THE LIKELY ADVERSE EFFECTS OF AN APPORTIONMENT-CENTRIC SYSTEM OF PATENT DAMAGES

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Executive Summary

Recently, critics of the U.S. patent system have called for a change in the way damages are calculated in patent infringement lawsuits. In the 110th Congress, legislation was proposed to change the method of calculating damages from a common-law methodology which equally considers a variety of factors to a statutory methodology elevating one factor, "apportionment," above others.

The purpose of this report is to outline the likely effects of an apportionment-centric system of damages. Contrary to the arguments made by proponents of this legislation, an apportionment-centric system of damages will likely have several adverse effects, including the following:

1. Reduction in U.S. patent value of between $34.4 billion and $85.3 billion.
2. Reduction in value of U.S. public companies of between $38.4 billion and $225.4 billion.
3. Reduction in R&D of between $33.9 billion and $66 billion per year.
4. Between 51,000 and 298,000 U.S. manufacturing jobs put at risk.
5. Industries employing fewer people favored over those employing more people.

The following paper provides a detailed explanation of the analyses underlying these estimates.

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Introduction

Recently, critics of the U.S. patent system have called for a change in the way damages are calculated in patent infringement lawsuits. In the 110th Congress, legislation was proposed to change the method of calculating damages from a common-law methodology which equally considers a variety of factors to a statutory methodology elevating one factor, "apportionment," [1] above others. Although the legislation also allows the consideration of other common-law factors, those factors likely would become secondary considerations because courts would be reluctant to ignore a clear Congressional preference for apportionment.

The proponents of apportionment of damages have argued that the current patent system is flawed and hampers innovation, and that apportionment is needed to remedy those flaws. Unfortunately, in all of the rhetoric about the inadequacy of the U.S. patent system, the resulting problems faced by innovators in this country, and the need to elevate apportionment of damages to solve those problems, careful examination of the likely effects of an apportionment-centric system of damages have been lost.

The purpose of this report is to outline some of those effects in order to inform policy makers and other stakeholders. Contrary to the arguments made by proponents of this legislation, an apportionment-centric system of damages will likely have several adverse effects, including:

1. Reduction in U.S. patent value of between $34.4 billion and $85.3 billion.
2. Reduction in value of U.S. public companies of between $38.4 billion and $225.4 billion.
3. Reduction in R&D of between $33.9 billion and $66 billion per year.
4. Between 51,000 and 298,000 U.S. manufacturing jobs put at risk.
5. Industries employing fewer people favored over those employing more people.

The next section of this report describes the evidence for these effects. The final section offers several conclusions for patent policy.

The Expected Effects of an Apportionment-Centric System of Damages

1. **An apportionment-centric system of patent damages would reduce the value of patented technology substantially.** Patents are a negative right; they give the patent holder the right to exclude others from practicing that invention. To do this, the patent holder must be willing to enforce his/her patent by bringing legal action to either seek an injunction or collect damages in the event of infringement. Because injunctive relief is increasingly difficult to obtain following the U.S. Supreme Court's decision in *eBay vs. MercExchange* (2006), the value of a patent is best determined as a function of the amount of damages one can collect if one wins an infringement lawsuit. Reducing the amount of damages reduces the value of patents, and reducing the value of patents reduces the value of patented technology.

   To estimate how much an apportionment-centric system of damages would reduce the value of patents and patented technology, we first need to estimate the amount that patent damages would change if the apportionment of damages legislation were enacted. We do this through a survey of a randomly selected group of patent attorneys employed by law firms (rather than corporate patent attorneys). The attorneys were asked to review legislative language from the 110th Congress and then determine how much they would expect that language, if enacted, to increase or decrease damage awards. (A full description of the survey methodology appears in the endnotes.[2]) The respondents typically estimated (median response) that an apportionment-centric system would result in a decrease in damage awards of between 20 and 39 percent.

   The next step is to estimate the value of U.S. patents. To do this, we multiply average patent value by the total number of U.S. patents in force. Three academic studies examining the average value of U.S. patents are useful: one by James Bessen, Lecturer in Law at Boston University, conducted in 2006; one by Jonathan A. Barney, an intellectual property attorney in Newport Beach, California, conducted in 2002; and one by Jonathan Putnam of Yale University, conducted in 1996. The three studies put the average value of a U.S. patent at between $93,463 and $118,988 (in 2008 dollars). In 2008, there were 1,838,242 U.S. patents in force.[3] At the average values reported by Bessen, Barney and Putnam, the total value of U.S. patents is between $171.8 billion and $218.7 billion.

   The final step is to estimate the resulting impact of lower damages on patent value. Because the value of a patent is a function of the amount of damages one can collect if one wins an infringement lawsuit, we multiply the expected reduction in damages estimated by the surveyed patent attorneys by the current value of patents in force. Using the median survey responses (a reduction of between 20 and 39 percent), we find that the proposed legislation would reduce the value of U.S. patents by between $34.4 and $85.3 billion.

2. **An apportionment-centric system of patent damages would reduce the value of public corporations.** The proposed legislation would reduce the value of public

corporations by an amount proportional to the share of their value that comes from their patent holdings and their relative dependence on patents as a source of competitive advantage. Although existing research in this area varies, one can estimate a reasonable range of outcomes by taking a middle ground between conservative and liberal methodologies.

a. *Conservative Methodology – Estimated Total Value of U.S. Patents Held by Public Companies Divided by the Market Value of Those Companies.* We can conservatively estimate the share of the value of public companies attributed to patents by taking the estimate of the value of U.S. patents in force that are held by public companies and dividing it by the total value of U.S. public companies.

   According to research by James Bessen, 45 percent of the value of U.S. patents is held by public companies.[4] At the averages reported by Bessen, Barney and Putnam, this means that the total value of U.S. patents held by U.S. public companies is between $77.3 billion and $98.4 billion. On November 17, 2008, the market capitalization of the Wilshire 5000 was $9.8 trillion. Thus, using a conservative estimate, the value of patents held by U.S. public companies was between 0.8 and 1.0 percent of the value of those companies.

   As mentioned in the previous section, the proposed apportionment of damages legislation is estimated to reduce the value of patents by between 20 and 39 percent. As a result, the proposed legislation would reduce the value of patents held by U.S. public companies by between $15.5 billion and $38.4 billion, and consequently eliminate a corresponding amount of value from those companies.

   (The proposed apportionment legislation would also reduce the value of U.S. private companies, foreign public companies, and individuals by an amount proportional to the share of their value that comes from U.S. patents held by these organizations. In dollar terms, this reduced value would be between $18.9 billion and $46.9 billion.[5] In total, the proposed apportionment legislation would reduce the value of all U.S. patent holders – U.S. public companies, U.S. private companies, foreign companies, individuals, and other organizations – by between $34.4 and $85.3 billion.)

b. *Liberal Methodology – Use of Algorithm Measuring the Relative Value of Patent Portfolios.* Some sources attribute a much greater share of the value of public companies to their patents than comes from this conservative estimate. Recently, Ocean Tomo, a patent merchant bank involved in managing patent auctions and valuing patents, found that, after the stock market decline in 2008, intangible assets accounted for 75 percent of the market capitalization of public companies. Using a complex algorithm to measure the value of patent portfolios and changes in corporate earnings over time, they found that 30 percent of the value of the intangible assets comes from patents, with the remainder coming from other forms of intellectual property. Thus, they estimate that 22.5 percent of the value of public corporations in the United States comes from the companies' patented

technology.[6] That Ocean Tomo's data is based on an algorithm that measures the value of patent portfolios from a large database measured over a fourteen-year period ending in 2008 gives it particular value from an estimating perspective.

The Ocean Tomo estimates combine the value of patents with the value of the underlying technology that the patents protect. To value the patents net of the innovations that they protect, one must look at the patent premium, or the value that an innovator gains from use of the patent to protect the innovation against imitation. In other words, the patent premium is the value difference between Technology A with a patent and Technology A without a patent. The 2004 National Academies of Science study, *A Patent System for the 21st Century*," says the best design for measuring the patent premium finds it to be 50 percent of the value of the invention.[7] Thus, if we subtract the value of the patented technology from the value of the patents that protect them, we are left with an estimate of approximately 11.3 percent of the value of public companies residing in their patents.

Against that 11.3 percent of value figure, we apply our estimated reduction of the value of patents of between 20 and 39 percent that would result from the adoption of apportionment legislation, which indicates the value of U.S. public corporations would drop between 2.3 and 4.4 percent as a result of the legislation. As mentioned earlier, on November 17, 2008, the market capitalization of the Wilshire 5000 was $9.8 trillion. Reducing $9.8 trillion by 2.3 to 4.4 percent would result in a decrease of between $225.4 billion and $431.2 billion of the value of public corporations as a result of the proposed apportionment legislation.

c. *Middle Ground*. Although the Ocean Tomo data is based on the application of a complex algorithm to a large amount of data collected over a fourteen year period, it is important to temper the results of its approach with more conservative estimates based on the estimated value of patents held by public companies. We can do this by taking the middle ground between the two approaches described above, using the upper bound of the more conservative estimate and the lower bound of the more liberal estimate. Thus, we estimate that the effect of the proposed legislation on the value of public companies would be a decrease of between $38.4 billion and $225.4 billion, equating to a reduction of between 0.4 and 2.3 percent of the value of public companies.

3. **An apportionment-centric system of patent damages would decrease investment in R&D.** Companies only invest in research and development (R&D) if they expect to earn more from the output of R&D than the cost of the R&D itself. This expected return is a function of the cost of R&D, the probability of a positive outcome from it, and the amount of earnings from the products or services created from the R&D. Apportionment of damages would lower the returns to R&D, thus reducing the incentive to invest in it.[8]

The value of R&D is a function of the value of the technology it produces. For a licensee, the royalties are the equivalent of a deferred R&D expense – that is, the licensee gets a proven technology at a determined rate, thereby obviating the time, cost, and risk of independent R&D.

One way that patent value is measured is by the royalty rate one would pay to license the technology, which in turn is affected by the amount of damages the patent holder would expect to receive in the event of infringement.[9] The expected amount of damages creates a ceiling on the royalty rate a licensee will agree to pay. If damages decrease, the royalty decreases, reducing the value of the patented technology – the product of the R&D investment. Thus, by lowering damages, apportionment would reduce the returns to innovation and the incentive to invest in R&D.[10]

The size of this effect depends on the patent premium, as explained in the previous section. The patent premium means that anything that reduces the value of patents would reduce R&D significantly in all R&D-performing industries in which patents are used. Specifically, a 10 percent decrease in the patent premium corresponds to a 7 percent decline in R&D. [11] Patents are a negative right; their value depends on the amount of damages that patent holders can collect from infringers. Therefore, the value of patents is captured in the damages that could be obtained in the event of patent infringement. As a result, the size of the patent premium is equal to the amount of patent damages that would be awarded in the event of infringement. Because a ten percent decrease in the patent premium corresponds to a 7 percent decline in R&D, a 10 percent decrease in patent damages also corresponds to a 7 percent decline in R&D.

As stated earlier, an apportionment-centric system of damages is estimated to reduce the value of patents by between 20 percent and 39 percent. Based on the 10 to 7 relationship described above, this reduction in patent value would lead to a corresponding reduction in R&D of between 14.0 and 27.3 percent. According to the National Science Foundation, in 2006, U.S. R&D expenditures amounted to $342.9 billion, of which $241.8 billion was paid for by industry.[12] Therefore, an apportionment-centric system of damages is estimated to reduce industry-funded R&D by between $33.9 billion and $66.0 billion.

4. **An apportionment-centric system of damages would put downward pressure on manufacturing employment and compensation.** Using data from the Census Bureau, we can develop a reasonable estimate of the employment effects of the reduction in the value of manufacturing companies that would come from the proposed apportionment of damages legislation. This estimate is based on information about the sales of U.S. manufacturers, the relationship between the sales of manufacturers and their market value and labor costs, and the average compensation of manufacturing employees. According to the Census Bureau's 2006 Annual Survey of Manufacturers, the total receipts of U.S. manufacturers were $5.02 trillion. In that same year, U.S. manufacturers employed slightly less than 13 million people. The total compensation of those employees (payroll plus fringe benefits) was

$757.5 billion. Thus, labor costs were 15.1 percent of U.S. manufacturers' revenues, and the average compensation of an employee in manufacturing was $58,336.[13]

Because the average price-to-sales ratio for U.S. manufacturing firms is approximately 1:1,[14] the market value of U.S. manufacturers corresponding to the 2006 Census data cited above would also be the same as manufacturing receipts -- approximately $5.02 trillion. Reducing a $5.02 trillion market value by 0.4 to 2.3 percent (see our earlier estimate that the proposed apportionment of damages legislation would likely reduce the market value of patent holders by 0.4 and 2.3 percent), we would expect apportionment of damages legislation to reduce the value of U.S. manufacturers by between $20 billion and $115 billion. Because of the 1:1 price-to-sales ratio, this effect is equivalent to a $20 billion to $115 billion reduction in revenues.

Against this backdrop of a $20 to $115 billion reduction in market value, we can make a reasonable estimate of the impact on manufacturing employment. Because labor accounts for 15.1 percent of U.S. manufacturing revenues, the amount that U.S. manufacturers would need to reduce labor costs to make up for the loss in company value resulting from apportionment legislation would most likely be between $3.0 billion and $17.4 billion, if labor costs are reduced proportionately to the labor cost share of market value. At an average compensation per employee of $58,336, this decrease in labor costs would correspond to a likely reduction of between 51,000 and 298,000 manufacturing jobs.

This is an estimate based only on averages. U.S. manufacturers could make up the lost value from apportionment of damages through labor force reductions or other means. One alternative would be to reduce employee compensation and benefits, as currently seen in troubled industries like automobile manufacturing. However, on average, it is likely that the labor force reductions that occur in response to apportionment of damages legislation would approximate the share of revenues accounted for by labor costs.

Another significant employment impact is opportunity cost – jobs which would not be created in the United States in the future. As patent holders perceive reduced value in patents and patented technology as a result of the apportionment of damages legislation, they would be less willing to add employees to produce new technology, as well as to supply new plant, equipment, components and services. Moreover, efforts to produce patented technology overseas would become an increasingly attractive option. Weaker patent protection on their products would motivate manufacturers to seek cheaper ways to produce products based on the patented technologies, and a shift to production in lower wage countries would be an effective way to do this. As a result, some production will migrate overseas.

Alternatively, as mentioned above, U.S. manufacturers could maintain the jobs necessary to produce the products based on patented technologies but at lower compensation and benefit levels to compensate for the loss of value that would result

from the diminished patent protection. Insufficient data exists to make a reasonable estimate of the size of these effects, but the effects are likely to occur.

5. **An apportionment-centric system of patent damages would favor certain industries over others.** Effective patent reform needs to enhance innovation in all industries, not enhance innovation in one industry at the expense of innovation in another. The apportionment legislation fails to meet this condition because it benefits some industries at the expense of others.

   Patents work differently in different industries because mechanical, electrical, chemical and computer technologies are utilized differently. [15] Researchers have tended to categorize industries into two broad groups on the basis of how patents work: "discrete" technology industries and "complex" technology industries. "Complex" technology industries are those in which new products are made up of many (hundreds) of separate patentable elements, like computer and electronic products, and "discrete" technology industries, like chemicals, in which new products are composed of a small number of patentable elements.

   "Discrete" technology industries would be more adversely affected by apportionment because products in those industries have fewer patents protecting them, making each patent more valuable. Because a single component is more likely to make a disproportionate contribution to the value of a product in "discrete" technology industries, apportionment would be more harmful than in "complex" technology industries. Any industry in which a given component tends to provide more value than its proportional share would be harmed because apportionment would result in damage awards too small to compensate the patent holder for the losses incurred.[16]

   The apportionment legislation also would disproportionately hurt "discrete" technology industries because it underestimates the value of components that are worth very little outside of the product in which they are combined. For instance, the components of a chemical have little value outside of the composition in which they are put together.

   Ironically, apportionment would benefit industries that employ fewer people at the expense of industries that employ more people. Economist Wesley Cohen of Duke University and his colleagues have examined the characteristics of technology in different industries and have characterized industries with ISIC codes of less than 2900 as discrete technology industries, and those with ISIC codes of 2900 or higher as complex technology industries (with ISIC 3600 excluded).

   By assigning industries to those that Professor Cohen and his colleagues have identified as discrete and complex, we can identify the amount of employment in these two types of manufacturing industries,[17] as shown in Table 1. In the United States in 2007, complex technology industries employed 5.0 million people, while discrete technology industries, which generally would be hurt by apportionment, employed 8.1 million people.

Table 1. Employment in discrete and complex technology industries.

Industry	NAICS code	Employment in 2007 ('000)	Employment in September 2008 ('000)
Discrete Technologies			
Food	311.0	1481.3	1510.1
Beverage and tobacco products	312.0	195.7	197.1
Textiles, apparel, and leather	313–16	575.2	528.4
Wood products	321	519.7	469.8
Paper, printing, and support activities	322-323	1084.8	1045.2
Petroleum and coal products	324	113.4	116.5
Chemicals	325	862.9	851.9
Plastics and rubber products	326	754.0	725.8
Nonmetallic mineral products	327	503.4	479.1
Primary metals	331	456.0	444.9
Fabricated metal products	332	1563.3	1529.2
Total for Discrete Technologies		8109.7	7898.0
Systemic Technologies			
Machinery	333	1188.2	1185.9
Computer and electronic products	334	1271.9	1246.7
Electrical equipment, appliances, and components	335	427.2	417.6
Transportation equipment	336	1563.3	1577.2
Furniture and related products	337	534.5	484.1
Total for Systemic Technologies		4985.1	4911.5

Source: Author's compilation from data downloaded from the Bureau of Labor Statistics web site.

Conclusions

Recently, critics of the U.S. patent system have called for a change in the way damages are calculated in patent infringement lawsuits, elevating apportionment over other factors currently considered and calling the use of those other factors into question in general.[18]

Proponents of apportionment have argued that it is needed to remedy flaws in the U.S. patent system. However, in their advocacy of apportionment, they have failed to examine the likely effects that it will have on the national innovation system.

This report outlined several of the primary effects that apportionment of damages would have on innovation in the United States This analysis shows that the adoption of an

apportion-centric approach would reduce patent value substantially, shrink the value of public companies, decrease investment in R&D, impose downward pressure on manufacturing jobs and compensation, and favor certain industries over others.

The likely adverse effects of apportionment of damages are substantial, and policymakers should take these effects into consideration when making decisions about pending patent reform legislation. Moreover, policymakers should request additional research from affected stakeholders to further study the manner in which they will be affected by the proposed legislation.

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[1] S. 1145, the Patent Reform Act of 2007, 110th Cong., 1st Sess. (introduced April 18, 2007); H.R. 1908, the Patent Reform Act of 2007, 110th Cong., 1st Sess. (introduced April 18, 2007). Apportionment attempts to apportion the value which the patented invention brings to a product apart from value attributed to other components or aspects of the product.

[2] The methodology for the survey was as follows: A temporary employee with no background in the patent reform debate was engaged to select random entries from the USPTO list of registered attorneys/agents. We selected only attorneys at law firms, who typically consider the perspective of multiple clients, in order to maximize objectivity. Approximately 22 percent of the 949 attorneys surveyed responded. The respondents were asked to comment on the effect of the proposed legislation on patent damages, the cost of expert witnesses to set patent damages, and the amount of patent litigation. The proposed legislation was defined as follows: "The 110th Congress (2007-08) considered legislation to change the process for calculating damages in patent litigation from the common-law Georgia-Pacific 15-factor framework to a statutory framework in which the court selects a method of calculating a reasonable royalty from: (a) the economic value attributable to patent's specific contribution over the prior art; (b) the entire market value, if the claimed invention's specific contribution over the prior art is the predominant basis for market demand; or if neither (a) nor (b) is appropriate, then (c) the terms of any nonexclusive marketplace licensing of the invention, and other relevant factors."

[3] The stock of active patents is calculated by taking the patents in force over the previous 17 years (because patents used to have 17 year life from the date of issue and now have a 20 year life from the date of application, but take almost three years to issue) multiplied by the estimates of the percentage of patents still in force by age provided by Lemley, M. 2001. Rational ignorance at the patent office. Northwestern University Law Review, 95(4): 1495-1532.

[4] This estimate was calculated based on data contained in Bessen, J. 2008. The value of U.S. patents by owner and patent characteristics, Research Policy, 37(5): 932-945.

[5] Apportionment of damages also would result in significant reduction in value of the assets of venture capital-backed start-ups because their patents account for a significant portion of the value of those companies. Economist Josh Lerner found that the scope of patents has an effect on the value of venture capital backed companies; a one standard deviation increase in patent scope increases company valuation by 21 percent. (See Hanel, P. 2004 Intellectual Property Rights Business Management Practices: A survey of literature, Working Paper, CIRST, p.30.)

[6] Malackowski, J., and Barney, J. 2009. Patent Attribution to Equity Returns, January 5. Downloaded from http://www.oceantomo.com/PDFs/Patent_Attribution_to_Equity_Returns_1-6-09.pdf

[7] Merill, S., Levin, R., and Myers, M. 2004. A Patent System for the 21st Century, Washington, D.C.: National Academies Press, p. 48.

[8] Hausman, J., and Leonard, G. 2006. Real options and patent damages: the legal treatment of non-infringing alternatives, and incentives to innovate, Journal of Economic Surveys, 20(4): 493-512.

[9] Sherry, E., and Teece, D. 2004. Royalties, evolving patent rights, and the value of innovation, Research Policy, 33: 179–191.

[10] Hausman, J., and Leonard, G. 2006. Real options and patent damages: the legal treatment of non-infringing alternatives, and incentives to innovate, Journal of Economic Surveys, 20(4): 493-512.

[11] Arora, A., Ceccagnoli, M., and Cohen, W. 2003. R&D and the patent premium. NBER Working Paper, Number 9431.

[12] http://www.nsf.gov/statistics/nsf07331/content.cfm?pub_id=3829&id=2

[13] http://factfinder.census.gov/servlet/IBQTable?_bm=y&-ds_name=AM0631GS101

[14] According to Ned Davis Research, the median price-to-sales ratio for the S&P Industrials for the 54 year period from 1954-2008 was 0.92.

[15] Cohen, W., Nelson, R., and Walsh. 2000. Protecting their intellectual assets: Appropriability conditions and why U.S. manufacturing firms patent (or not), NBER Working Paper, 7552.

[16] California Healthcare Institute. 2007. Impact of patent law changes on biomedical investment and innovation, downloaded from http://www.chi.org/uploadedFiles/CHI%20Patent%20Law%20changes%20paper.pdf.

[17] ISIC codes were converted to NAICS codes using the concordance provided by the Census Bureau. Employment figures were obtained from the Bureau of Labor Statistics web site.

[18] S. 1145, the Patent Reform Act of 2007, 110th Cong., 1st Sess. (introduced April 18, 2007); H.R. 1908, the Patent Reform Act of 2007, 110th Cong., 1st Sess. (introduced April 18, 2007).