NEW TOOLS FOR THE CALCULATION OF INFRINGEMENT DAMAGES

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48th Annual Conference
On Intellectual Property Law

The Center for American and International Law – Plano, Texas

November 8, 2010

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I. Introduction

Until recently, the computation of damages in patent infringement litigation was, for the most part, straightforward. The template was described in *Georgia-Pacific*.[1] An economist or accountant would review the 15 *Georgia-Pacific* factors and produce a royalty rate "adequate to compensate for infringement."[2] Underlying the analysis were assumptions that the patent in suit was valid and infringed and that the parties (patent holder and infringer) would enter into a "hypothetical negotiation" shortly before infringement began. The assumed outcome of that negotiation would produce a royalty rate (or combination upfront lump sum payment plus a running royalty rate) that would be applied to the damage base of infringing sales.

Only three of the *Georgia-Pacific* factors (1, 2 and 12) reference an actual royalty rate (see Exhibit 1, "*Georgia-Pacific* Factors"). The other 12 factors are directional, i.e., up or down from the starting point royalty rate devised in accordance with factors 1, 2 and 12. Factor 1 examines "royalties received by the patentee" for licensing the patent in suit. Factor 2 addresses "rates paid by the licensee" (i.e., the infringer) for other patents *comparable* to the patent in suit. Factor 12 directs one to examine industry standard rates customarily associated with "comparable businesses." In essence, these three factors establish appropriate benchmarks (i.e., "comparable") to use as a starting point.

Traditionally, the expert would review license agreements produced in discovery (Factors 1 and 2), publicly available royalty rates obtained from 10-K reports, or databases such as

[1] *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116 (1970).
[2] The Patent Act of 1952 (35 U.S.C. §284).

RoyaltyStat (Factor 12) to obtain a starting point with respect to the hypothetical negotiation referenced earlier (call this Part A of the analysis). The expert would then review the remaining 12 factors (Part B of the analysis) and decide whether the starting point obtained in Part A should be adjusted up or down.

The analysis described above was tempered by *Grain Processing*,[3] which stands for the reasonable proposition that royalties paid by an infringer cannot exceed design around costs. However, it is hard to calculate design around costs. This is typically a job for a technical expert who is asked to determine the cost of a product that was never manufactured. The analysis is also influenced by the "entire market value rule" which is referenced in *Rite-Hite*[4] and elsewhere. The entire market value rule requires that the patented feature (as opposed to other factors) be responsible for customer demand for the royalty rate obtained through Parts A and B of the analyses in order to be applicable to the entire base of infringing sales. To simplify, the entire market value rule can be thought of as an apportionment problem – how much of the value of the product embodying the patented feature is attributable to the patented feature, and how much is attributable to other factors (i.e., other patents, experience, marketing, brand name, etc.).

Although these were the rules, real world data limitations meant that it was not always possible to be as analytical as one might have wished. If license agreements and royalty rates were available (Part A of the analysis) typically some sort of subjective averaging of those rates would be necessary to come up with a starting point royalty rate. If relevant license agreements were not available, it would be even more difficult to obtain a starting point royalty rate. In either case, the rate obtained in Part A of the analysis would be tweaked up or down during the Part B phase of the analysis. Even when license agreements were available, they typically

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[3] *Grain Processing Corp. v. American Maize-Products Company*, 185 F. 3d 1341 (1999).
[4] *Rite-Hite Corp. v. Kelley Co., Inc.*, 56 F. 3d 1538 (1995).

included other patents, know-how, or cross license provisions. These real world complications made it difficult to separate out the value of the patent(s) in suit from other assets included in these agreements.

Things began to get more complicated with *eBay*.[5] After *eBay*, an injunction would no longer issue automatically upon a finding of infringement. This represents a significant shift in favor of the infringing party with respect to the value of the patent(s) in suit. *Spreadsheet Automation*[6] contemplated that settlement agreements and licenses reached under the threat of litigation were not admissible (previously, they were admissible in most jurisdictions). Since most license agreements are the direct result of actual or threatened litigation, this meant that the number of license agreements available for Part A of the analysis was significantly reduced, resulting in an even thinner base from which to estimate a starting point royalty rate. *Paice*[7] raised the standard of proof to include unspecified "additional economic factors" as part of the analysis.

But the real shot across the bow is *ResQNet*,[8] which focuses on the requirement that licenses analyzed for the purpose of determining a reasonable royalty bear some relationship to the claimed invention (i.e., the licenses need to be "comparable"). Clearly, the most comparable license would be one that included the patent in suit. Often, however, the patent had never been licensed before; even if there were prior licenses, they frequently included additional patents and know-how. And even if the patent had been licensed separately, economic conditions may have changed and the uses to which the patented technologies are put may be different. This leaves

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[5] *eBay Inc. v. MercExchange, LLC*, 126 S. Ct. 1837 (2006).
[6] Order, *Spreadsheet Automation Corp. v. Microsoft Corp.*, 2:05-CV-127-DF, February 23, 2007.
[7] *Paice, LLC v. Toyota Motor Corp.*, 504 F. 3d 1293 (2007).
[8] *ResQNet.com, Inc. v. LANSA, Inc.*, 594 F. 3d 860 (2010).

the expert without building blocks necessary for a sound, admissible analysis, which is not a comfortable place to be in a time of almost automatic *Daubert*[9] challenges.

Spreadsheet Automation was ultimately reversed by *Tyco*,[10] so that settlement agreements are now back in the analysis, meaning that the database of available information is larger. But *ResQNet*, which also noted that "the most reliable licenses in the record arose out of litigation," still requires comparability, and *ResQNet* has been receiving almost as much attention as *Georgia-Pacific*. Unless the patent in suit has been licensed, it would seem to be virtually impossible to say whether a particular license involving some other technology, even when the patents in suit are part of that license, is "comparable" without a mini-trial on comparability. The enhanced standard for determining comparability also implicates Georgia-Pacific Factors 2 and 12, both of which invite comparisons with other license agreements. But that is the standard to which experts are now being held.

In essence, the *Georgia-Pacific* analysis has been elevated to a higher standard. While the consensus view among attorneys and experts is that these changes are technically sound (i.e., they require the use of *relevant* benchmarks rather than random license agreements), the question is how to meet these higher standards when the concept of a *hypothetical negotiation* confronts *real world* data.

To summarize, patent damages law is at a juncture where both the courts and practitioners should be receptive to the application of new tools, techniques, and methods of analysis that can be used for the purpose of calculating royalties. The environment is ready for an analytical approach that goes well beyond a traditional *Georgia-Pacific* analysis.

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[9] *William Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 113 S. Ct. 2786 (1993).
[10] Memorandum Opinion and Order, *Tyco Healthcare Group LP v. E-Z-EM, Inc.*, 2:07-CV-262 (TJW), March 2, 2010.

The analytical problem is related to the real world and the available data. Almost all products that employ a patented technology typically use hundreds of other patents as well. (See Exhibit 2, "Number of Semiconductor Patents Issued to Selected Companies, 1985-2009.") This is particularly true in high tech industries – semiconductors, cell phones, ATM machines, etc. which raises questions such as, how does one evaluate the contribution of a single specific patent (or a family of patents) in an evolutionary environment when nothing remains constant for much longer than a nanosecond? What role should be assigned to competition, the state of the economy, management, other product features, brand name, etc.? Does "comparability" refer to technical features associated with the patented claims, temporal relationships, the presence or absence of ancillary technology or know-how, economic conditions, the form of candidate benchmark license agreements (i.e., running royalty or lump sum), etc.? Providing answers to these questions has become the new required task.

II. Navigating the Typical Fact Pattern

A frequently encountered fact pattern in infringement cases is as follows:

1. The patent in suit has never been licensed, or, when it has been licensed, it has never been licensed by itself. Instead, it has been licensed along with know-how, other patents, or as part of a cross license agreement. This means that there is no established value for the patent in suit.
2. The patent in suit has never been licensed absent actual litigation or the threat of litigation. This means that licenses involving the patent were subject to uncertainty about the outcome of pending or contemplated litigation. They also may have been influenced by other factors such as the relative bargaining positions of the parties, economic conditions, etc.

3. The alleged infringer has never licensed a single patent, let alone a single patent that is demonstrably comparable to the patent in suit. Its licenses typically include other patents, know-how or are part of a cross license agreement.
4. The infringing product requires access not only to the patent in suit, but also to hundreds or thousands of other patents.
5. The infringing entity engages in extensive research and development efforts, much of which is not segregated by product.
6. The infringing entity maintains a significant sales and marketing department which is not broken down by product lines that correspond precisely to infringing product sales.
7. The infringing entity claims to possess no product line profit data; the narrowest available breakdown is what appears in SEC filings.

How does one navigate the new world of patent infringement damages given this fact pattern? Perhaps the best overall guidelines are found in *Lucent*.[11] Lucent begins with reference to "the analytical method," which is described as "calculating damages based on the infringer's own internal profit projections for the infringing item at the time the infringement began, and then apportioning the projected profits between the patent owner and the infringer." This is helpful since it allows one to rely on the kinds of documents that most companies create and maintain, such as internal forecasts and profit plans. While in the past, these documents might have been considered under Georgia-Pacific factors 8 or 12, *Lucent* seems to suggest that they enter directly into the analysis, even before one gets to *Georgia-Pacific*. Thus, Lucent provides a sensible way to circumvent the data limitations that one typically encounters.

[11] *Lucent Technologies, Inc. v. Gateway, Inc.*, 580 F. 3d 1301 (2009).

After addressing the analytical method, *Lucent* turns to a discussion of the traditional *Georgia-Pacific* analysis. In general, it seeks evidentiary support in connection with the following questions: (1) Would the hypothetical negotiation have produced a lump sum or running royalty agreement; (2) In what ways do the circumstances surrounding the hypothetical negotiation differ from the circumstances that produced license agreements referenced by the *Lucent* litigants; (3) How important is the patent in suit relative to other patents and technology that contribute to the use and success of the final product, i.e., how does the entire market rule figure into the analysis; and (4) What is the role of post infringement evidence. We address each of these questions below.

1. Lump Sum or Running Royalty

Lucent recognizes that "significant differences exist between a running royalty license and a lump-sum license." It correctly notes that with a lump sum payment, the licensor is able to obtain funds quickly, while the licensee is able to cap its liability. A lump sum license also eliminates the need for ongoing monitoring of sales in order to compute royalties and creates symmetrical risks for the parties that one side or the other has underestimated the value of the technology in question. Also, the way in which risk is allocated between the parties is impacted by the form of the license (lump sum or running royalty).

Lucent suggests that there are at least three areas of investigation to be addressed in connection with whether the hypothetical negotiation would produce a lump sum or running royalty agreement. First, evidence should be developed that relates to the expectations of the parties as to how the patented method would be used by consumers. This evidence should then be connected to the kind of agreement that would likely have emerged from a hypothetical negotiation. Second, there should be factual testimony explaining how actual license agreements

structured as a running royalty would be probative of lump sum payments in those instances when it was believed that hypothetical negotiation would have produced a lump sum agreement. Third, the context governing previous license agreements involving the parties should be understood if those agreements are to be used as possible benchmarks for the hypothetical negotiation.

2. Context

Time and again, *Lucent* states that it is plaintiff's burden to prove that the licenses relied upon are *sufficiently comparable* to sustain the running royalty rate or the lump sum payment advocated by the plaintiff. The *Lucent* court seemed to be seeking an explanation of how differences between the real and the hypothetical negotiations would factor into the royalty calculation. It also sought a basis for translating running royalty rates found in prior agreements into lump sum equivalents for those instances in which the hypothetical negotiation was believed to produce a lump sum agreement. Finally, *Lucent* sought evidence supporting the choice of lump sum or running royalty as the outcome of the hypothetical negotiation.

3. The Entire Market Value Rule

The most fundamental articulation of the entire market value rule is that damages can be based on the value of an entire product or apparatus when the patented feature constitutes the basis for customer demand. Accordingly, *Lucent* stated that it would be important to understand the reasons why consumers purchased products containing patented features when factors other than the patented features contributed to the economic value. That said, *Lucent* allowed some leeway to enter the analysis by noting that "the base in a running royalty calculation can always be the value of the entire commercial embodiment as long as the magnitude of the rate is within an acceptable range determined by the evidence." This is a critically important concession to the

realities of calculating damages in a real world environment where the usual circumstance finds multiple patents and technologies contributing to the production and sale of products containing infringing features.

4. The Role of Post Infringement Evidence

Lucent recognized that "evidence of usage after infringement started can, under appropriate circumstances be helpful to the jury and the court in assessing whether a royalty is reasonable." This seems to adopt the well-known *Book of Wisdom* for guidance.[12] *Lucent* suggested that such evidence could "come from sales projections based on past sales, consumer surveys, focus group testing and other sources." It also recognized that "companies in the high-tech computer industry often strike licensing deals in which the amount paid for a particular technology is not necessarily limited to the number of times a patented feature is used by a consumer."

Paice went further than *Lucent* with respect to the role of post infringement evidence. *Paice* recognized that since *eBay*, granting the patent holder a permanent injunction after a finding of infringement was no longer automatic. Accordingly, *Paice* called for the taking of additional evidence as appropriate to account for economic factors arising out of a finding of infringement. *Paice* noted that pre-suit and post-judgment acts of infringement are distinct and may warrant different royalty rates given the changed legal circumstances between the parties and the fact that the ongoing use of the patented technology after a finding of infringement constitutes an element of willfulness that is subject to enhanced damages under the law. In view

[12] "[A] different situation is presented if years have gone by before the evidence is offered. Experience is then available to correct uncertain prophecy. Here is a book of wisdom that courts may not neglect. We find no rule of law that sets a clasp upon its pages, and forbids us to look within" (*Sinclair Refining Co. v. Jenkins Petroleum Process Co.*, U.S. 689, 698, 53 S. Ct. 736, 77 L. Ed. 1449 (1933)).

of these circumstances, *Paice* recognized that a district court may prefer the simplest course and impose its own compulsory license for future infringement. This, however, would afford the parties "the least chance to inform the court of potential changes in the market or other circumstances that might affect the royalty rate reaching into the future" once the nature of the relationship between the parties changed after a finding of infringement. Indeed, *Paice* determined that the best course of action would be to allow the parties to negotiate their own rate prior to the imposition of one by the court. However, if the parties were unable to reach an agreement, the court would retain the authority to impose its own reasonable royalty to remedy past and ongoing infringement.

III. Candidate Analytical Approaches

An earlier discussion appearing in the *Journal of Law and Technology*[13] set out the conditions governing negotiation outcomes under alternative assumptions. In view of the movement away from the most simplistic type of *Georgia-Pacific* analyses in favor of approaches that connect the hypothetical negotiation to economic conditions in the real world, portions of that earlier discussion are worth repeating. Summarizing briefly:

1. If the licensing firm is incapable of manufacturing any product embodying its invention, its bargaining position depends ultimately on the licensee's outside alternatives. Other things equal, the greater the mark-up on products embodying the patented technology, the greater the royalties should be for its use since the patent holder and licensee get to split a larger pie. On the other hand, the more lucrative the

[13] Weinstein, Roy and William Choi, "An Analytical Solution to Reasonable Royalty Rate Calculations," *The Journal of Law and Technology*, Vol. 41, No. 1, 2001.

licensee's next best alternative absent the patented technology, the lower the value of the patent.

2. If the licensing firm possesses production capabilities, the patent holder has no incentive to license unless (a) the licensee can produce at lower costs than the patent holder and/or (b) the licensee can serve markets the patent holder is unable to access. Under these circumstances, the royalty rate will increase with the mark-up on the patented technology. Terms of the license agreement also will favor the party having the better outside alternatives to licensing.
3. The underlying value of a patent also is based on the present value of past and future economic benefits. These benefits will reflect cash flows from the point in time when infringement began through the life of the patent. Estimates of a reasonable royalty are aided by information pertaining to manufacturing costs, research and development expense, marketing expenditures, and market size. Independent market analyst reports can help supplement internal market forecasts.

With these conditions in mind, one can begin by noting that the hypothetical negotiation framework asks one to evaluate the differences between a world in which the patented invention is used by a licensee and a world in which it is not, and assign values to those differences (measured in terms of performance, sales, profits, etc.). Conceptually, some of the tools routinely employed by economists and statisticians in other applications are candidates for use in this context. These tools are described below.

In *hypothesis testing*, the analyst compares an actual world with a hypothetical one.[14] The analyst then evaluates the difference between the actual and hypothesized outcomes using

[14] Weil, Roman L., et al., *Litigation Services Handbook*, Fourth Edition, John Wiley & Sons, 2007, p. 30.6.

statistical tests to determine if the differences are statistically significant (i.e., the outcomes are likely or unlikely to have occurred by chance). These tests permit one to formulate opinions concerning whether statistically significant differences exist between two or more series of numbers. For example, in employment cases, the economist is frequently asked whether differences in average compensation or average time to promotion exist between different classes of employees. A *t*-statistic allows one to compare these kinds of averages and reach conclusions as to whether those differences are a product of chance on the one hand or statistically significant on the other.

Data permitting, this type of test could be applied in a patent damages context. Suppose, for example, one is able to generate two sets of profit data, one that includes profits obtained using the patented invention and one that measures profits absent the patent(s) in suit (or one that includes profits obtained by a licensee and one that includes profits of an infringer). One could calculate the "*t*-statistic" associated with the difference in average profits between the two streams, and derive the probability of the difference occurring by chance and, thus, reach a conclusion as to whether the two streams differ significantly from one another. If they are, then absent other information, presumably the differences are attributable to the patent(s) in suit. In general, the greater the number of observations, the more likely a difference will be statistically significant. *T*-tests can be used to compare economic variables such as profits, revenues, or costs; they also can be used to compare technological concepts, like speed of operation.

Ordinary least squares regression analysis is another seldom-used tool in patent damages litigation. To date, its primary application in patent litigation has been in connection with an analysis of fixed v. variable costs. Regression analysis is used to make quantitative estimates of

economic relationships.[15] It allows one to simultaneously control for more than one factor and also identify the relationship between each *independent* variable included in the regression model on the one hand and the *dependent* variable on the other. Although many economic relationships are, in fact, causal by their very nature, regression results, regardless of their statistical significance, do not establish causality. Instead, regression analysis can test whether a significant quantitative relationship exists. Judgments as to causality require further thought.

To illustrate the use of regression analysis in the context of intellectual property disputes, consider the following example. Suppose the question is whether an oral contraceptive patent has a significant impact on product sales. This can be an important question in establishing a connection between the patented claims and the *commercial success* of the product. It is also relevant to the calculation of patent damages. Oral contraceptive patents typically relate to the dosages of estrogen and progestin; over time, the tendency has been for new oral contraceptive formulations to reduce dosages to smaller and smaller amounts of these two drugs on the theory that less medicine in the body is preferable to more, as long as the intended purpose is met (i.e. to prevent conception). Regression analysis can be used to determine the relationship between dosage and sales. Depending on the statistical significance of the effect of dosage and the direction of the effect, the relationship can be determined if patients and prescribing physicians prefer oral contraceptives with less estrogen and progestin.

The problem, of course, is that factors other than dosage also affect sales. These factors can include detailing expense, cost of samples, journal advertising expense, direct to consumer advertising, brand name of the manufacturer, price, etc. Regression analysis is the ideal tool for

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[15] Studemund, A. H., *Using Econometrics: A Practical Guide*, Fourth Edition, Addison Wesley Longman, 2001, p. 7.

separating out the impact of each of these factors simultaneously. Equally important, pharmaceutical industry participants create, maintain and rely on extensive data reflecting each of these factors – data that, in many cases, go back as far as the 1970s. The availability of this information allows economists and econometricians to undertake an investigation that includes regression analysis. Such an analysis allows one to quantify the relationship (if any) between each of the independent variables (detailing expense, cost of samples, etc.) and the dependent variable (oral contraceptive sales).

In the case of patent damages, when data permit, regression analysis could be used to examine the impact of various factors that might affect product sales. These could include product features such as speed of operation, which, in some cases, can be attributed to the patented claims. Other factors that might affect product sales could include the availability of other patents, research and development expense, economic conditions, etc. Regression analysis allows one to sort out the relative importance of each factor potentially impacting product sales. By measuring the importance of the patent relative to other factors, regression analysis can provide useful information for determining an appropriate royalty in the context of the hypothetical negotiation.

Several additional tests are sometimes employed along with regression analysis. A *joint F test* is used to determine whether multiple independent variables in a regression analysis are jointly significant.[16] In the context of patent damages litigation, once a regression analysis has been performed, a *joint F test* could be useful in determining whether a group of factors, separate and apart from the patented claims, jointly influence a product's revenue, price, profit margin, etc.

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[16] Studenmund, A. H., *Using Econometrics: A Practical Guide*, Fourth Edition, Addison Wesley Longman, 2001, pp. 237-238.

A *Chow test* is used to determine whether the independent variables have different effects on the dependent variable in separate subsets of the data.[17] This could help one determine the extent to which any of the independent variables had significantly different influences during two separate time periods, such as before and after the patented technology was practiced.

Similarly, a *chi-square test* is used to determine whether two or more categorical variables are statistically independent, in other words, are the distributions of the factors the same.[18] For example, if there is a pre- and post-period at issue, one can use a chi-square test to determine if the distribution of a factor is statistically similar.

Finally, using a *Fisher's exact test*, one can calculate the probability that the observed outcome could have occurred by random chance.[19] This test is often used in the same context as a *chi-square test.* For example, suppose the distribution of sales was significantly different between competing products after the onset of infringement. A *Fisher's exact test* can ascertain whether the expected and the actual number of units sold are significantly different. This could be interpreted to mean that "something" happened, presumably related to the presence of the patented technology.

The central point is that tools customarily used by economists and statisticians in other contexts may have applicability to the calculation of patent damages. The tools described here allow one to isolate the importance or one or more variables. Accordingly, use of these tools has the potential to add a significant element of rigor to the traditional *Georgia-Pacific* analysis. In

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[17] Greene, William, H., *Econometric Analysis*, Fifth Edition, Prentice Hall, 2003, pp. 130-131.
[18] Picconi, Mario J., et al., *Business Statistics: Elements and Applications*, HarperCollins College Publishers, Inc., 1993, pp. 647-648.
[19] Studenmund, A. H., *Using Econometrics: A Practical Guide*, Fourth Edition, Addison Wesley Longman, 2001, pp. 558-559.

light of recent changes in the landscape of patent damages law, this would be an important step forward.

IV. Conclusion

The world of patent damages has evolved considerably in recent years. One can no longer count on an automatic injunction following a finding of infringement. Further, strict adherence to a *Georgia-Pacific* standard and routine reliance upon license agreements that are not limited to the patent in suit (and which, therefore, may not have been strictly comparable in terms of value given and received) no longer ensures that damages calculations will pass muster at the District Court level and especially with the Federal Circuit. These challenges are compounded by the fact that in the real world, and especially in the current environment where so much innovation involves high-tech industries, many inventions employ not only the patented technology but a combination of other patents and considerable know-how unrelated to the patent(s) in suit. The value of inventions also may be influenced by economic conditions, marketing efforts, management, brand name, pricing, etc.

The task, then, is to identify tools and approaches suitable for use in this new environment. Many of these tools already exist and are routinely employed by economists and statisticians in other areas of the law. Application of these tools to the calculation of patent damages in the new environment will produce more robust results.

One additional thought: In the world of antitrust, regulators such as the Department of Justice and the Federal Trade Commission have issued *Merger Guidelines* from time to time. These have provided business entities and their counsel with important information regarding the likelihood that a merger or acquisition would be subject to regulatory challenge. Given the enormous costs and dislocations associated with consummating such transactions, the

availability of this kind of information promoted economic efficiency by allowing the parties to know in advance the likely outcome of business deals under consideration. The world of patent damages is presently without an equally strong set of rules that help guide one safely through the analysis. Perhaps application of some of the tools identified herein will help move things along in that direction.

About the Authors

Roy Weinstein is an economist and President of Micronomics. Mr. Weinstein has been engaged in economic research and consulting since 1969. Areas of expertise include industrial organization, antitrust economics, the valuation of intellectual property, wage and hour litigation, statistics, econometrics and the calculation of economic damages. He has testified as an economic expert in numerous jurisdictions and has spoken before the American Bar Association, the National Association of Attorneys General, the National Association of Business Economists and the Los Angeles County Bar Association. Mr. Weinstein's articles have been published in the *Journal of the Patent and Trademark Office Society*, the *Journal of Law and Technology* and the *Antitrust Bulletin*. He received his Bachelor of Business Administration degree cum laude with honors in economics from City College New York and his Master of Arts degree in economics from the University of Chicago. He is a recent recipient of the Career Achievement Award from the Business and Economics Alumni Society of the Baruch School at City College.

Janet Thornton is a Director in the Tallahassee, Florida, office of ERS Group, where she has specialized in analyzing credit and employment decisions since 1986. Dr. Thornton has prepared economic and statistical analyses involving allegations of gender, race, ethnicity, and age discrimination in a variety of employment practices including selection, termination, and compensation as well as Fair Labor Standards Act compliance. She has prepared analyses for employers both proactively and in response to litigation and OFCCP audits. As an expert witness, Dr. Thornton has appeared in administrative hearings and before federal district courts and regulatory agencies, such as the Federal Trade Commission and the Federal Reserve. Her testimony has never been rejected by any court. She is experienced in both large class action and single plaintiff litigation and has testified for plaintiffs and defendants regarding issues of liability, damages, settlement, and class certification. She has been involved in matters such as *Rhodes v. Cracker Barrel*, *McDermott v. Cracker Barrel*, *Rodriguez v. Ford Motor Credit*, and *Crum v. State of Alabama.* Dr. Thornton is an adjunct professor of quantitative methods and statistics at Florida State University. She has published papers in the *Journal of Legal Economics* and in the *Journal of Forensic Economics*, and co-authored a chapter in the anthology Developments in Litigation Economics. Dr. Thornton holds doctoral and master's degrees in economics from Florida State University and a bachelor's degree from the University of Central Florida in economics and political science.

Paul White is the Managing Director of ERS Group's Washington, D.C. office. He has been with ERS since 1993. His nationwide practice areas cover all aspects of employment discrimination cases, including: compensation, hiring, promotion, and termination. Dr. White's labor and employment practice also includes OFCCP investigations of federal contractors, proactive monitoring of compensation and employee selections, FLSA wage and hour cases, economic damages (single-plaintiff, multi-plaintiff, and class actions), EEOC investigations, union contract negotiations, and NLRB hearings. Additionally, Dr. White has conducted analyses on mutual fund trading practices, asbestos exposure and prescription drug pricing. Dr. White has testified on numerous times on behalf of plaintiffs and defendants in local, state, and federal courts. He has

assisted employers such as Duke Energy, Coca Cola and the University of Georgia in their OFCCP compensation audits. Dr. White has served as an adjunct member of the graduate school faculty at Florida State University and has published papers in the *Journal of Forensic Economics* and the *Journal of Applied Business Research.* He received his Bachelor of Science degree in economics from James Madison University and his Masters and Ph.D. degrees from North Carolina State University.

About Micronomics

Micronomics is an economic research and consulting firm located in Los Angeles, California. Founded in 1988, it is engaged in the application of price theory, analysis of issues relating to resource allocation, and assessment of real-world problems requiring practical and sound solutions. Micronomics focuses on industrial organization, antitrust, intellectual property, the calculation of economic damages, employment issues, and the collection, tabulation and analysis of economic, financial and statistical data. Clients include law firms, publicly and privately held businesses, and government agencies.

About ERS Group

ERS Group is the preeminent economic and statistical consulting firm for analyses related to employment matters. Founded in 1981, with offices in Tallahassee, Washington, D.C. and San Francisco, its statistically sound studies provide clients with a better understanding of their organizations and decision-making processes. Its research has been used by clients in high stakes employment litigation and regulatory matters involving allegations of discrimination in hiring, promotion and compensation. Its national reputation is founded on the unparalleled experience of its Ph.D. economists and testifying experts. Its reach extends to more than 3,000 clients, including Fortune 500 companies, prominent law firms, universities, government agencies, and industry trade associations. Its experts also have been asked to share their experience and knowledge with regulatory agencies such as the Office of Federal Contract Compliance and the Equal Employment Opportunity Commission.

EXHIBIT 1

Georgia-Pacific Factors

1. ***The rates received by the patentee for licensing the patents 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 unrestricted in terms of territory or with respect to whom the manufactured product may be sold.**

4. **The licensor's established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly.**

5. **The commercial relationship between the licensor and licensee, such as whether they are competitors in the same territory in the same line of business or whether they are inventor and promoter.**

6. **The effect of selling the patented specialty in promoting the 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 patented property over the old modes or devices, if any, that have 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 of those who have used the invention.**

11. **The extent to which the infringer has made use of the invention and any evidence probative to the value of that use.**

12. ***The portion of the profit or of the selling price that may be customary in the particular business, or in comparable businesses, to allow for the use of the invention or analogous inventions.***

13. **The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.**

14. **The opinion of qualified experts.**

15. **The amount that a licensor (such as a patentee) and a licensee (such as an 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.**

Note: Factors 1, 2 and 12 (which are italicized) provide guidance as to an appropriate starting point for the royalty rate; the other factors are directional in that they may suggest upward or downward adjustments in the starting point rate.

EXHIBIT 2

NUMBER OF U.S. SEMICONDUCTOR PATENTS ISSUED TO SELECTED COMPANIES 1985 - 2009

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total 1985-2009
	(Number of Patents Issued)																									
1. AMD	13	27	42	37	42	40	33	26	29	43	38	94	157	333	559	741	833	884	673	587	366	288	190	131	121	**6,327**
2. Broadcom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	41	75	115	121	107	92	112	**683**
3. Fujitsu	91	115	116	112	122	111	136	121	130	157	203	218	229	295	265	298	341	395	391	410	377	347	343	402	359	**6,084**
4. Harris	14	14	29	17	23	27	24	21	24	27	31	29	39	36	34	3	7	13	5	4	5	7	3	6	3	**445**
5. Hitachi	124	107	152	154	209	214	231	199	210	274	234	249	232	269	254	289	345	506	631	525	428	661	553	573	427	**8,050**
6. Hynix	0	0	0	0	0	1	14	11	15	39	73	94	111	154	165	207	367	372	324	330	315	356	326	337	454	**4,065**
7. IBM	174	163	151	152	165	159	196	250	337	392	451	590	568	857	894	942	1,174	1,231	1,140	1,114	1,092	1,294	1,101	1,443	1,575	**17,605**
8. Intel	10	8	11	21	31	19	29	41	69	105	140	212	212	348	364	384	374	483	721	736	712	942	834	794	641	**8,241**
9. LSI Logic	0	1	1	3	5	1	3	10	22	28	49	77	93	113	165	169	113	138	185	185	167	153	34	40	10	**1,765**
10. Lucent	0	0	0	0	0	0	0	0	0	0	0	40	99	103	152	221	155	56	52	36	35	39	29	35	50	**1,102**
11. Micron	0	0	0	0	5	18	53	87	132	80	49	83	250	460	791	1,015	1,240	1,320	1,261	1,323	1,232	1,221	1,150	959	728	**13,457**
12. Mosaid	0	0	0	1	0	1	2	1	4	2	6	4	6	12	9	12	10	10	19	17	13	23	13	11	31	**207**
13. NEC	13	49	80	95	124	129	142	154	184	375	334	355	413	514	644	706	698	646	481	323	276	252	260	232	291	**7,770**
14. NSC	13	8	13	16	30	20	41	45	54	63	75	92	91	97	104	89	82	84	91	83	84	97	79	64	69	**1,584**
15. Philips	38	51	65	59	66	73	78	54	60	61	59	51	61	76	70	92	121	160	191	158	96	104	48	38	43	**1,973**
16. Sanyo	3	11	12	13	17	7	17	19	27	14	17	21	24	38	41	42	52	75	96	104	120	136	110	101	94	**1,211**
17. STMicroelectronics	0	0	0	7	25	47	60	69	66	112	105	139	163	214	235	258	277	273	286	232	187	207	186	174	138	**3,460**
18. Texas Instruments	77	92	128	88	218	154	201	194	185	251	281	265	273	286	329	381	385	297	303	403	297	300	273	261	228	**6,150**
19. Toshiba	8	58	128	129	199	220	281	286	297	335	316	318	333	413	457	487	431	435	470	529	540	702	594	606	658	**9,230**
20. Unisys	0	0	10	17	17	19	19	14	11	21	40	50	36	48	32	32	31	28	21	33	20	22	20	16	17	**574**
21. Total	**578**	**704**	**938**	**921**	**1,298**	**1,260**	**1,560**	**1,602**	**1,856**	**2,379**	**2,501**	**2,981**	**3,390**	**4,666**	**5,564**	**6,368**	**7,042**	**7,420**	**7,382**	**7,207**	**6,477**	**7,272**	**6,253**	**6,315**	**6,049**	**99,983**

Note: Semiconductor patents are defined as patents with at least one of the following current US classifications: 257, 365, 438, 710, 711, or 713.

Source: U.S. Patent and Trademark Office Website (http://www.uspto.gov).