not addressed by the market share rule.

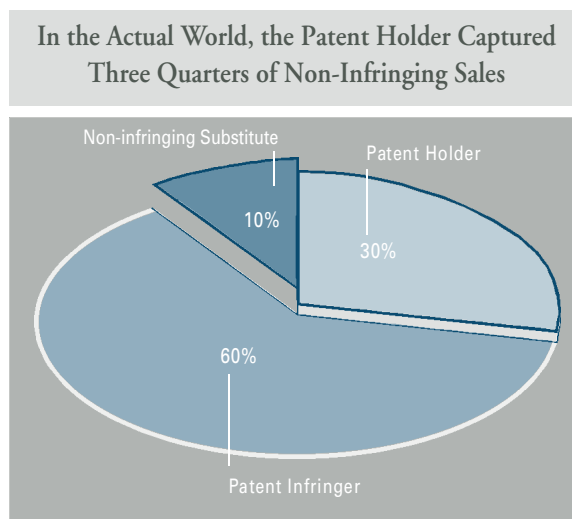


Figure 1

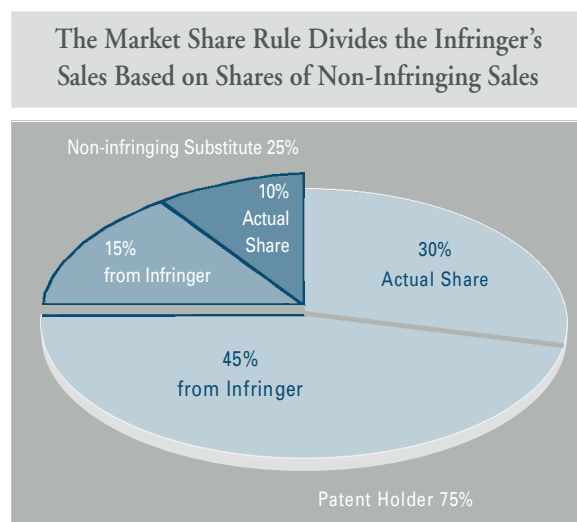


Figure 2

PRICE EROSION ESTIMATES: MINDING P’S & Q’S

A major drawback of the market share rule is that it does not provide a framework for calculating price erosion damages. Price erosion occurs when competition from an infringing product reduces the price that the patent holder would otherwise be able to receive for the patented good.

In *Crystal v. Trittech* the issue of price erosion took center stage. In *Crystal* a producer of analog-digital converter chips sought a damage award that included both lost profits and price erosion. The plaintiff's economist calculated price erosion damages as the estimated reduction in price multiplied by the patent holder's sales as calculated using the market share method.

As the court noted, however, this method of calculating price erosion damages violates one of the fundamental tenets of economics – that, in general, as the price of a product increases, the demand decreases. The court's decision emphasized that to claim price erosion damages “a patentee must produce credible evidence to show the decrease in sales ...that would have occurred at the higher hypothetical price.”

The plaintiff's expert estimated the extent of price erosion by using a benchmark price from a market for a slightly different type of analog-to-digital chip. The court found that the benchmark market was not sufficiently similar to the infringed market, and rejected *Crystal's* price erosion claim. The court also indicated how such analyses should be approached in the future, noting that “economists can define hypothetical markets, derive a demand curve, and make price erosion approximations without relying on inapposite benchmarks.” By doing so, the court explicitly encouraged the application of more sophisticated economic tools to the analysis of the but-for world.

THE TOOLS OF MERGER ANALYSIS: A STEP IN THE RIGHT DIRECTION

One approach for analyzing the but-for world in patent infringement cases is to apply the tools of merger analysis that have been used to determine whether proposed horizontal mergers will substantially lessen competition and harm consumers. These models assume that market participants adjust either prices (Bertrand Competition) or quantities (Cournot Competition) strategically to maximize single period profits. These analyses rely upon pre-merger market characteristics, such as prices, quantities, own and cross-

elasticities of demand, and production costs to estimate the equilibrium prices and quantities that each participant would realize in a post-merger world.

The economic issues in patent infringement litigation are highly analogous to those raised by the antitrust analysis of proposed mergers, except the question is whether reduced competition would have benefited the patent holder. In a patent infringement context the analysis of these market impacts would use post-infringement market data to estimate both the prices and quantities that would have occurred but-for the alleged infringement. This corrects the problems created by assuming that the quantities assigned by the market share rule are appropriate for calculating lost profits with price erosion.

However, merger analysis uses a static model to evaluate firm behavior in a single period. In the context of patent infringement, this means that the analysis considers market characteristics in a single post-infringement period to calculate what prices and market shares would have been but-for infringement. In many cases, however, this static approach will not accurately capture features of dynamic markets.

BEYOND MERGER ANALYSIS: MODELING THE DYNAMIC EFFECTS OF INFRINGEMENT

The Bertrand and Cournot models of oligopoly at the heart of static merger analysis do not successfully capture how firms make strategic decisions to optimize their profits over several periods rather than a single period. Even with analyses of multiple periods, the underlying assumption is that the results in each period are independent of the others. However, in many industries market outcomes in one period do, in fact, have a significant effect on prices, quantities, and market shares in subsequent periods. In these markets, decisions made today can substantially alter the trajectory of future profits.

For example, in an industry that exhibits “network” effects, a firm that increases market share in one period may experience even greater demand for its product in future periods. Network effects occur when the value of a product increases as the

number of users increases. These effects are seen in many high-tech industries. For example, the value of a particular word-processing product (*e.g.*, Microsoft Word) increases with the number of users because it becomes easier to exchange files or to find trained users. This occurs even though there are other comparable products available in the market (*e.g.*, WordPerfect).

A dynamic model that represents the but-for world by optimizing the behavior of firms over a long (or even infinite) horizon *can* capture intertemporal effects. This model employs a dynamic market game that in each period finds an equilibrium for firms seeking to maximize the present value all future profits. The model considers the impacts on the market of such potentially important features as the market shares or installed user bases of previous periods. These impacts are estimated by finding the best fit of the model to actual market results. This process provides statistical evidence as to whether these effects are present and, if so, to what extent – the type of evidence required to persuade finders of fact that these effects do, in fact, exist.⁵

As we have found in our work associated with the *Netscape v. Microsoft* matter, dynamic models permit the analysis of industries in which pricing and investment strategies in one period affect market outcomes in subsequent periods. These strategies can be particularly important in industries in which companies can capitalize on network or first-mover effects to parlay an initial market share advantage into an even greater advantage in subsequent periods. In the case of patent infringement, such intertemporal effects can have a significant impact on the calculation of damages.

WHAT COULD HAVE BEEN

Firms that are able to exploit network effects can achieve increased market share and potentially higher profits. In extreme cases, a market may exhibit a winner-take-all property, in which the firm that is able to develop the earliest and largest base of users (often called the “installed base”) can “tip” the market toward monopoly, achieving close to a 100 percent market share.

Competing with a patent infringer can severely restrict the ability of a patent holder to take advantage of network effects. As a result, estimates of but-for prices and quantities based on today’s market data may not accurately reflect how a market would have evolved. The following example illustrates this point.

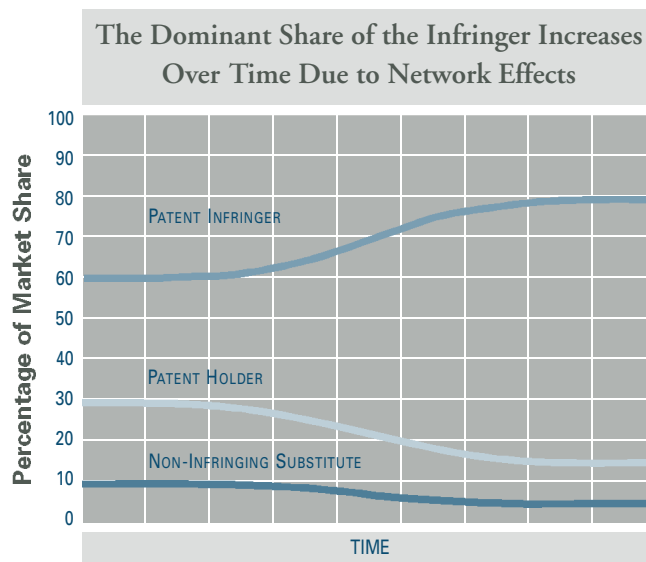


Figure 3

Assume as in our initial example that there are three firms in a hypothetical market – the patent holder with a market share of 30 percent, a patent infringer with a market share of 60 percent, and a producer of non-infringing substitutes with a market share of 10 percent. Figure 3 shows that the share of the infringing firm grew over time, while the relative shares of the patent holder and the non-infringer maintained about a three-to-one ratio.

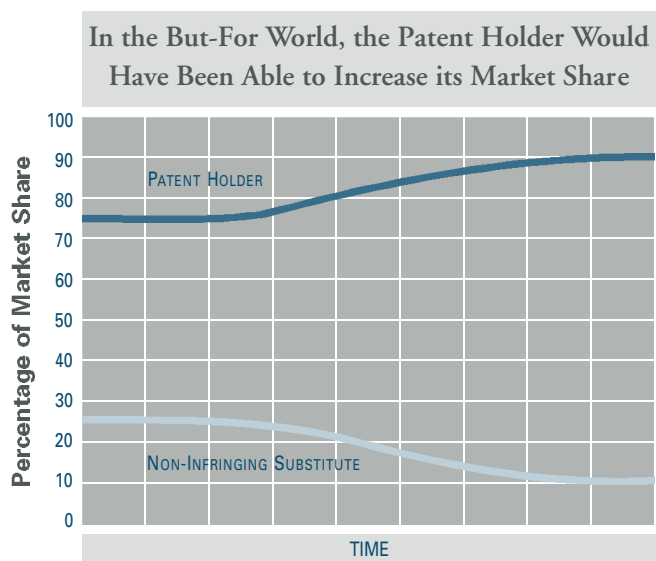


Figure 4

To calculate damages from patent infringement in this case, one must predict the market shares but for the patent infringement. The market share rule would assign 75 percent of the infringing sales to the patent holder. This estimate of the patent holder's but-for share, however, could be significantly understated. Assume that, absent the infringer, the patent holder would have had 75 percent of the market in the early years. As shown in Figure 4, because of network effects the lead of the patent holder would have increased over time, resulting in the capture of almost the entire market by the time of the analysis. The percent allocation by the market share rule would be too low.

However, higher market share does not necessarily translate into higher damages. To estimate correct but-for quantities for the patent holder one needs not only the market share, but also the size of the market. There can be circumstances in which an infringer's innovations or marketing strategies affect overall market size. For example, an infringer by adding sales to a market with network effects may accelerate overall market growth.

Only a dynamic model will estimate for each period the size of the total market and the quantities and prices realized by each market participant – the raw material required to compute a complete and correct analysis of lost profit.

CONCLUSION

Simplification comes at a price. Lost profit damage analyses in intellectual property cases have been slow to embrace the economic tools used to assess antitrust concerns, even though the underlying economic issues are highly analogous. The *Crystal v. Tritech* decision, by acknowledging an economic factor as basic as a downward sloping demand curve, has paved the way for the application of more sophisticated economic methods. More sophisticated static models may improve upon the market share method but will still fall short in the case of markets that are characterized by temporal interdependencies. The cost of simplification can be either significant overstatement or understatement of lost profit damages. The full range of relevant economic effects can only be captured through the use of dynamic models.

ENDNOTES

¹ *State Industries v. Mor-Flo Industries*, 883 F.2d 1573, 12 USPQ2d 1026 (Fed. Cir. 1989).

² *Crystal Semiconductor v. Tritech Microelectronics*, 246 F.3d 1336 (Fed. Cir. 2001), 57 USPQ2d (BNA) 1953.

³ *Panduit Corp. v. Stahl Bros. Fibre Works, Inc.*, 575 F.2d 1152, 197 U.S.P.Q. (BNA) 726 (6th Cir. 1978).

⁴ In addition, the patent holder may be awarded a reasonable royalty on the remaining 25 percent of the sales of the patent infringer. This type of award, called a "split" award, was also introduced in *Mor-Flo*.

⁵ For example, the Appeals Court in *U.S. v. Microsoft* recognized the possibility of network effects but called for a showing that network effects were necessary or probable before accepting the presence of such effects. United States Court of Appeals for the District of Columbia, Opinion, *United States v. Microsoft Corp.*, June 28, 2001, at 67.

GLENN WOROCH JOINS *THE BRATTLE GROUP*

Dr. Glenn A. Woroch, Adjunct Professor of Economics at the University of California at Berkeley and Executive Director of the *Center for Research on Telecommunications Policy* at the Haas School of Business, has joined *The Brattle Group* as a Senior Advisor in the San Francisco Office.

Dr. Woroch's research undertakes theoretical and empirical investigations of competition and regulation in network industries, with particular application to the telecommunications and computer sectors. His research also examines antitrust policy toward intellectual property protection and exclusionary business practices.

Dr. Woroch has been an economic advisor to government agencies including the U.S. Departments of Energy and Justice and Congress' Office of Technology Assessment. He regularly consults to private-sector clients and testifies on matters involving monopolization claims, mergers, intellectual property infringement, and economic damages.

Dr. Woroch has published numerous articles in the fields of industrial organization, antitrust and regulation. He served on the editorial boards of *Information Economics & Policy* and the *Journal of Regulatory Economics*, and was a founding member of the board of directors of the International Telecommunications Society. He has also taught at the University of Rochester and Stanford University, and was a senior member of the technical staff of GTE Laboratories.

THE BRATTLE GROUP PROVIDES CUTTING EDGE ANTITRUST DAMAGE ANALYSIS IN THE RECENTLY SETTLED *NETSCAPE V. MICROSOFT*

Professor Daniel McFadden, Nobel Laureate and Principal of *The Brattle Group*, led a project team that provided economic damage analysis on behalf of Netscape in its antitrust action against Microsoft. After a Federal District Court's ruling in 2000 that Microsoft's behavior violated the antitrust laws and had harmed Netscape, Netscape filed suit against Microsoft Corporation seeking damages. A \$750 million settlement was announced in June.

Bringing together techniques from game theory and econometrics, the *Brattle* team developed an innovative and detailed dynamic market model to estimate the specific impacts of Microsoft anti-competitive conduct on the market for internet browsers. The tools developed for that case offer a powerful way to examine the impact of anti-competitive conduct or patent infringement in all industries and, particularly, those characterized by network effects.

The *Brattle* team included Drs. Kenneth Wise, Bill Moss, and Paul Liu from the San Francisco office. Rosa Matzkin, Professor of Economics at Northwestern University, assisted *The Brattle Group* as a Senior Advisor.

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