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PATENTS AND SMALL PARTICIPANTS IN THE SMARTPHONE INDUSTRY

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ABSTRACT

For intellectual property law and policy, the impact that patent rights may have on the ability of small companies to compete in the smartphone market is a critically important issue for continued robust innovation. Open and competitive markets provide vitality for the development of smartphone technologies. Nevertheless, the impact of patent rights on the smartphone industry is an unexplored area of empirical research. Thus, this Article seeks to show how patent rights affect the ability of small participants to enter, compete, and exit smartphone markets. The study collected and used comprehensive empirical data on patent grants, venture funding, mergers and acquisitions, initial public offerings, patent litigation, and marketing research data. This Article shows empirically that small participants succeed in the market when they have a low and specific critical mass of patents and that this success exceeds the general

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norms in the startup world. Surprisingly, the analysis demonstrates that the level of financing and market success do not increase with larger patent portfolios. Lastly, despite the controversies over patent trolls, this Article demonstrates that patent litigation, whether from operating companies or NPEs, does not appear to be a significant concern for small players and does not appear to pose barriers to entry. The Article concludes by arguing that patent rights are providing incentives for innovation among small industry players and that contrary to some expectations, patent rights support competitiveness in the smartphone industry for small market players.

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INTRODUCTION

The relationship of patent rights to the competitiveness of companies in the smartphone industry is critical to understanding the dynamics of the smartphone market. This market is growing rapidly worldwide at staggering rates. Just in the third quarter of 2014, vendors sold over 325 million smartphones[1] Meanwhile, "patent grants and patent lawsuits are rising dramatically."[2] Whether or to what extent patents support competitiveness or present barriers to entry is thus a key policy question for intellectual property and the development of future innovations in the smartphone field.

Prior work shows that very little empirical analysis focuses on the specific role that patents play in the competitiveness of participants in information technology based markets.[3] To begin to fill this gap, the World Intellectual Property Organization (WIPO) commissioned a study that examined the role of patents with respect to large market participants in the smartphone industry (the "2012 Smartphone Patent Study").[4] The 2012 Smartphone Patent Study found that there was significant fluidity in market entry and exit among the large companies during a period of dramatic growth and concentration of patent portfolios.[5] The study also showed that patent litigation reflected a trend for large companies to use patents as a defensive business strategy.[6]

Since the 2012 Smartphone Patent Study only examined large participants in the market, there remains a need to understand the impact on small participants such as small businesses, individual inventors, or organizations with relatively limited involvement in the smartphone field. The goal of this study is thus to analyze comparable empirical data about small market participants with patents and individual inventors in order to ascertain how patents impact their ability to compete in the marketplace.

In Part II of this study, we summarize the definitions for the smartphone market that will be used by our analysis and describe the database of

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1. *See* Press Release: Worldwide Smartphone Shipments Increase 25.2% in the Third Quarter with Heightened Competition and Growth Beyond Samsung and Apple, Says IDC (Oct. 29, 2014), http://www.idc.com/getdoc.jsp?containerId=prUS25224914.

2. *2014 Patent Litigation Study*, PWC at 5-6 (Jul. 2014) [hereinafter 2014 PWC study], http://www.pwc.com/en_US/us/forensic-services/publications/assets/2014-patent-litigation-study.pdf.

3. *See* Committee on Development and Intellectual Property (CDIP), Report on an Analysis of the Economic/Legal Literature on Intellectual Property (IP) Rights: a Barrier to Entry? WORLD INTELLECTUAL PROPERTY ORGANIZATION (Jan. 16, 2012), http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_8/cdip_8_inf_6_corr.pdf.

4. *See* Joel R. Reidenberg, Jamela Debelak, Daniel Gross & Elaine Mindrup, *The Impact of the Acquisition and Use of Patents on the Smartphone Industry (WIPO: 2013),* FORDHAM CENTER ON LAW AND INFORMATION POLICY (Dec. 13, 2012) [hereinafter 2012 Smartphone Patent Study], http://www.wipo.int/ip-competition/en/studies/clip_study.pdf.

5. *Id*.

6. *Id*.

smartphone patents used for this study. To provide comparability, these definitions and the database were the same as those used and elaborated in the 2012 Smartphone Patent Study.[7] In Part III, we develop a methodology to identify small participants in the market and to collect data for these participants. Because comprehensive and reliable data on all small market participants is not readily available, the study analyzed empirical data for market participants holding at least one patent, as this group of market participants can be identified comprehensively. However, this selection necessarily limits the results and statistical analysis to those entities that have opted into the patent system and omits small entities that have not sought patent protections for their innovations.[8] In Part IV, we present the findings from the empirical data in terms of the impact of patents on the small participants. Part V then addresses the impact of patent rights on the openness of the smartphone market with respect to small participants.

I. DEFINING THE MARKET AND PATENT DATABASE

The 2012 Smartphone Patent Study defined smartphones as "hand-held computing devices that (a) have the ability to make phone calls over cellular networks and (b) can transfer data and run applications over mobile computing networks."[9] That study further defined the smartphone market as comprised of four segments:

1. Handset providers: Companies that provide smartphone devices to consumers.
2. Software developers: Companies that develop operating systems, communication protocols, and other applications governing the behaviors of smartphones. Software developers provide software packages to handset providers in the form of operating systems and applications as well as to consumers in the form of applications. Operating system vendors represent a subset of the software developer market segment.
3. Hardware suppliers: Companies that provide hardware integrated into the handsets, including computer chips, batteries, antennas, and many other significant components. Hardware suppliers primarily sell integrated hardware, such as chipsets, to handset

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7. *Id*. at 2-6.

8. This is an unavoidable selection bias. In the context of software, one study argues that startups in the software field may be reluctant to seek patents because of cost and a belief that patent rights will not be sufficiently useful to protect their inventions. *See* Stuart J.H. Graham, Robert P. Merges, Pam Samuelson & Ted Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Study*, 24 Berkeley Tech. L.J. 1255, 1309 (2009). If this is correct more specifically for the smartphone field, then our study findings will not address those innovators.

9. 2012 Smartphone Patent Study, *supra* note 3, at 2.

providers, but also provide parts and accessories, such as extended life batteries and cases, directly to consumers.

4. Designers: Companies that focus on aesthetic design as a selling point for their products. Designers represent a subset of the handset providers and software developers, and generate hardware designs and designs for visual displays for smartphone handsets.[10]

We use the same definition and market segments for this study.

Similarly, the 2012 Smartphone Patent Study identified the most relevant patent classifications for smartphone technologies. The research showed that class 455 in the United States Patent and Trademark Office (USPTO) classification was the most relevant, and that a total of 14 classifications related most closely to smartphones:

Table 1 – Relevant Patent Classes[11]

Class	Description
320	Electricity: Battery or Capacitor Charging or Discharging
341	Coded Data Generation or Conversion
349	Liquid Crystal Cells, Elements and Systems
361	Electricity: Electrical Systems and Devices
370	Multiplex Communications
375	Pulse or Digital Communications
379	Telephonic Communications
398	Optical Communications
455	Telecommunications
704	Data Processing: Speech Signal Processing, Linguistics, Language Translation, and Audio Compression/Decompression
706	Data Processing: Artificial Intelligence
707	Data Processing: Database and File Management or Data Structures
715	Data Processing: Presentation Processing of Document, Operator Interface Processing, and Screen Saver Display Processing
719	Interprogram Communication or Interprocess Communication (IPC) (Electrical Computers and Digital Processing Systems)

From these classes, the 2012 Smartphone Patent Study assembled a patent bibliographic database for the utility patents and a separate database for the design patents, each consisting of the following information for all patents granted between 2006 and 2012:

- **Abstract** – summarizing the contents of the patent.
- **Patent Type** – determining whether the patent is a utility or design patent.

10. *Id*. at 3.
11. *Id*. at 8.

- **Patent Number** – identifying the relevant patent.
- **U.S. Classification** – identifying the primary classification used for the relevant patent.
- **Title** – identifying the contents of the patent.
- **Number of Claims** – identifying how many claims were included in the issued patent.
- **Assignee** – identifying the current patent holder for the issued patent.[12]

This study takes the 2012 smartphone patent bibliographic databases as the starting point. The data set reflects both the rapid growth and the importance of smartphone innovation over the last ten years. In 2012, 20% of the patents granted were related to mobile phones.[13] Less than a decade ago, this number was lower than 10%.[14] Overall, smartphone patents account for just over 16% of all active patents.[15] In comparison, the pharmaceutical industry has accounted for a little over 6% of U.S. patents over the past 15 years, and the Information and Communication Technologies (ICT) sector accounts for 40% of U.S. patents.[16]

II. SMALL PARTICIPANTS IN THE SMARTPHONE MARKET AND DATA COLLECTION

To focus on small smartphone market participants, this study used several metrics to select a random sample of appropriately sized entities and individual inventors. The study looks only at entities and inventors that have already sought patents because comprehensive, meaningful public data is available for these market participants unlike other small private businesses. As a result, the study does not consider entities that have no patents such as those organizations that license technologies rather than innovate, or those organizations that choose not to seek patents for their innovations.[17] We first identified small participants based on the size they claimed in filings with the USPTO. We then narrowed the selection based on the number of patents they had in the field and

12. *Id*. at 11.

13. CHETAN SHARMA, MOBILE PATENTS LANDSCAPE: AN IN-DEPTH QUANTITATIVE ANALYSIS 7-8 (2d ed. 2009).

14. *Id*.

15. Daniel O'Connor, *One In Six Active U.S. Patents Pertain To The Smartphone*, PROJECT DISCO (Oct. 17, 2012), http://www.project-disco.org/intellectual-property/one-in-six-active-u-s-patents-pertain-to-the-smartphone/.

16. *Id*.

17. Relevant data for non-patent-holding individuals and organizations in the smartphone field is not publicly available. Some studies, though, argue that innovators in certain industries including software choose to use strategies other than intellectual property rights to commercialize their discoveries. *See* Michael J. Burstein, *Exchanging Information without Intellectual Property*, 91 TEX. L. REV. 227 (2012).

the number of patents they had in a particular subfield. From those entities and inventors, we chose a random sample and conducted a final manual filter to assure that the patent holders were small participants in the smartphone market. To collect further data for analysis, we researched publicly available information about each patent holder and prepared a survey to elicit information about the importance of their patents.

A. *Identification of the Entity Size Disclosed to the USPTO*

Because the U.S. patent statute provides for reduced filing fees and maintenance fees for small companies and individual inventors, the USPTO has records on the size of patent applicants and holders. Companies and individual inventors qualify for the reduced fees if they meet the following criteria:

Small Business Entity:

1. Applicant has fewer than 500 employees; and
2. No rights in the application are promised or licensed to an entity that does not qualify.[18]

Micro Entity:

1. Must qualify as a Small Business Entity (per the above);
2. Applicant or any joint inventor has filed fewer than four U.S. non-provisional patent applications (not assigned to a prior employer);
3. Applicant and listed inventor have income for the past year less than $150,000[19]; and
4. No rights in the application have been promised or licensed to a non-micro-entity.[20]

Fordham CLIP obtained the entity size based on these fee categories for all entries in the smartphone patent bibliographic database where an assignee was identified. For utility patents, Fordham Center on Law and Information Policy (CLIP) also extracted size information from the USPTO database of maintenance events.[21] For design patents, size data is only available for applications because design patents are not subject to the payment of maintenance fees.[22] In both the design and utility databases, entity size was often not available for patents where no assignee was named (these patents were likely to be held by individual inventors or scholars). Fordham CLIP

18. 13 C.F.R. § 121.802(a) (2013).

19. This number will change annually based upon census median U.S. household income (3X median income).

20. 35 U.S.C. § 123 (2013).

21. Every time a payment was made on a utility patent, the entity size of the payor at the time of payment was recorded by the USPTO.

22. Fordham CLIP thus captured entity size as of the time the application was filed.

added all entity size data to the smartphone patent bibliographic database for analysis.

Table 2 below shows the breakdown by entity size for both the utility and design smartphone patent bibliographic databases.[23]

Table 2 – Number of Entities by Entity Size

Entity Size	Number of Entities
Large	223,252
Small	48,945
Micro	89
Unavailable	42,204
Total	**314,490**

B. *Selecting Small Participants and Generating a Random Sample*

From the large number of potential market participants, relevant small participants had to be selected and a random sample drawn for analysis. In selecting the population to analyze, we sought a diverse group of small businesses and startups. First, the utility patent database was divided by classification into three groups—communications, hardware, and software—using the classifications shown in Tables 3, 4, and 5 and drawn from the 2012 Smartphone Patent Study[24]:

Table 3 – Hardware Classification Numbers

Class	Description
349	Liquid Crystal Cells, Elements and Systems
361	Electricity: Electrical Systems and Devices
320	Electricity: Battery or Capacitor Charging or Discharging

23. Another study estimated that approximately 250,000 patents were relevant to modern smartphones in 2011. RPX Corp., Amendment No. 3 to Form S-1, 59 (Apr. 11, 2011), http://www.sec.gov/Archives/edgar/data/1509432/000119312511240287/ds1.htm (last visited Nov. 20, 2014).

24. 2012 Smartphone Patent Study, *supra* note 3, at 12-13.

Table 4 – Software Classification Numbers

Class	Description
341	Coded Data Generation or Conversion
704	Data Processing: Speech Signal Processing, Linguistics, Language Translation, and Audio Compression/Decompression
706	Data Processing: Artificial Intelligence
707	Data Processing: Database and File Management or Data Structures
715	Data Processing: Presentation Processing of Document, Operator Interface Processing, and Screen Saver Display Processing

Table 5 – Communications Classification Numbers

Class	Description
370	Multiplex Communications
375	Pulse or Digital Communications
379	Telephonic Communications
398	Optical Communications
455	Telecommunications
719	Interprogram Communication or Interprocess Communication (IPC) (Electrical Computers and Digital Processing Systems)

Design patents were placed into their own category. Table 6 below shows the breakdown by entity size and smartphone-related category of the entire smartphone bibliographic patent database.

Table 6 – Smartphone Patent Bibliographic Database

Category Entity Size

Category/Size	Number of Entities
Communications	**95,057**
Large	86,835
Small	7,301
Micro	30
Unavailable	891
Hardware	**25,727**
Large	23,225
Small	2,203
Micro	13
Unavailable	286
Software	**43,186**
Large	38,177
Small	4,373
Micro	46
Unavailable	590
Design	**150,520**
Large	35,068
Small	75,015
Unknown	40,437
Grand Total	**314,490**

Because the number of qualifying entities in the database was so large, a random sample was necessary. However, the generation of a random sample from the database at large (or "direct element sampling") would have yielded unpredictable results and would not necessarily provide a clear picture of the various kinds of small players in the data set. For instance, a random sample may have been skewed toward one category of patents such as design or communications, which make up larger relative proportions of the database. Similarly micro entities made up less than 1% of the database entries because the designation is new and might have been missed altogether. To avoid these potential biases, we adopted the "population framing" method for the generation of the random sample.[25]

25. In statistics, "population framing" allows the survey planner to organize a data set to improve the efficiency and effectiveness of the random sample and to ensure that the

For population framing, the patent database was further subdivided as shown below in Table 7. From each of the patent classification groupings, companies with three to five patents were extracted. This ensured that niche players in each category would be analyzed. We did not limit these patent-holders by entity size in order to capture startups and small companies that were purchased by larger entities before making their first maintenance payment. Similarly, we extracted as a sample frame for each of the patent classification groupings, companies that reported a small or micro entity size, regardless of the number of patents they held. This was to ensure there was no bias in the sampling based on the number of patents. To obtain companies that were not limited to niche products or services, we also extracted all entities with one or two patents regardless of reported size as a population frame and all companies that reported small or micro status with ten or more patents. To capture individual inventors or unincorporated entrepreneurs, we also framed all filings for which entity status was not available and that had no assignee name.

Table 7 – Population Sample Frames

Category	**Entity Size**	**Number of Patents**	**DB Hits**
Communications	Any	Between 3 and 5, inclusive	3,692
Communications	Small or Micro	Any	7,331
Hardware	Any	Between 3 and 5, inclusive	1,283
Hardware	Small or Micro	Any	2,216
Software	Any	Between 3 and 5, inclusive	2,128
Software	Small or Micro	Any	4,419
Design	Any	Between 3 and 5, inclusive	12,067
Design	Small or Micro	Any	35,069
Any	Small or Micro	10 or more	14,713
Any	Any	1 or 2	34,492
Any	Small, Micro, or N/A	N/A – (No Assignee Name)	2,250
Grand Total			119,660

Because the frame selection resulted in more companies than could reasonably be studied, a random sample was chosen. Each entry was assigned a random number within each population frame and the groups were shuffled by sorting on the random number. We chose an initial random sample of 400 companies by extracting the patent entries from the categories shown in Table 7. This large initial sample was chosen to account for duplication and so that

various groups of interest are represented in the random sample. *See* RAYMOND JAMES JESSEN, STATISTICAL SURVEY TECHNIQUES 160-62 (1978).

sampling errors could be corrected through manual filtering, as discussed below.

Finally, to be sure that we did not omit any important players with patented technologies in the relevant field, we applied key word searches to the full smartphone patent bibliographic database for a manual review. The key word search was conducted on the abstract and title of every patent in the database for the following terms: "smartphone," "smart phone," "handset," "mobile phone," "cellular phone," "touchscreen," "3G," and "4G." Small or micro entities that hit on the keywords were added to the random sample for filtering. Most results yielded large companies such as Samsung and High Tech Computer Corp. Only nineteen potentially small companies were identified using this method and were included in the initial frame.

C. *Manual Filtering*

Manual filtering entailed a review of the patent or patents for each of the randomly selected entities and an initial review of the publicly available data for each company or inventor to confirm the entity size as a small company and whether the business was relevant to the smartphone industry.[26] Some very large organizations with few patents in the relevant field were removed by this filtering.[27] Similarly, a manual review and filter of the nineteen potentially small companies identified by key word searches was also conducted. This review sought to confirm the claimed entity size, the relevance of the patents to smartphones, and the actual involvement of the business in the smartphone market.

Also, some patents were assigned to multiple large entities at the same time. These were either charitable conglomerates or telecommunications standards co-invented in the context of a standards setting organization.[28] Though these entities were small patent holders and novel, we did not consider them to be small players. Therefore, they were not included in the final sample.

In addition, several very large entities, captured in the random sample as patent holders, had small entity status due to their non-profit structure. This

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26. The main sources used (where available) for this preliminary review were the entities' own websites, LinkedIn and similar marketing materials, Business Week entries, other patents assigned to the entity or inventor, and news articles.

27. This included companies like Sirius and NEC. Many of these large companies made a one-time foray into the smartphone world (i.e. internal startups), and thus were not included in this study of small companies. Several large corporations had subsidiaries or slightly misspelled names, which caused them to erroneously show up in the small entity population frame.

28. Charitable conglomerates, such as Intel-GE Care Innovations, provide useful innovations to the public, often in the form of patents. Standards setting organizations, in this database, mostly fell in the realm of telecommunications standards. These are often created and proposed to a standards setting organization by multiple companies who then file a joint patent.

included government-sponsored research institutes, institutions of higher education, and standards setting organizations listed as patent owners. These organizations were also pruned from the sample. Standards-essential patents not owned directly by these large non-profit organizations would still be captured in the sample.

Care was taken not to exclude large entities that were, until recently, small players. To accomplish this, a historical records and news search was conducted to determine whether the entity recently was in a startup funding phase, was purchased by a larger corporation, suddenly expanded, or went public. Likewise, small companies that recently went defunct and/or sold their intellectual property to larger entities were maintained in the sample.

The sample was also pruned of patents and businesses that were clearly not related to the design, software, hardware, or communications involved with smartphones. The sample was also expressly filtered to exclude accessories to smartphones such as batteries and cases, base-station technologies, server-side technologies, and product packaging.

Lastly, the sample was filtered to exclude industrial wireless communications innovations that were not related to smartphones, such as error monitoring on pump jacks and vehicle fleets, or municipal communications grids. Likewise, entities with patents for mesh networks were excluded unless they dealt specifically with smartphones. Semiconductor companies that did not market to smartphones were excluded as well.

In the process of pruning, several more random samples were extracted from the population frame to achieve a data set comparable to the size of the 2012 Smartphone Patent Study. Of the 650 companies initially extracted as a random sample for consideration, 46 companies and individual inventors satisfied the filtering criteria and were retained for analysis as small participants in the smartphone market. These small participants are listed in Appendix A.

D. *Collection of Publicly Available Data*

For each of the 46 selected small market participants, a data set was compiled using publicly available sources. The data consists of (1) the type of business conducted by the companies; (2) contact information; (3) litigation involving the company, both patent and non-patent; (4) acquisitions, funding, and other investment information; (5) patents; (6) press releases and web marketing related to patents. The following describes generally the information collected and the public sources of data that were reviewed and cross-checked for each category.

1. **Type of businesses conducted**: This data gives a brief overview of the company's main business and how, if at all, it is related to smartphones. The information was used to evaluate each company's perceived impact on the target industry—smartphones. The information was collected through the following online

resources: LinkedIn; CrunchBase; Bloomberg BusinessWeek; and companies.findthebest.com.

2. **Contact information**: The names of individuals at the target companies including title of the person, address, phone number, email, and website of the company, were collected where available. This information was used to contact the companies to administer the survey. This information was collected through the following online resources: USPTO Public PAIR; LexisNexis; Yahoo Business; Bloomberg BusinessWeek; and companies.findthebest.com. Where this information was unavailable, we attempted to contact the attorney that filed the patent application in order to try to make contact with the patent holder.
3. **Litigation information**: All U.S. court litigation where the small participant companies were a party, including patent infringement and non-patent cases, were collected and reviewed. This information was used to determine how these companies interact and conflict with each other using the U.S. court system. RPX Corp., LexisNexis, and Bloomberg News databases were used to identify the relevant litigations. In total, we identified and reviewed thirty-eight patent lawsuits and twenty-two non-patent ones.
4. **Acquisition, funding, and other investment information**: Information regarding the date, amount, and participants in mergers and acquisitions, rounds of funding, public stock investments, and other investments were collected for each target company. This information was compared to the patent data to determine whether any correlation existed between patents and investments. The information was collected from AngelList, CBInsights.com, Crunchbase.com, Dealipedia.com, BusinessWeek.com, edgar-online.com, BizJournals.com, and Nasdaq.com.
5. **Patents**: A database of each target company's patent portfolio was collected and then compared to our database of smartphone-related patents from which we chose our initial sample of target companies. This information was mined from the bulk patent data provided by the USPTO through Google's and ReedTech's database retrieval tools found at google.com/patents and patents.reedtech.com, respectively, as well as by strutpatent.com.
6. **Press releases and web marketing**: Publications by and about each target company were retrieved and reviewed for discussion of the company's patent portfolio. This information was used to gauge the perceived importance of each company's patents as seen by the companies themselves and in the public press. This information was collected from Google News, Bloomberg News,

CrunchBase, and each company's websites, where one or more existed.

E. *Demographic Breakdown of the Sample*

Table 8 shows the countries of origin for the 46 selected small participants.

Table 8 – Breakdown by Country

Country	Total
Canada	2
Israel	1
Netherlands	1
Sweden	2
Switzerland	1
US	39
Grand Total	**46**

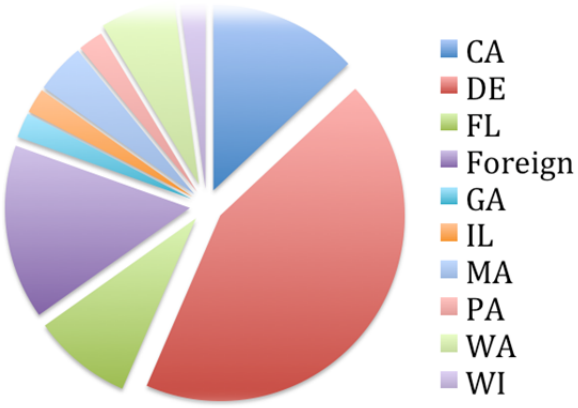
The vast majority of the 46 selected small participant companies were domestic U.S. companies or ones that had headquarters and strong ties in the U.S. The seven foreign companies appear to be from known startup hubs. Israel and Sweden are both well known for their startups and Switzerland's "Silicon Alps" is an up-and-coming startup hub. According to data compiled by Washington State University College of Business, Canada ranks as one of the top places to build a startup due to its high rate of post-secondary education, low cost of living, and relatively flat rate of inflation. Amsterdam too has had its fair share of startup successes.[29] For these reasons, it is not surprising that our random sample pulled companies from these specific countries.

Similarly unsurprising is the distribution of the states of incorporation of smartphone startups within the U.S. Table 9 shows this distribution. The largest percentage (43.5%) is incorporated in Delaware. This compares to the incorporation rates for other industries. In 2012, more that 50% of the major corporations in the world were incorporated in that state.[30]

29. *Location, Location, Location*, WASH. ST. U., http://omba.wsu.edu/resources/infographics/infographic-location-location-location/ (last visited Oct. 18, 2014).

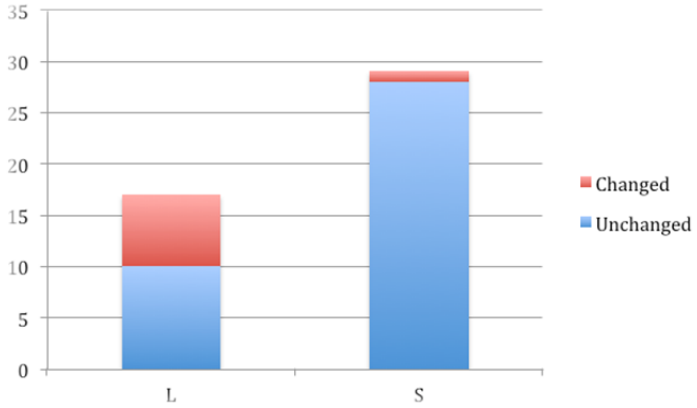
30. Leslie Wayne, *How Delaware Thrives as a Corporate Tax Haven,* N.Y. TIMES (Jun. 30, 2012), http://www.nytimes.com/2012/07/01/business/how-delaware-thrives-as-a-corporate-tax-haven.html?pagewanted=all&_r=0.

Table 9 – Breakdown by State of Incorporation



Of the 46 chosen participants, 17 registered with the USPTO as large organizations and 29 as small ones. Of the large organizations, seven changed from small to large over the date range examined. Of the small ones, only one changed from large to small. Therefore, at some point over the time period studied, 78.3% of the chosen participants were registered as small. This is reflected in Table 10 below.

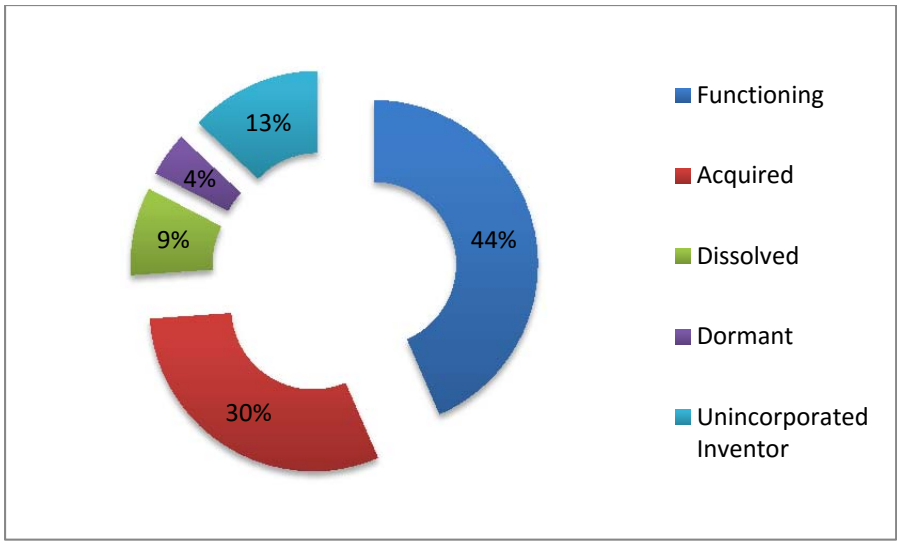
Table 10 – Breakdown by Reported Size



As of October 2014, most of the 46 selected small participants were still alive in some form. Of the selected participants, 60.7% are still functioning or have been acquired by a company that is still functioning; 9% have dissolved; 4% are dormant but not formally dissolved; and 13% are inventors in the smartphone field who have not assigned their patent rights to a corporate organization.[31] Table 11 shows this distribution.

31. Companies classified as "Functioning" were those companies that were current on

Table 11 – Current State of Sample Companies



For other demographic data, public information was not easy to find for our selected sample because most of the sample consisted of small private corporations (some foreign) or individual inventors with no public reporting requirements. Only 9% of our sample companies were at some point public. We were, nonetheless, able to collect detailed funding information totaling over $2.8 billion for 63% of the selected companies. Of the 46 selected small participants, 47.8% received venture funding. A few of our participants also received a mix of funding from government contracts, "Angels," partial acquisitions, full acquisitions, and joint ventures. Litigations are, for the most part, public so that was more easily collected. Thirty-five percent of the study participants were involved in some type of litigation including intellectual property and other matters, as plaintiff or defendant. This is much lower than the reported rate of litigation (82%) for U.S. companies and lower than the rate of litigation for smaller companies (65%).[32]

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their corporate filing fees in the place of incorporation or otherwise were still clearly doing business (e.g. active website and/or sales). Companies classified as "Acquired" were determined with reference to public information through AngelList, CBInsights.com, Crunchbase.com, Dealipedia.com, BusinessWeek.com, edgar-online.com, BizJournals.com, and Nasdaq.com. Companies classified as "Dissolved" were those companies that filed for dissolution with the secretary of state in the place of incorporation. Companies classified as "Dormant" were those companies that were delinquent on one or more filing fees in the place of incorporation, allowed their website to go down for an extended period of time, and/or were classified as such because press releases indicated the company was no longer functioning. Companies classified as "Unincorporated Inventors" were those whose patents were assigned directly to an inventor and not a corporate entity.

32. In assessing litigation trends, Norton Rose Fulbright surveyed U.S. companies and reported that in the U.S.: (1) 82% of companies had at least one suit filed during 2013; (2)

F. *Survey*

In addition to the data we collected from public sources, we sought direct information from the 46 selected small participants. We constructed a survey to collect information about the use and effect of smartphone patents from individuals at the chosen companies. This survey is attached as Appendix B.[33]

Survey respondents were offered the opportunity to remain anonymous. But, even with that assurance, we received an insufficient number of responses to perform any meaningful analysis.

III. ANALYSIS OF THE MARKETPLACE

In this Part, we analyze the empirical data. First, we examine the smartphone patent database as a whole. Then, we examine how patent portfolios are built as a small player in the smartphone field begins to grow. This examination looks at the relationship between smartphone business activity and patent holdings, and at the relationship between overall business activity and patent holdings. Next, we examine whether patent portfolios affect the ability for small participants to secure funding. Finally, we investigate whether patent litigation is helping, harming, or neutral to the small players.

A. *Smartphone Business Activity and Patent Holdings*

1. *Analysis*

From a high level taxonomy of the entire smartphone patent database including all organizations holding any smartphone-related patents, it appears that smartphone-related patents are concentrated with large companies. Organizations that registered as large (i.e. with more than 500 employees) hold

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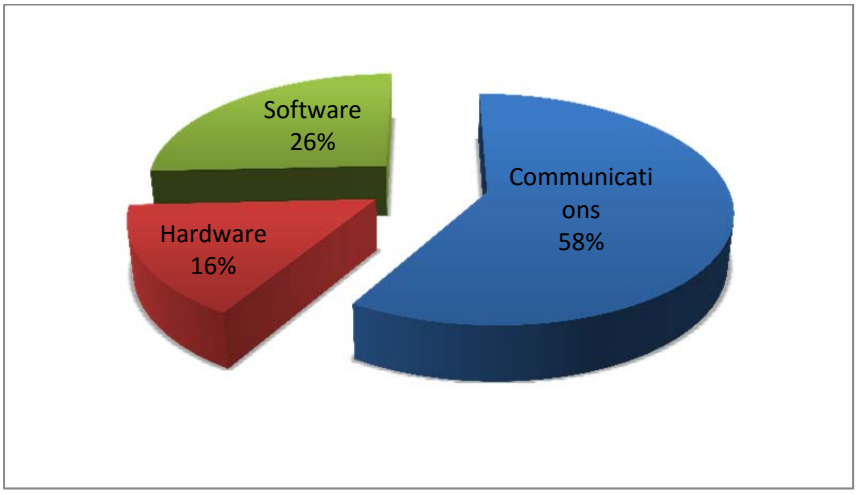
65% of smaller companies (those with less than $100 million in revenue) had at least one suit filed. *See Norton Rose Fulbright's 10th Annual Litigation Trends: US companies increasingly concerned about regulatory investigations,* NORTON ROSE FULBRIGHT (Apr. 15, 2014), http://www.nortonrosefulbright.com/knowledge/publications/115045/norton-rose-fulbrights-10th-annual-litigation-trends.

33. We identified contact information for 41 of the firms that were selected for this study. We began sending emails to these contacts on July 10, 2014. We sent a first reminder email to the participants on July 22, 2014. Then, we began calling each company to solicit responses on August 12, 2014. We continued calling the numbers that had had not been disconnected, and for whom participants had not specifically opted out, until September 5, 2014. We sent a final reminder email on September 3, 2014 to the 35 participants that had not yet responded to the survey and whose email addresses did not bounce back as undeliverable on the first email attempt. All-in-all, and despite these efforts, the Fordham CLIP received a very minimal response to the survey. Two companies agreed to submit electronic survey responses, but only one in-fact did so, and one company provided off-the-record oral responses.

90.4% of smartphone utility patents.[34] Broken down by type of patent, the concentration of large corporations remains the same. Large corporations own 91.4%, 90.3%, and 88.4%, respectively, of the communications, hardware, and software patents.[35] On average, a large corporation in the smartphone field has 1488 patents. By contrast, a small organization has an average of 61 patents and a micro organization (though this designation is fairly new in the USPTO) has an average of 3.4 patents.

Most smartphone-related utility patents are communications patents. There are many more software patents than there are hardware patents, but both categories represent a significant percentage of smartphone patent portfolios. Table 12 shows this distribution.

Table 12 – Breakdown of Smartphone Utility Patents in Database[36]



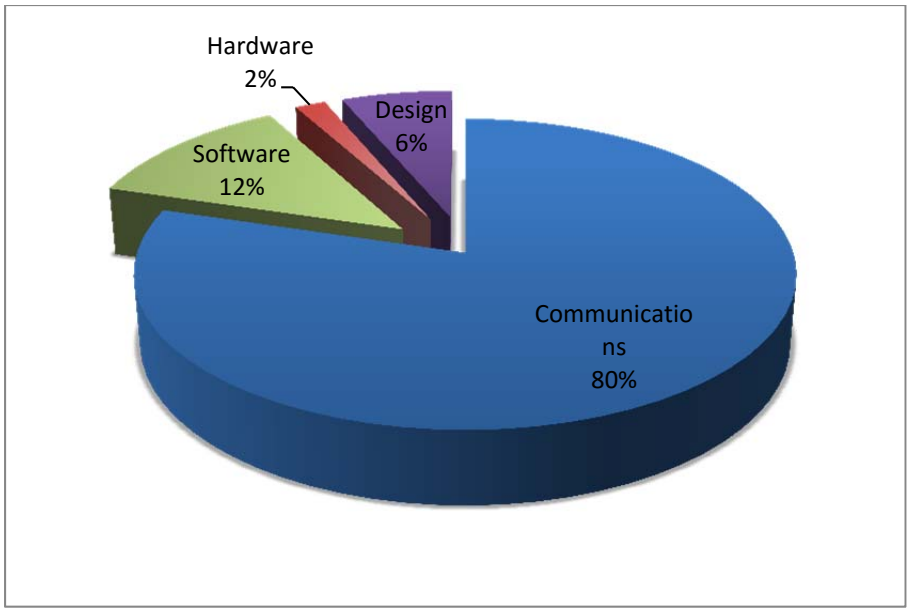
Our randomly selected sample of small players has a similar breakdown, albeit with a few key differences as shown in Table 13 below. The basic hierarchy is the same; communications represents the largest share followed by software and then hardware. However, for our small players, there is a higher percentage of communications patents and a very small percentage of hardware patents.

34. *See supra*, section III.A.

35. The patent classification numbers that break down into these three categories, communications, hardware, and software, are defined above in section II.B.

36. Design patents are not shown here for the overall database because the separate database that was constructed for the 2012 Smartphone Patent Study was over-inclusive to account for the uncertainty of design classifications.

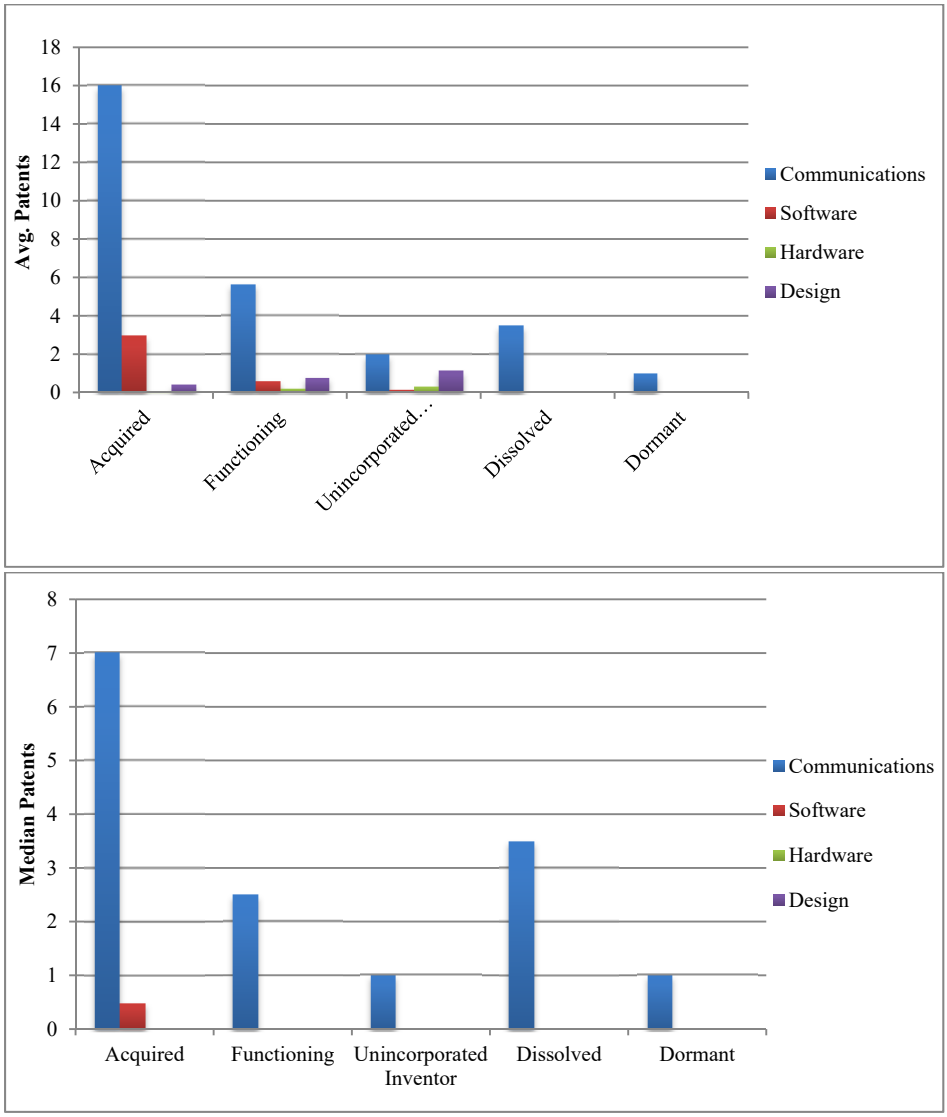
Table 13 – Breakdown of Smartphone Patents in Sample



Among the 46 selected small participants, those that have been acquired or are still functioning had, on average, a larger portfolio. Similarly, the median portfolio size for acquired companies was noticeably larger than those for all other dispositions. However, an outlier in the functioning category meant that the median for functioning companies was slightly lower than the median holdings for dissolved companies. This is shown in Table 14.

The category of patents a company has does not seem to matter for the company's long-term outcome. All the companies that were dissolved or are now dormant only had a small number of communications patents. Of the sample, 60% of the companies had only communications patents in their portfolios, 13% had only software patents, 2.2% had only hardware patents, and 2.2% had only design patents. This means that only 22.6% of selected small participants had a diversified portfolio.

Table 14 – Patent Categories and Business Survival



2. *Impact*

The demographics of the small participants with patents indicate that they have a surprisingly strong survival rate. Studies show that between 40% and 90% of all types of startups in the United States fail, depending on the

industry.[37] While these studies do not distinguish between startups with patents and those without, the failure rate of the small participants that have patents in the smartphone industry (as measured by dissolution or dormancy over the six year period between 2006-2012) was only 13%.[38] This suggests that the small participants in the smartphone industry with one or more patents are significantly more stable than startups in general.[39]

While the overall failure rate of the small participants was extremely low, the failures seemed to be concentrated in participants holding a small number of communications patents.[40]

Table 14 illustrates that those small participants with more diversified portfolios, or with a large number, of smartphone patents had a better chance of business survival. For those companies that were dissolved or went dormant, half formally assigned all their patents to another company, while the disposition of the patents of the other half could not be ascertained.[41] The

37. Faisal Hoque, *Why Most Venture Backed Companies Fail,* FAST COMPANY (Dec. 10, 2012, 6:02 AM), http://www.fastcompany.com/3003827/why-most-venture-backed-companies-fail; *Startup Business Failure Rate By Industry*, STATISTIC BRAIN, http://www.statisticbrain.com/startup-failure-by-industry/ (last visited Oct. 18, 2014); Glen Dalakian II, *90% of Tech Startups Fail,* WAMDA (Feb. 7, 2013), http://www.wamda.com/2013/02/90-percent-of-tech-startups-fail-infographic; Scott Shane, *Startup Failure Rates*, SMALL BUSINESS TRENDS (Apr. 28, 2008), http://smallbiztrends.com/2008/04/startup-failure-rates.html.

38. *See supra,* Tables 11 and 14 and accompanying text. Recognizing that there are other possible instances that may be considered failures, including bankruptcy restructuring, unfavorable acquisitions, or a complete lack of market share growth, the study examined the publicly available data and did not find any other significant events indicating apparent "failure" in this sample.

39. Failure rates specific to start-ups holding patents are not available; and thus, a direct comparison for patent holding start-ups and patent holding smartphone market participants is not possible.

40. For our sample of small participants, communications patents are clearly the most important and sought-after patents in the field. Communications patents have, at their heart, a theoretical and cognitive element that does not always require the application of expensive machinery to invent. Reducing hardware to practice—whether it is a consumer device or component for another business to use—is more expensive. This may explain the difference between the relative portfolios of the small and large players. It may also be that participation in the various communications standards-setting organizations is lucrative enough to incentivize even small companies to focus their efforts in that area. While designing around software and hardware patents may be possible, communications patents are often incorporated into standards, such as 4G LTE, and may be more difficult to avoid. This study did not identify whether any patents were declared essential to a standard. A prior study found that less than one third of smartphone patents in litigation were declared essential to a standard, concluding that "the smart phone patent wars do not appear to be driven by SEPs . . . ." Kirti Gupta & Mark Snyder, *Smart Phone Litigation and Standard Essential Patents*, HOOVER IP WORKING PAPER SERIES NO. 14006 (May 16, 2014), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2492331.

41. Of the six companies in the sample that were dissolved or dormant, three (Wisair, ORO Grande Technology, and ISP Operator) assigned all of their smartphone patents to another company while the disposition of the patents for the other three (Samhain Union,

unknown disposition of patents for half the failed companies may reflect either an abandonment of the patent or an unrecorded assignment. In any case, the recorded assignments of eight of the nineteen smartphone patents held by failed companies indicate that smartphone patents are still an important asset to be salvaged from a company's failure. That some companies took the time to perfect their assignment by filing it with the USPTO (eight patents in total) provides an indication that these smartphone patents had ongoing value despite the company failures.

While design patents are also part of a well-diversified portfolio, small participants in our sample did not typically include design patents in their portfolios. Our sample companies and inventors had, on average, less than one design patent each, and only 8.6% of the sample had a design patent. The rarity of design patents may be because the small participants are rarely large enough to manufacture, sell, and distribute a physical consumer product. It is also possible that, to protect the outward appearance of a product, companies simply rely on trademark and trade dress law.

B. *Overall Business Activity and Patent Portfolios*

To understand the overall business activity of the small market participants in our sample, we examined the complete patent portfolios including non-smartphone related patents and sought to understand the impact of the portfolios on the small participants' competitiveness.

1. *Analysis*

Many of the 46 selected small smartphone market participants also have patents in fields other than smartphones. This means that their business activities are not exclusively, and possibly not predominantly, in the smartphone market. Overall, only 41% of the patent portfolios owned by the entities in the sample are smartphone-related patents. On average, the small participants have twenty-two patents granted and thirty-two patents filed. The median number of patents granted, however, is only eleven, with the largest number of companies in the four to ten patent range. A few entities in the sample with very large portfolios (specifically, SiRF with 268 and Newport Media with 116 patents) skew the average to appear higher. Table 15 shows this frequency distribution of utility patent grants and filings.

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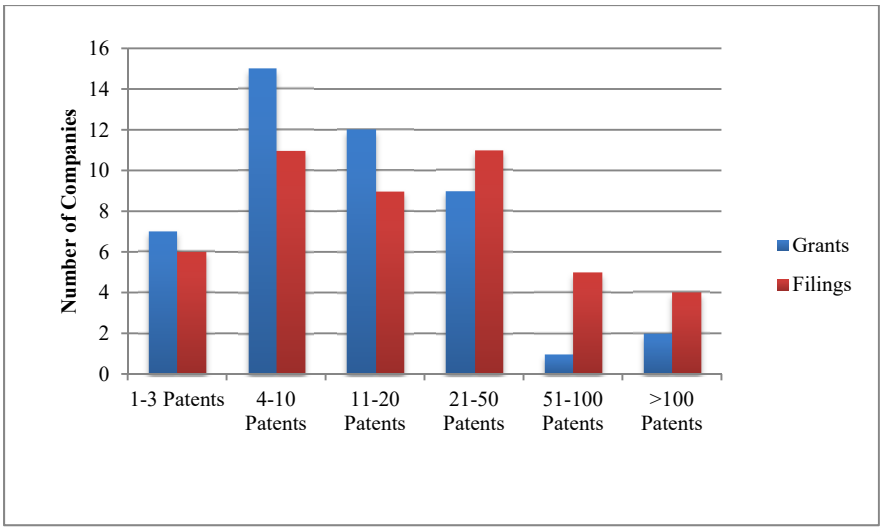
incNetworks, NexStep) is not known. The USPTO assignment database for the eleven patents held by Samhain Union, incNetworks, or NexStep contains no information on the disposition of the patents.

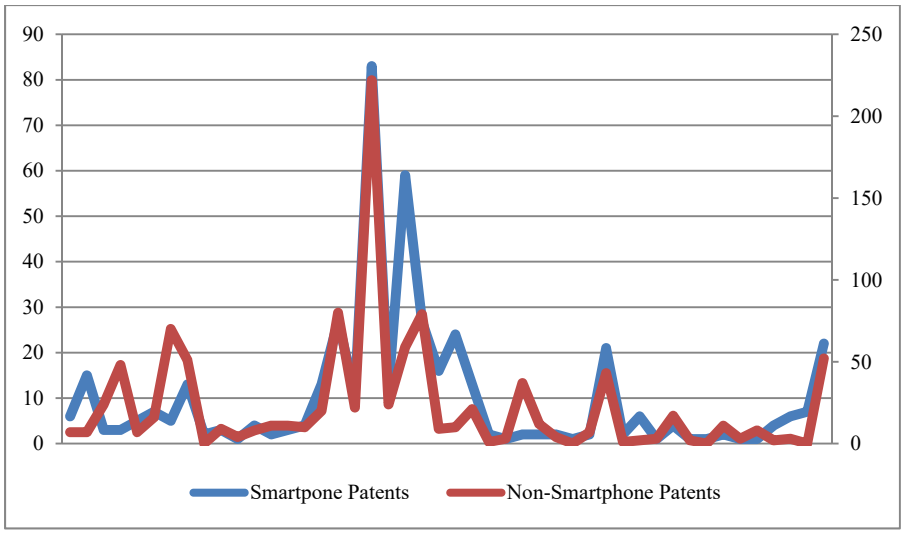
Table 15 – Total Utility Patent Grants and Filings



With respect to the overall types of patents held by the small participants in the smartphone market, they appear to keep their portfolios balanced between smartphone patents and other patents, as seen in Table 16 below. We examined this balance by running a statistical correlation analysis to determine whether our sample participants favor smartphone patents over non-smartphone related patents while growing their portfolios. The correlation coefficient between the arrays of the number of smartphone patents per entity and the number of other patents is 0.84 with a coefficient of determination (r^2) of 70.5%.[42] This correlation shows that small players in the smartphone market generally keep the number of smartphone patents in their portfolio in similar proportion to the number of non-smartphone patents.

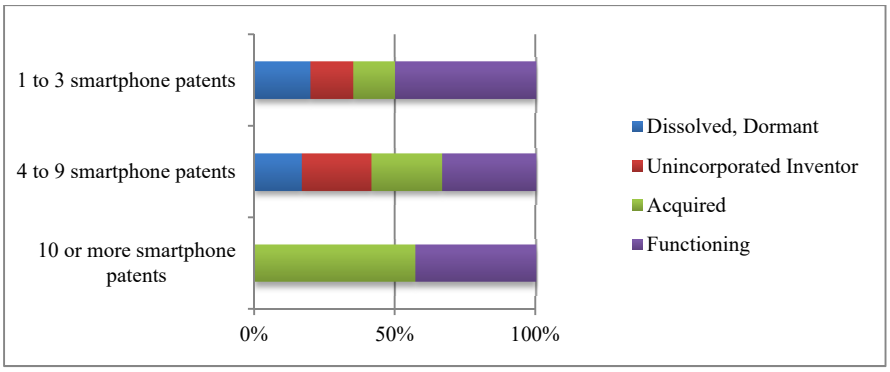
42. The correlation coefficient here is used to measure the direction and strength of the linear relationship between these two variables: smartphone patents and other patents. This coefficient is between -1 and 1. The closer the coefficient is to 1 or -1, the stronger the relationship between the variables. If it is close to zero, there is no correlation. A coefficient of greater than .8 generally indicates a strong correlation. If the coefficient is positive, it means that the two values tend to change in the same direction. If it is negative, they tend to change in opposite directions. The square of the coefficient (referred to as the "coefficient of determination") is the measure of how often of the variance of one variable is predictable by a change in the other.

Table 16 – Patent Distribution



In terms of business continuity, Table 17 below shows the outcomes based on the size of the patent portfolio. Of the sample participants with ten or more patents, eight were acquired and six are still functioning. None of these small participants appear to be dissolved or dormant. In other words, companies with ten or more patents tend to survive. With respect to the companies that own one to three patents, these market participants are distributed fairly evenly among the categories with the largest portion still functioning.[43]

Table 17 – Outcome Based on Number of Patents



43. The instance of lapsed utility patent maintenance fees is very low in our sample, indicating the continued operation of the patent holder. Seventy four percent of the sample did not miss a fee; all of their patents are in good standing. Five out of the twelve companies (42%) that allowed one or more patent fees to lapse were acquired by another company; three are still functioning; and only three appear to be dormant or dissolved. All but one have other patents in their portfolio for which fees are in good standing. Design patents have no maintenance fees, so no data about their retention is available.

2. *Impact*

The juxtaposition of patent holdings with business activity indicates that a larger patent portfolio correlates to a higher likelihood of business survival. None of the companies with ten or more smartphone patents in their portfolio appear to have stopped functioning during the study period. By contrast, nearly 20% of the companies with fewer than three patents appear to have failed; the remaining companies with fewer than three patents appear to be still functioning or have been acquired.

Table 17 reveals similarly that the companies with four to six patents fail more frequently than those with larger portfolios. After ten patents, a company's survival rate increases dramatically.[44] But, this may simply indicate that companies with more funding obtain more patents.[45] This may show that there is a benefit to having patents for the survival of a business and coupled with the findings in Table 18 that show increases in patent prosecution during fundraising, patents do appear to correlate with business survival. We examine the relationship between funding and patents in Part IV.C below.

The research also indicates that small market participants rarely focus exclusively on smartphones. Though we have identified companies and individuals that have a small presence in the smartphone market place, only 41% of the patents in their portfolios were smartphone patents. The available websites for the 46 selected small participants reveals that most of the small participants have other products and markets outside the smartphone field. For example, 82.6% of the sample had patents in non-smartphone patent classifications; of the remainder, 6.5% were individual inventors. Only a small portion of the sample (10.9%) were companies that patented technologies solely related to smartphones.[46]

With respect to design patents, the trends are similar to the industry as a whole. The small participants do not obtain design patents nearly as often as utility patents, and they rarely obtain design patents. As a general matter, design patents are valuable to protect the external designs of consumer-facing products, and the small participants typically do not offer consumer products. The small participants will often sell their products to other businesses, or their

44. This study found no correlation between the age of a company and the number of patents it held. A regression analysis yielded an r^2 of 0.002 for the correlation between the age of a company and the number of smartphone patents that it owned and an r^2 of 0.02 for the correlation between the age of a company and the total number of patents (including non-smartphone patents) that it owned.

45. A recent study conducted by data analytics firm CB Insights strongly suggests that the amount of funding a company raises is strongly correlated with the likelihood of its survival. 55% of startup companies that failed had raised less than $1 million. *The R.I.P. Report – Startup Death Trends*, CBINSIGHTS (Jan. 18, 2014), https://www.cbinsights.com/blog/startup-death-data/.

46. This relationship appears to persist as companies grow their overall portfolio of patents. *See supra*, Table 16 and accompanying text.

consumer product is software, not a physical product. This may be one reason design patents are rare among small players. Another reason may be that there is relatively little jurisprudence covering design patents, as compared to utility patents. Enforcing a design patent (unless it is so iconic and necessary to the success of a company) is complicated when compared to trademark and trade dress assertions.

Hence, on average, a small participant has less than one (0.83) design patent in its portfolio. All but five of the small participants (89%) in the sample have no design patents at all. The rare small participants that do have design patents, such as Control4 and Intertel, have a collection of design patents. Not surprisingly, Control4 and Intertel are manufacturers of hardware for end-users. Control4 manufactures smart-home equipment,[47] and Intertel makes business phones[48] as well as other types of end-user products for businesses. One unincorporated inventor, Michael Townsend, has only design patents in his portfolio for touch screen user interfaces. Interestingly, design patents may be seen as an inexpensive benefit. One respondent to the survey indicated that his company was considering applying for a design patent because it is "inexpensive and potentially useful."[49] That company, despite being a hardware business with 80% of its patents related to smartphones, has no design patents currently.

Of additional note, the data does not indicate any significant hindrance for small participants from utility patent maintenance fees. Patent fees are generally not high,[50] and the majority of lapsed patent maintenance fees do not appear to be the result of financial difficulties. Companies appear to allow some of their patents to lapse while preserving others in their portfolios. This makes sense if patents generally have a value greater than the cost of the maintenance fees.[51] Other companies appear to choose to move their businesses in a different direction. Some instance of lapsed fees for profitable companies may simply be due to oversight or clerical error.

C. *Smartphone Patents and Funding*

1. *Analysis*

The overwhelming majority of the corporate entities among the small

47. *See* CONTROL4, http://www.control4.com/ (last visited Oct. 31, 2014).

48. *See* INTERTEL PHONES, http://www.intertel-phones.com/ (last visited Oct. 31, 2014).

49. Survey response.

50. *United States Patent And Trademark Office Fee Schedule*, USPTO, http://www.uspto.gov/web/offices/ac/qs/ope/fee010114.htm (last visited Oct. 18, 2014).

51. Patents can lose value if they are found - either through litigation, due diligence, or by other contact from an interested party - to be unenforceable. Some companies may also choose to dedicate their patented technologies to the public.

participants were founded during or after 2000.[52] The relationship, thus, between patents and funding for small participants may provide an important indicator of the openness of the smartphone market.

The data shows that twenty-nine (or 63%) of the sample participants received some form of funding over the period studied, including seventeen entities that received at least one series of venture or "angel" funding.[53] On average, these small participants had 1.41 patents granted and 4.45 patents filed before their first funding event. After the final round of funding, 79% of these participants (twenty-three of the twenty-nine) stopped filing for patents. Indeed, after the final round of funding, the average number of patent filings for all participants was only 0.79 patents per participant. Table 18 shows the relationship between patents and the first and last funding events.

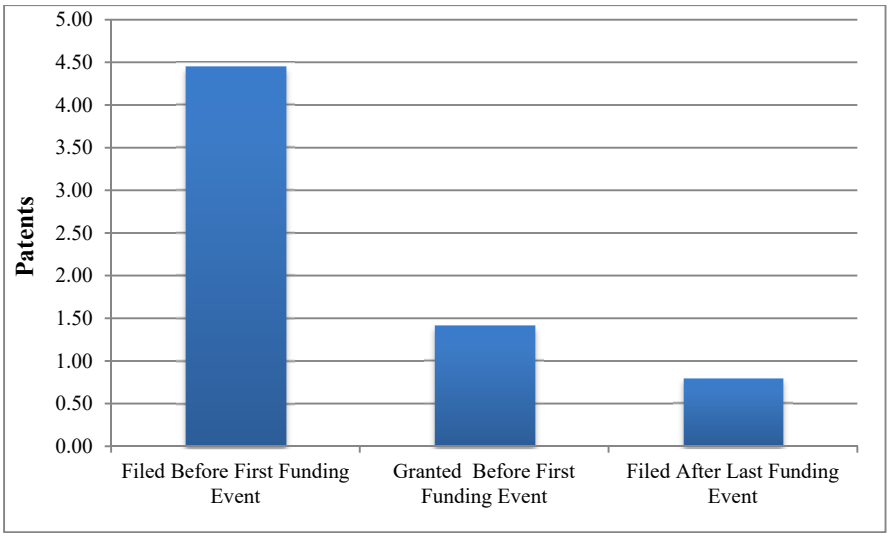
52. Of the forty corporate entities in the data set, 70% (twenty-eight) were founded after 2000. By contrast, many of the key large participants in the 2012 Smartphone Patent Study were incorporated many years earlier:

Research in Motion	1984
Apple	1976
Samsung	1938
Microsoft	1975
Nokia	1871
Google	1998
Motorola	1928
Sony	1946
Huawei	1987
Broadcom	1991

Of the twenty-eight companies in the sample that only came into existence in the year 2000 or later, eighteen received some form of funding during the period studied (64.3%). Of the twelve corporate entities that were less than ten years old, seven received funding (58.3%).

53. The data shows similar results for the subset of small participants that are truly small companies, rather than larger companies that have small forays into the smartphone market. Of the companies that registered as small companies, fifteen (51.7%) received some form of funding.

Table 18 – Average Number of Smartphone Patents



Patent prosecution in our sample picks up during the periods between funding events, in particular right before the first funding event and before an exit event. The companies that received funding showed an average of 2.4 patent filings during the six months before a funding event and 4.7 patent filings during the twelve-month period before a funding event. At least one patent application was filed by 37.9% of the companies six months before a funding event, and 44.8% of the companies filed at least one patent application within the twelve months prior to a funding event. Participants that received funding filed fewer patent applications after the events, with an average of 1.9 patents during the six months after a funding event (with 34.5% filing at least one patent) and an average of 3.3 patents during the year after (with 51.7% filing a patent).

To better understand the points at which companies choose to seek patents, we examined patent prosecution activity more closely. Table 19 presents the patent filings of each small participant in relation to the timing of the funding events. We focus on the last funding event or "exit" event to determine if these generate greater activity than other funding events.

Table 19 – Patents Before Exit Event[54]

	Number of Patents Granted Before Exit Event	Number of Patents Granted Before Previous Event	Difference
Airwalk Communications	9	4	5
Augme Technologies, Inc.	2	-	-
Bitstream Inc.	3	-	-
Cellemetry, LLC	0	0	0
Cequint, Inc.	4	4	0
Control4 Corporation	22	20	2
Core Mobility, Inc.	16	-	-
Cortina Systems, Inc.	21	1	20
Daylife, Inc.	2	0	2
Inter-Tel, Inc.	5	-	-
LiveWire Mobile, Inc.	1	1	0
Nethra Imaging Inc.	2	0	2
Newport Media, Inc.	60	7	53
PureDepth Inc.	0	-	-
SIRF Technology, Inc.	27	0	27
StarHome GmbH	11	0	11
Strix Systems, Inc.	7	4	3
Ubinetics Ltd.	2	0	2
Varia Mobil LLC	4	-	-
Veveo, Inc.	27	1	26
XG Technology, Inc.	27	5	22
Average	**16.14**		**11.7**

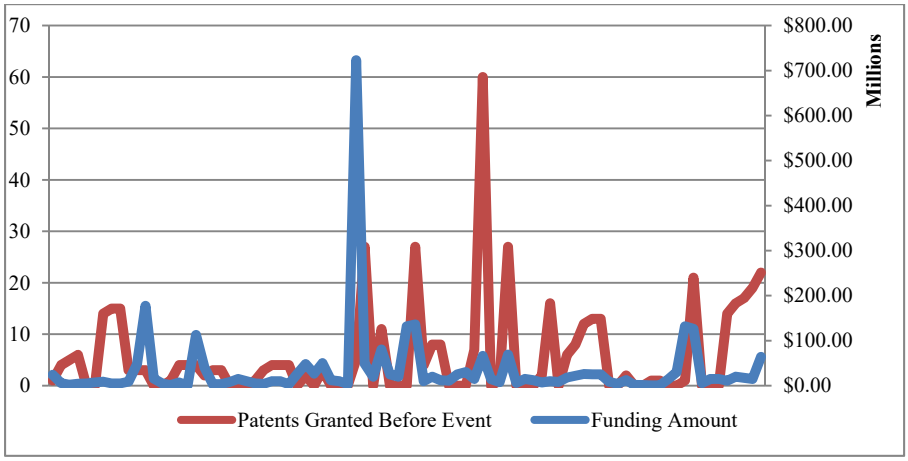
For exit events, nearly a majority of the small market participants in the sample, twenty-two (48%), experienced an exit event (either by acquisition or by initial public offering). On average, these twenty-two companies had 15.4 patents filed before the exit event occurred. The above data shows a run-up to obtain a larger number of patents right before the exit event. Companies that had a regular funding event prior to their exit event acquired, on average, another 11.7 patents shortly before they were acquired or went public.

While increases in the number of patents correlate to funding and exit events, the amount of money raised by those events does not correlate to the

54. A "-" indicates that there was no previous event; the acquisition or IPO was the only funding event for this participant.

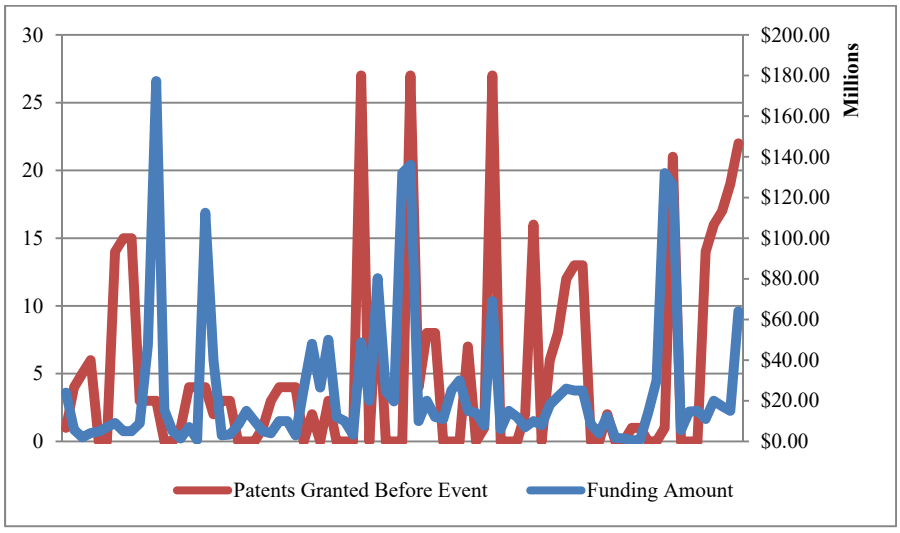
number of patents. Table 20 below shows that the funding amount and the number of granted patents before that event rarely move together. The correlation is very weak at 0.127. This correlation means that 1.6% (0.127^2) of variance between the funding amount and the number of patents is related.

Table 20 – Correlation Between Funding and Smartphone Patents



There are, however, two very clear outliers: one a very high number of patents and one a very high funding amount. If the two outliers are removed, the correlation improves but only slightly as illustrated in Table 21 below. Without these outliers, the correlation coefficient is 0.312 (9.7% of variance is related); this does not indicate meaningful correlation.

Table 21 – Correlation Between Funding and Smartphone Patents Excluding Outliers



The r correlation improves slightly to 0.192 when patent filings are considered rather than patent grants. With the two outliers removed, the r correlation between the amount of funding in respective funding events and the number of patent filings before those events is 0.41, another weak correlation coefficient.

To rule out funding bias based on age, we ran a correlation analysis on age versus funding. The amount of funding that a company received does not appear to be a function of a company's age. A regression analysis of all eighty-five recorded funding events shows no correlation between age and amount. The r^2 was very weak at 0.014 and was even weaker than the correlation between the number of patents and funding amount. However, an outlier (a funding amount of $732 million) caused the statistical significance to fall below a reliable threshold. With the outlier funding event removed, the statistical significance of the regression was restored and the r^2 rose slightly to .084, which is still a weak correlation and which does not show a connection. The age of a company, thus, does not appear to be a good predictor for the amount of funding the company will receive nor does age create funding bias.

2. *Impact*

The data shows that small participants in the smartphone market with patents significantly outperform startups in general in their fund-raising success.[55] According to one study, 0.05% of startups receive venture funding and 0.91% of startups receive angel funding.[56] In our sample, 63% received funding totaling $2.8 billion. In every measure we used to isolate the truly small companies from the small participants in the market that were actually part of large organizations, the data still showed more than half of the entities with smartphone patents receiving some form of funding. Moreover, 50% of our sample received more than one round of funding; and split between the twenty-nine companies that received funding, the funding received averaged $96,551, which exceeds the startup industry average of $78,406.[57]

As our data showed, a company's ability to build its smartphone patent portfolio correlates with the company's ability to raise funds but not the amount of funds raised in each round. Though there is no causal relationship between the number of patents and the amount of funding, the companies' actions show that they perceive this connection between patents and funding. The data also

55. According to a Money Tree study, venture capitalists entered only 3,995 deals totaling about $29 billion in 2013, an increase of 7% over the previous year. Jeffrey Davidson & Laura Cruz, *Annual venture investment dollars rise 7% and exceed 2012 totals,* PRICE WATERHOUSE COOPER (Jan. 17, 2014), http://www.pwc.com/us/en/press-releases/2014/annual-venture-investment-dollars.jhtml.

56. Laura Entis, *Where Startup Funding Really Comes From*, ENTREPRENEUR (Nov. 20, 2013), http://www.entrepreneur.com/article/230011.

57. *Id.*

shows that age alone does not correlate with higher (or lower) funding amounts. The sample companies exhibited a common pattern in timing for prosecuting patents.[58] The companies in the sample began to build patent portfolios, then sought funding, and then had an opportunity to operate in the market or merge with larger companies. Between funding rounds, companies increase their patents filings. According to the data, the small participants typically increased their acquisitions of patents at a significant level beginning twelve months before obtaining funding. This indicates that patented innovation increases a company's ability to survive in the marketplace. After their final funding event (an acquisition, or an IPO), companies then significantly reduce their smartphone patent filings.

This trend among the small participants indicates that the patent right serves as an important asset for small participants to enter the smartphone market. The patent right appears to strengthen the small participants' existence and to strengthen the small participants ability to compete for necessary funding. The small participants also perceive the patent right as an important signaling marker for the company. Of the forty corporate entities in our sample, twenty-five (62.5%), mentioned patents somewhere on their own website.[59] This also indicates that companies value their patent portfolio as a means to entice interest from customers or investors.[60]

Corporate mergers and acquisitions also give circumstantial evidence that patent rights provide access to market presence for small participants. For example, three of our selected companies were bought by larger organizations. CSR, a large UK-based semiconductor company, bought SiRF (a participant in our sample) for $136 million in stock. SiRF was a very active innovator and held 305 patents of which eighty-three were smartphone patents. CSR also bought Ubinetics (another sample participant) for $48 million in cash. Ubinetics was a less active innovator and only held twelve patents, of which three were smartphone patents. The third company, Intertel, was acquired by Mitel for $723 million. At the time of the acquisition, Intertel had a total of thirty-three patents, of which thirteen were smartphone patents. The patent rights appeared to be significant components of the acquisition strategies for all the companies involved.

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58. *See supra,* Tables 20 and 21

59. This percentage does not include the unincorporated inventors; six companies had no patent info and eight websites were down or otherwise unavailable.

60. Anecdotally, it also seems that seeking investment is a top reason for seeking patent rights. One survey respondent noted that the most important impact of smartphone patents on his business was the "[a]bility to negotiate with much more powerful business entities." One survey respondent indicated that it used its patents only "when seeking funding" for the business and had sought funds more than ten times in the last three years. That respondent had never asserted infringement of its patents, in or out of court, or used its patents in advertisement for customers. The other survey respondent stated that his or her company used smartphone patents only in seeking investments and in informal assertions (e.g. cease and desist letters) against competitors.

Lastly, the finding that companies significantly slowed or ceased filing for patents following the last funding round may be attributed to a variety of factors. The companies may simply have stopped innovating and shifted focus to other areas such as product manufacturing, customer acquisition and retention or sales. Alternatively, the companies might have switched to a trade secret-based business model once certain financial thresholds were reached. Or, companies may have begun to file under other names once they have sufficient financial stability, such as through the name of a patent holding subsidiary. And, it may also be possible that once financial stability was established, companies simply began purchasing patent rights from others rather than generating new patentable inventions from within. Finally, the reduction in patent filings may be less pronounced than the data indicates. This is due to the possibility that the data may be incomplete if some companies changed their names after they were acquired or if the entities themselves acquired another company. Nevertheless, there is a marked and unexplained slowdown in patent acquisition even among companies that are still functioning under the same name.

D. *Typology of Litigation*

We examined all the litigation involving the small market participants in our sample to understand how suits affected their market presence.

1. *Analysis*

In total, the fourty-six selected small participants were parties in sixty lawsuits–thirty-two as plaintiffs and twenty-eight as defendants. Thus, in terms of litigation, the average entity saw 1.3 suits with 35% of the companies involved in one or more public lawsuits.

Few of these suits, however, involved patents, and even fewer involved smartphone patents. The total number of patent-related suits for all the companies was thirty-eight. Yet, those suits were concentrated among ten small participants, and the remaining thirty-six participants (78%) were not involved in any patent litigation.[61] Of the ten companies that were involved in some form of patent litigation, all but one are still functioning or have been acquired. On average, the small participants had less than one (0.83) suit each. Only six of the companies were defendants in a patent suit.[62] Of the twenty-three suits

61. *See supra* section III.E (35% of small companies have no suits of any type.).

62. The following six companies from the sample were defendants in a patent litigation: 1) Wisair; 2) SiRF Technology; 3) Strix Systems.; 4) LiveWire Mobile; 5) Augme Technologies.; and 6) Control4. The following thirteen companies were plaintiffs in litigations adverse to the above defendants: 1) Broadcom; 2) Global Locate; 3) Linex Technologies.; 4) Callertone Innovations; 5) LucidMedia Networks; 6) Velti; 7) Sipco; 8) Lutron; 9) US Ethernet Innovations; 10) Olivistar; 11) Inncom International; 12) Azure

where our sample companies were plaintiffs, only four of the suits asserted smartphone patents.[63] Of the fifteen suits where our sample companies were defendants in patent litigation, twelve included one or more patents with a smartphone patent classification, all of which were in the "communications" category.[64]

Several of the small participants in this study brought patent infringement claims against large companies, including some identified in the 2012 Smartphone Patent Study as "key" participants. For example, Nonend Inventions N.V. sued Spotify (a music services company that had three million paying users at the time) for infringement of Nonend's patents covering content streaming.[65] Another small player, Cequint, Inc., sued Apple for infringement of Cequint's patents covering advanced caller identification technology.[66] Augme Technologies, Inc. sued Yahoo, Pandora, and others for infringing on Augme's patents covering a process for adding functionality to a web page.[67]

Networks; and 13) Tri-County Excelsior Foundation. We did not undertake the qualitative and subjective determination of whether the patents asserted against our sample were closely enough related to the smartphone industry. However, from a high level analysis, most of the patents were closely related with assertions of GPS, data communications, and caller ID patents.

63. The following seven companies from the sample were plaintiffs in a patent litigation: 1) Nonend Inventions; 2) Cequint; 3) StarHome; 4) SiRF Technology; 5) Veveo; 6) Augme Technology.; and 7) Varia Mobil.

64. *See supra* section III.B, Tables 3-5; Linex Techs. v. Motorola, Inc., et al., No. 9:05-CV-80300); Global Locate, Inc. v. SiRF Tech., Inc. et al., No. 4:06-CV-06964 (N.D. Cal. Nov. 14, 2006); Lutron Elecs. Co., Inc. v. Control4 Corp., No. 2:06-CV-00401, 2009 WL 137170 (D. Utah Jan. 20, 2009); Global Locate v. SiRF. Tech., Inc. (ITC Inv. No. 337-TA-602); Broadcom Corp. v. SiRF Tech., Inc., No. 8:08-CV-00546, 2009 WL 8591845 (C.D. Cal. July 20, 2009); Inncom Int'l Inc. v. Control4 Corp., No. 3:09-cv-00649-CFD (D. Conn. 2009); Broadcom Corp. v. CSR plc et al., No. 8:10-CV-01662 (C.D. Cal. Jan. 13, 2011); Callertone Innovations LLC v. U.S. Cellular Corp. et al., No. 1:11-CV-01068; Sipco, LLC v. Control4 Corp., No. 1:11-CV-0612-JEC, 2012 WL 526074 (N.D. Ga. Feb. 16, 2012); Azure Networks LLC et al. v. Samsung Telecomms. America LLC et al., No. 6:12-CV-00745; U.S. Ethernet Innovations, LLC v. Cirrus Logic, Inc., No. 6:12-CV-00366, 2013 WL 8482270 (E.D. Tex. Mar. 6, 2013); Wilan, Inc. v. Apple Inc., No. 3:14-CV-01507 (S.D. Cal. June 23, 2014).

65. Complaint & Demand for Jury Trial, Nonend Inventions N.V. v. Spotify USA Inc. et al., No. 1:13-CV-00389 (D. Del. Mar. 8, 2013), *available at* https://search.rpxcorp.com/lit/dedce-51308-nonend-inventions-nv-v-spotify (last visited Oct. 18, 2014); Dawn McCarty, *Spotify Sued by Nonend Over Technology for Music Sharing,* BLOOMBERG (Aug. 17, 2012, 12:06 PM), http://www.bloomberg.com/news/2012-08-17/spotify-sued-by-nonend-over-technology-for-music-sharing.html.

66. Complaint & Demand for Jury Trial, Cequint Inc. v. Apple Inc., No. 1:11-CV-01224 (D. Del. Dec. 12, 2011), available at https://search.rpxcorp.com/lit/dedce-47651-cequint-v-apple (last visited Oct. 18, 2014); Wolfgang Gruener, *Cequint Sues Apple Over Advanced Caller ID*, TOM'S GUIDE (Dec. 14, 2011, 8:00 AM), http://www.tomsguide.com/us/patent-infringement-lawsuit-apple-iphone,news-13503.html.

67. Augme Techs., Inc. v. Tacoda LLC, No. 1:07-CV-07088, 2011 WL 5547983 (S.D.N.Y. Nov. 14, 2011) (Tacoda was in the middle of being acquired by AOL when this lawsuit was filed.); Augme Techs., Inc. v. Yahoo!, Inc., No. 09-05386-JCS, 2012 WL

Of the six small participants in the smartphone market that were defendants in patent litigation, three were registered with the USPTO as large corporations[68] and three as small ones.[69] These three "small" participants, Augme Technologies, Control4, and Strix Systems, are now fairly large successful companies, though some with only small smartphone-related ventures. Augme Technologies, for example, acquired Hipcricket and now, operating under that name, reported revenue of $7.3 million in the first fiscal quarter of 2014.[70] Though currently operating at a deficit, Hipcricket does not appear to fault patent litigation for any of its losses and in fact lists patent litigation as an asset in its public filings.[71] Control4 has over three hundred employees and generated revenue of $109.5 million in 2012.[72] Strix systems in 2007 held the top two positions in the number of nodes and radios shipped in terms of both revenues and market share.[73] One of the six defendants among the small participants in the sample, Wisair Ltd., seems to be no longer functioning,[74] while the other five are either active or acquired.[75]

Non-practicing entities are largely absent from litigation involving the small participants.[76] Of the twelve plaintiffs who brought smartphone patent law suits against the small participants in our sample, five were listed by RPX as NPEs .[77] Of those few sample participants that were involved in litigation with a NPE (8.7%), all but one were named as co-defendants in a suit where the

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3627408 (N.D. Cal. Aug. 21, 2012); Augme Techs., Inc. v. Pandora Media, Inc., No. 1:11-CV-00379, 2012 WL 6055010 (D. Del. Dec. 5, 2012); Augme Techs., Inc. v. Gannett Co., No. 1:11-CV-05193; 2011 WL 3207118 (E.D. Va. July 26, 2011); Augme Techs. Inc. v. Velti USA Inc., No. 1:12-CV-00294 (D. Del. Mar. 9, 2012); Augme Techs. Inc. v. Millennial Media Inc., No. 1:12-CV-00429 (D. Del. Apr. 5, 2012).

68. *See supra* note 12.

69. *See supra* note 18.

70. Hipcricket, Inc., Quarterly Report (Form 10-Q) at 12 (July 20, 2011), a*vailable at* http://a.aug.me/augmeimg/44000/43235.pdf. (Augme/Hipcricket has brought patent infringement actions against AOL, Time Warner Cable, and Yahoo Inc.).

71. *Id.* at 11.

72. *Control4*, INC., http://www.inc.com/profile/control4 (last visited Oct. 18, 2014).

73. *News Spotlight*, STRIX SYSTEMS, http://www.strixsystems.com/newsspotlight.aspx (last visited Oct. 18, 2014).

74. Azure Networks and Tri-County Excelsior Foundation added Wisair and several other technology companies as defendants to an amended complaint in a lawsuit initially brought against Samsung. Though Wisair was named as a defendant, there is no indication that the lawsuit had any meaningful impact on Wisair's ability to function or contributed to Wisair's demise. Even if this one litigation were damaging to Wisair, it would stand alone as an outlier in our study as the only company so adversely affected by smartphone patent litigation.

75. These observations were made as of October 2014.

76. Non-practicing entities (NPEs) involved in patent litigation are identified by RPX and listed in the database of litigations. Their status was determined by reference to the RPX database of annotated litigations, which is: available at http://www.rpxcorp.com/.

77. 1) Azure Networks; 2) Linex Technologies, Inc.; 3) Callertone Innovations; 4) Sipco; and 5) U.S. Ethernet Innovations.

primary defendant was a large corporation, including Apple and Samsung.[78] The companies that defended patent infringement suits against a NPE also tended to have large portfolios of patents themselves.[79]

A study by Professor Chien using NPE litigation data for high-tech patents from the Stanford Intellectual Property Litigation Clearinghouse (IPLC) shows a similar result.[80] According to her study, 76% of all high-tech patent suits were brought by public or private corporations, and among industries, the range was 71-84%. Individuals initiated 5% of suits and nonprofits 1%. That left the NPE share at 17%, including 8% of all hardware suits, 20% software suits, and 23% of all financial suits.[81] Therefore, among the technology suits (hardware and software), NPEs brought only 14% of all the high-tech patents lawsuits. This is slightly higher than our figure of 8.7% for the narrower class of smartphone patents. Contrary to popular perception, the percentage of NPE-initiated lawsuits is lower than anticipated.

Of the forty-six small participants in the sample, two (4.3%) were identified as an NPE themselves.[82] Both of these companies initiated patent lawsuits against very large companies, but not against other small players.

In all, only 6.5% of the small participants were sued for patent infringement by an operating company. There is also only one instance of a large actor identified in the 2012 Smartphone Patent Study suing a small participant.[83]

2. *Impact*

Patent litigation itself does not seem to be a major threat for small participants in the smartphone field. Twenty-two percent of the small participants in our sample were involved in patent litigation at some point from their inception through October 2014. However, of those only half (11%) of the small participants were named as defendants in a suit where a smartphone

78. *Sipco, LLC v. Control4 Corp* (1:11-CV-00612); *Olivistar, LLC v. Control4 Corporation* (2:14-CV-00393).

79. The following 4 companies from the sample were sued by an NPE for alleged infringement of smartphone patent: 1) Wisair; 2) Strix Systems; 3) LiveWire Mobile; and 4) Control4.

80. Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. Rev. 1571 (2009). Here, high-tech patents refer to hardware, software, and financial patents based on the USPTO patent classification of the litigated patents. *See id*. at 1593-94.

81. *Id*. at 1600.

82. The following two companies in the sample were identified by RPX corp. as NPEs: 1) Nonend Inventions; and 2) Augme Techs.

83. Broadcomm sued a relatively small market participant—SiRF—for patent infringement related to GPS. SiRF was a semiconductor manufacturing company. Broadcomm later named SiRF in another patent lawsuit against CSR, a much larger semiconductor company which had acquired SiRF.

patent had been asserted. And of those 5 companies, only two (4%) were named as a defendant directly while the others were named as co-defendants in a suit where the primary defendant was a large corporation.[84] With regard to NPEs the data is similar, with only one member out of 46 from the sample facing an NPE directly in patent litigation. This data does not indicate that these lawsuits adversely affected any of the small participants' ability to function in the smartphone market.[85] The data does suggest, however, that a strategy of amassing a defensive patent portfolio would be unnecessary. Neither large industry players nor non-practicing entities appear to have much of an interest in suing small participants for patent infringement.

By contrast, there are several instances where small participants have used their patents against large companies as a method of obtaining compensation for their innovations.[86] On the reverse side, some litigation appears to result in the acquisition of the defendant. For example, Bitstream was acquired by Monotype imaging, which had previously sued Bitstream for patent infringement. Likewise, in the midst of litigation with Broadcomm, SiRF was acquired by the much larger semiconductor company CSR. This acquisition was not directly related to the litigation as the purchase was part of a strategy for CSR to become "a connectivity centre for everything from bluetooth to FM radio, GPS and near-field communications."[87]

IV. OPENNESS OF THE MARKETPLACE

The relationship of patents to the openness of the smartphone market for small participants is, like that of large participants, difficult to isolate. The trends in three areas provide insight for the assessment of openness of the smartphone market to small participants: A) market access; B) market exit; and C) litigation.

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84. Global Locate, Inc. v. SIRF Technology, Inc. et al. No. 4:06-CV-06964; Global Locate v. Sirf. Tech, Inc. (ITC Inv. No. 337-TA-602); Lutron Elecs. Co. v. Control4 Corp., No. 2:06-CV-00401; Broadcom Corporation v. SiRF Technology Inc No. 8:08-CV-00546; Inncom Intl Inc v. Control4 Corp No.3:09-CV-00649; Sipco, LLC v. Control4 Corp, No. 1:11-CV-00612; Olivistar, LLC v. Control4 Corporation, No. 2:14-CV-00393.

85. No company publicly attributed any financial difficulties to patent litigation.

86. *See e.g.*, Veveo, Inc. v. Verizon Services Corp. et al., No. 1:10-CV-06709 (S.D.N.Y. Sept. 9, 2010); Cequint Inc. v. Apple Inc., No. 1:11-CV0-01224 (D. Del. 2013); Augme Technologies Inc. v. Pandora Media Inc., No. 1:11-CV-00379; Augme Techs., Inc. v. Yahoo!, Inc., 2012 U.S. Dist. LEXIS 151 (N.D. Cal. Jan. 3, 2012); Augme Techs., Inc. v. AOL Inc., 2012 U.S. Dist. LEXIS 88463 (S.D.N.Y. June 20, 2012); Varia Holdings LLC v. Samsung Electronics Co, Ltd., No. 1:12-CV-01899; Veveo, Inc. v. Comcast Corp. et al., No. 1:13-CV-11885; Nonend Inventions NV v. Spotify USA Inc. et al., No. 1:13-CV-00389; Starhome GmbH v. AT&T Mobility LLC, 743 F.3d 849 (Fed. Cir. 2014).

87. Maija Palmer, CSR seeks out acquisitions, Financial Times, Oct. 27, 2009. http://www.ft.com/cms/s/2/b23392ea-c321-11de-8eca-00144feab49a.html

A. *Access to the Market*

The findings show that patents in the smartphone field help provide access to the market for small players. Whether the ease of access is equivalent for small market participants that do not hold any patents, the data here demonstrates that a portfolio of smartphone patents increases the likelihood of survival, and of being funded, acquired, or going public. The sample of patent holding companies with a small presence in the smartphone market showed a very high rate of survival or successful exit, well above the average for small tech companies in general. Though not an absolute requirement to do business, obtaining a patent covering smartphone innovations does seem to help considerably in gaining access to funding.

The research affirms that patents provide credibility to small participants with respect to investors. One reason may be that patents are expensive to prosecute and the existence of a patent demonstrates access to capital and a willingness to invest in the company's future (on average the companies had filed 4.45 patents before their first funding event[88]). This credibility may explain why a small entity in the smartphone field with patents has a disproportionately high probability of receiving funding and surviving.

The research shows that a very large portfolio of patents is not necessarily better than a small one. A company with just a few patents greatly increases its access to the market through funding and a company with ten or more patents substantially increases its likelihood of survival.[89] Beyond ten patents, however, no significant increase was observed in the ability to survive and there is no meaningful correlation between the number of patents and the amount of funding received.[90] This is important with respect to entry costs. The cost of obtaining a professionally drafted and prosecuted U.S. patent is somewhere between $5,000 and $20,000.[91] Therefore, the cost of obtaining several patents is not prohibitively high for a small commercial enterprise. If a very large portfolio of patents were required for survival and funding, the legal and filing fees could be considered a substantial barrier to entry. For example, if small companies needed a defensive portfolio to respond to large participants' infringement assertions that were designed to quash competition, the cost of entry might be prohibitive. This study did not observe such a barrier.

Small participants, though, focused on the communications segment of the market. The findings show that the vast majority (80%) of smartphone patents

88. *See supra* section IV.C.1.

89. *See supra* Table 17

90. See supra *sections IV.B.1 (Table 17* Table 17) and IV.C.1.

91. Paul Chang, *The Costs of Obtaining Patent Protection*, WOLVERINE STARTUP LAW (Apr. 15, 2014), http://www.wolverine-startuplaw.com/2014/04/15/the-costs-of-obtaining-patent-protection/.

produced by the small players are communications patents.[92] Software is the second in line with 12%, design is a low 6%, and hardware represents only 2% of patents in our data set.[93] The low rate of hardware and design patents might be explained by the costs of reducing an invention to practice. For hardware, expensive machinery may be needed to build prototypes of hardware. This may change in the near future with the proliferation of 3D printing. Design patents are usually for consumer products and our small players rarely have a consumer-facing product. Instead, they sell their products to other businesses that then include them in a consumer product.

The low number of software patents as compared to communications patents is more difficult to explain because the process of creating software and new communications methods is closely related. This might be explained by the confusing jurisprudence surrounding the enforceability of patents on software. The Supreme Court has in essence stated that software patent claims need to be limited to a commercial embodiment.[94] Another possible explanation is that prosecuting and enforcing communications patents may be perceived as easier.

B. *Exit*

A successful "exit" is the hallmark of the venture capital world[95] and represents an open market if both access and exit options exist for small participants. For an investor, the "exit" goal is to make a profit on the invested capital. Exit may occur by an internal buy-out of early investors, by another company's acquisition of the organization, or by the company offering shares to the public on a stock market.

The small participants with smartphone patents fare very well in terms of their potential for an exit. Of the forty companies represented among the forty-six small participants sample, fifteen (37.5%) exited through a successful acquisition event. Another four (10%) offered shares publicly on a stock exchange.[96] This is a very high percentage showing that there are readily available exit options along with investor confidence in those businesses

92. *See supra* Table 13.

93. *Id*.

94. *See e.g.*, Bilski v. Kappos, 561 U.S. 593, 593 (2010); Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2347(2014).

95. *See e.g. Exit Strategy*, INVESTOPEDIA, http://www.investopedia.com/terms/e/exitstrategy.asp (last visited Oct. 31, 2014); Nicole Gravagna, Peter K. Adams, *Venture Company Exit Options*, DUMMIES, http://www.dummies.com/how-to/content/venture-company-exit-options.html (last visited Oct. 31, 2014).

96. Data regarding the internal buyout of investors was not publicly available. Companies that went public are: 1) PureDepth; 2) Augme; 3) XG Technology; and 4) Control4.

holding patents with a small presence in the smartphone market. The patents, thus, appear to serve as a valuable asset for small participants.

But as with funding in general, there is no meaningful correlation in the research results between the amount of money generated by an exit event (an acquisition or an IPO in this study) and the number of patents. Thus, while a smartphone patent portfolio may be helpful to secure a successful exit, there is no indication that a large portfolio with many patents is necessary for a small market participant to exit successfully.

C. *Litigation*

Few patent holders seem interested in suing the small players in the smartphone field for patent infringement. With two exceptions, the small participants were not the targets of any oppressive costly litigation brought by competitors.[97] To the contrary, small participants sued large industry players for patent infringement more often than the other way around. And the few study participants that were the subject of patent litigation campaigns had already grown large enough to absorb those costs on their balance sheets by the time of that litigation, as demonstrated by the research results relating to market longevity.[98] In addition, NPEs do not appear to target small participants. This study found only one example when a small market participant was sued as a primary defendant by a NPE for infringement of a smartphone patent.[99]

The relatively low instance of patent litigation may be due to cost. According to a study performed by the American Intellectual Property Law Association (AIPLA) in 2013, the costs of patent litigation are extremely high.[100] Table 22 below illustrates these costs. Expenses can run as high as $2.8 million for disputes where the amount in controversy is between $1 million and $25 million. Disputes that exceed $25 million more than double that cost with an average of $5.9 million. And disputes of $1 million or less cost on average almost $1 million through trial, a cost that often exceeds the amount at stake.

Table 22 – Costs of Patent Litigation Generally[101]

Amount in Controversy	**Cost through Discovery**	**Cost through Trial**
<$1mm	$530K	$970K
$1mm - $10mm	$1.2mm	$2.1mm

97. One company closed its doors following patent litigation, Wisair, Ltd., but the suit did not appear as the reason Wisair ceased to exist.

98. *See supra* sections IV.A.1 and IV.D.1.

99. Sipco, LLC v. Control4 Corp (1:11-CV-00612); Olivistar, LLC v. Control4 Corporation (2:14-CV-00393); *See also supra* IV.D.1.

100. *2013 Report of the Economic Survey*, AIPLA, http://www.aipla.org/learningcenter/library/books/econsurvey/2013EconomicSurvey/Pages/default.aspx (last visited Oct. 31, 2014).

101. *Id.*

$1mm - $25mm	$1.7mm	$2.8mm
$10mm - $25mm	$2.2mm	$3.6mm
>$25mm	$3.6mm	$5.9mm

When an NPE sues a company for patent infringement, the cost of litigation is slightly lower.[102]

While the threat of costly patent infringement litigation might be used to create a significant barrier to entry, the cost-benefit analysis makes it unlikely that a small participant will actually be sued. The benefits for plaintiffs may be limited. According to Price Waterhouse Cooper's annual litigation trends report, the most prevalent measure of damages for patent infringement is a reasonable royalty.[103] Reasonable royalties are typically calculated as a percentage of revenue made on a product that embodies an infringed patent and that would have resulted from a hypothetical licensing negotiation.[104] This means that even with a hypothetical royalty as high as 10%, a small target company would need $10 million in revenue just from infringing products for a plaintiff to recover the costs of bringing the lawsuit.[105] While the Price Waterhouse Coopers' study further indicates that median damages are the largest in the telecommunications field compared to the nine other fields examined,[106] this does not seem to be enough to justify the high cost of litigation or the long time to trial (median time to trial for an NPE is 2.5 years with a 25% success rate and the median time for a practicing entity is 2.28 years with a 35% success rate). Even if a plaintiff is able to secure a sufficiently high judgment, there is no guarantee that the small market participant will be able to pay. The high cost of patent litigation, the inability to shift costs to the loser, and the low potential for high damages may actually be keeping offensive litigants from stifling small players.

For some of the large market participants, restraint in litigation against small participants may be a strategic choice for good will. If a large player begins suing all its potential competitors to eliminate them from the industry, they may receive backlash from their own customers or a government agency, or they may inadvertently bring publicity to competitors from media coverage.

102. *Id*. This slight reduction in cost is likely due to the fact that NPEs, by their nature, have no competing business to permit a countersuit and counter-discovery.

103. 2014 PWC Study, *supra* note 2 at 13.

104. *See* TWM Mfg. Co. v. Dura Corp., 789 F.2d 895, 898-99 (Fed. Cir. 1986).

105. Moreover, jury trials yield much higher damages than bench trials and are used much more often in patent trials, especially in the telecommunications industry. 2014 PWC study, *supra* note 80, at 15. But small companies are known to play the bully card if a larger company or a non-practicing entity brings a patent infringement suit. These facts combined with the high costs likely discourage patent litigation against small players in the smartphone field (and likely in other fields as well). This may explain why large market participants in the smartphone space and non-practicing entities choose not to assert patents against small players in court.

106. 2014 PWC Study, *supra* note 2, at 13.

One survey participant explained that the first mover advantage—being the first with a new product on the market—as opposed to patent assertions is the best way to protect a company's place in the market. It is also a difficult task to convince a jury and the public that a large corporation suing a small entity is not a bully.

Lastly, cease and desist letters might pose threats to small participants. These letters inform an adverse party of the existence of one or more patents and of the patent owner's intent to assert their rights. This in turn triggers several legal doctrines. It helps ensure that the patent owner does not lose the right to enforce the patent in the future.[107] A letter that specifies a patent also provides notice to the target company—a requirement for a claim of willful infringement, which can significantly increase damages. A widespread letter campaign could extract costly licensing fees from some of the targets that fear litigation and its high costs. But a cease and desist letter campaign may have a weak effect if litigation is not seen as a real possibility. The high cost of litigation, the low likelihood of recouping those costs from a small company, and the low instance of observed litigation against small companies may undercut the threat to small market participants of cease and desist letters. However, we have no way of measuring the actual effect of cease and desist letters such as licensing fees paid to avoid litigation.[108]

The data shows that patent litigation does not seem to be a barrier to entry in the smartphone field. The common perception that small companies are being stifled by unscrupulous, unfair, and overburdening litigation is not supported by our data for the smartphone market.[109]

CONCLUSION

Patents are an important tool for small players entering the smartphone market. With a few patents, small participants gain access to the market through financing that results from their increased attractiveness to investors as compared to the startup industry in general. The ability to obtain a number of patents also enhances small participants' ability to survive and to effect a successful market exit. This means that entry and exit are enhanced by small

107. For instance, the doctrines of collateral estoppel or laches prevent a patent holder from laying in wait while a company builds an entire business around a patented invention and then pouncing on them to demand their revenue years later. *See e.g.* Ashe v. Swenson, 397 U.S. 436, 436 (1970).

108. Our review of press releases from the companies did not provide any information about cease and desist letter campaigns and we had insufficient survey responses to draw information.

109. Loek Essers, *'Patent Trolls' Cost Tech Companies $29 Billion Last Year, Study Says*, PC WORLD (June 27, 2012), http://www.pcworld.com/article/258395/patent_trolls_cost_tech_companies_29_billion_last_year_study_says.html.

participants' patent holdings. Patent litigation, whether from operating companies or NPEs, does not appear to be a significant concern for small players and does not appear to pose barriers to entry. These are all positive indicators that patent rights are providing incentives for innovation among entry participants and small industry players.

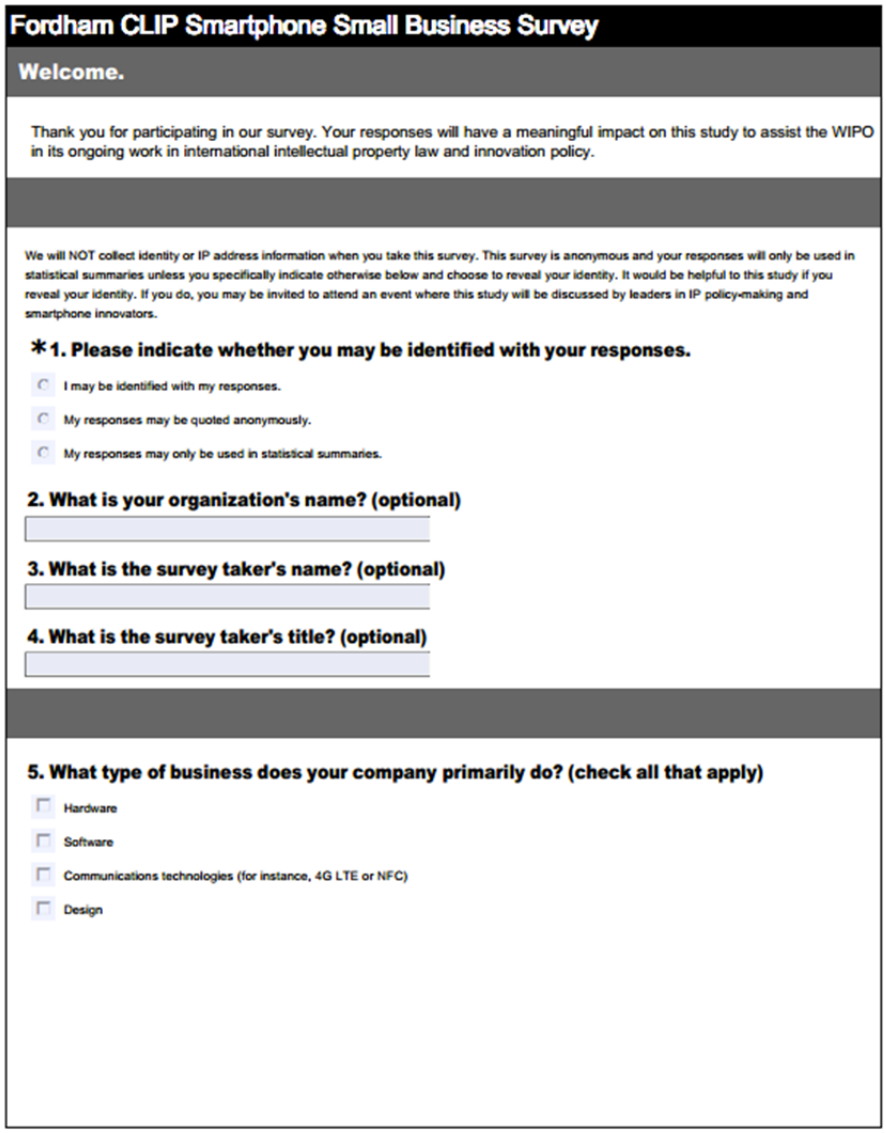
APPENDICES

APPENDIX A – LIST OF SELECTED SMALL PARTICIPANTS IN THE SMARTPHONE MARKET

Airwalk Communications, Inc.
Altair Semiconductor, Ltd.
Augme Technologies, Inc.
Beyer Jr, Malcolm K (Individual Inventor)
Bitstream, Inc.
Carrier IQ, Inc.
Cellemetry, LLC
Cequint, Inc.
Control4, Corp.
Core Mobility, Inc.
Cortina Systems, Inc.
Daylife, Inc.
Exphand, Inc.
IncNetworks, Corp.
Intertel, Inc.
Interstate Electronics, Corp.
ISP Operator Corp.
iTechTool, Inc.
Kauffman, George M (Individual Inventor)
KD Secure, LLC
Knapp, Ronald P (Individual Inventor)
Legend Silicon Corp.
LiveWire Mobile, Inc.
Nethra Imaging, Inc.
Newport Media, Inc.
NexStep, Inc.
Nonend Inventions, N.V.
Octasic, Inc.
ORO Grande Technology, LLC
PureDepth, Inc.
Salmon Technologies, LLC
Samhain Inion, LLC
SiRF Technology, Inc.
StarHome, GmbH.
Strix Systems, Inc.

Sudharshan, Srinivasan (Individual Inventor)
Tensorcomm ,Inc.
Townsend, Michael L (Individual Inventor)
Ubinetics, Ltd.
Varia Mobil, LLC
Veveo, Inc.
Viktor, Kaptelinin (Individual Inventor)
Wisair, Ltd.
Wmode, Inc.
Xcerion, Ab.
XG Technology, Inc.

APPENDIX B



Fordham CLIP Smartphone Small Business Survey

Welcome.

Thank you for participating in our survey. Your responses will have a meaningful impact on this study to assist the WIPO in its ongoing work in international intellectual property law and innovation policy.

We will NOT collect identity or IP address information when you take this survey. This survey is anonymous and your responses will only be used in statistical summaries unless you specifically indicate otherwise below and choose to reveal your identity. It would be helpful to this study if you reveal your identity. If you do, you may be invited to attend an event where this study will be discussed by leaders in IP policy-making and smartphone innovators.

***1. Please indicate whether you may be identified with your responses.**

- I may be identified with my responses.
- My responses may be quoted anonymously.
- My responses may only be used in statistical summaries.

2. What is your organization's name? (optional)

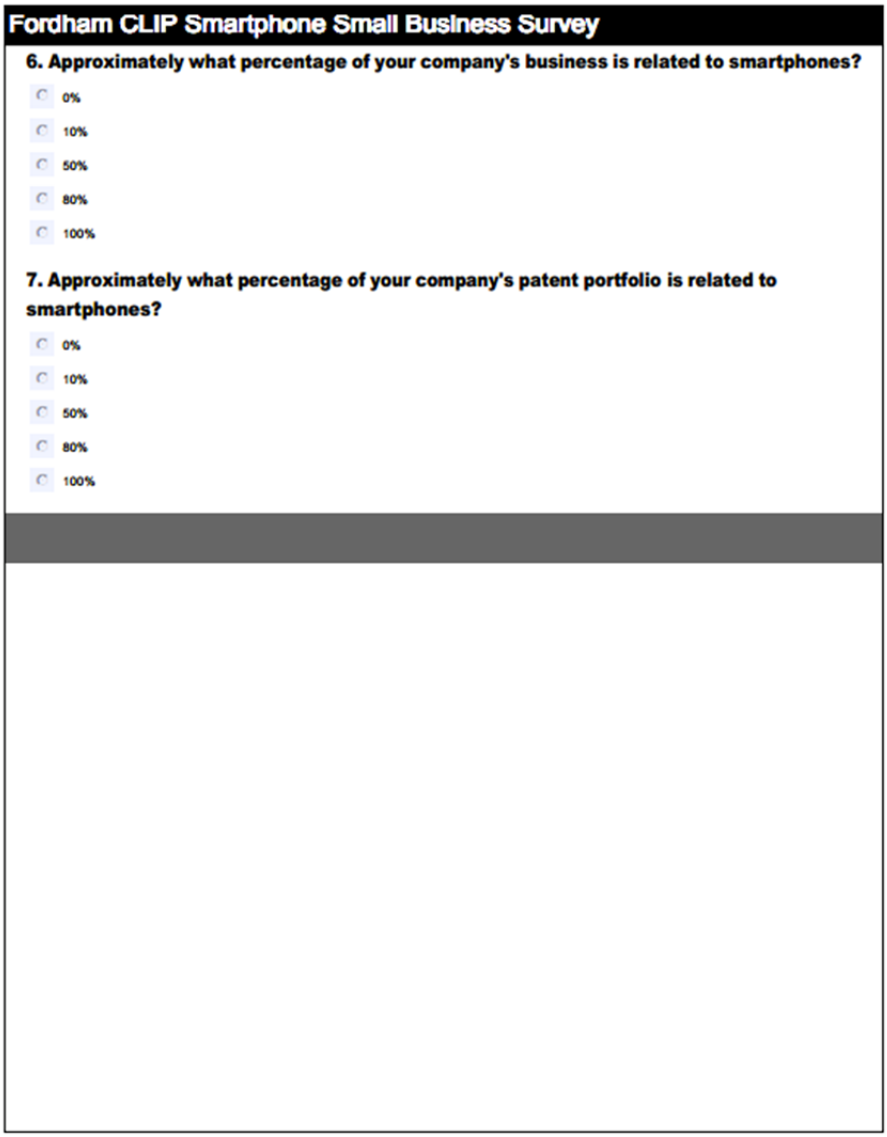
3. What is the survey taker's name? (optional)

4. What is the survey taker's title? (optional)

5. What type of business does your company primarily do? (check all that apply)

- Hardware
- Software
- Communications technologies (for instance, 4G LTE or NFC)
- Design

Page 1



Fordham CLIP Smartphone Small Business Survey

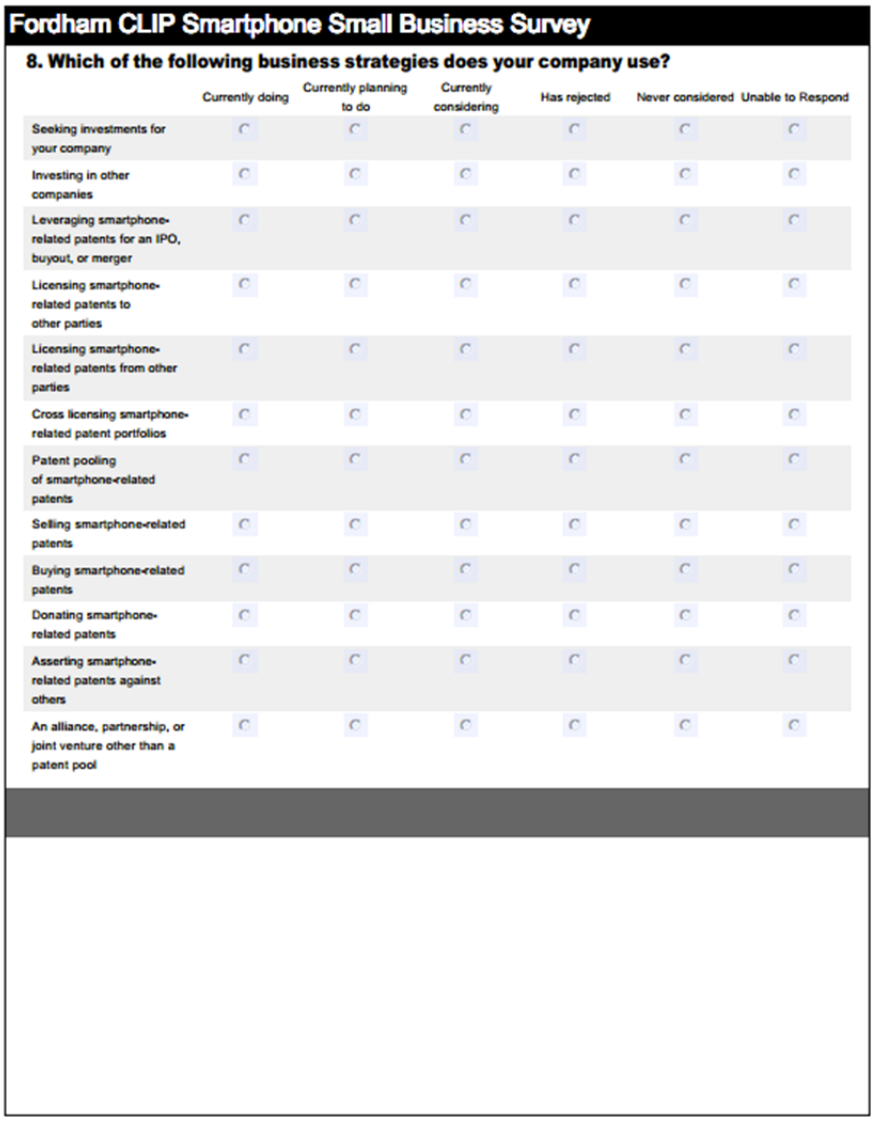
6. Approximately what percentage of your company's business is related to smartphones?

- 0%
- 10%
- 50%
- 80%
- 100%

7. Approximately what percentage of your company's patent portfolio is related to smartphones?

- 0%
- 10%
- 50%
- 80%
- 100%

Page 2

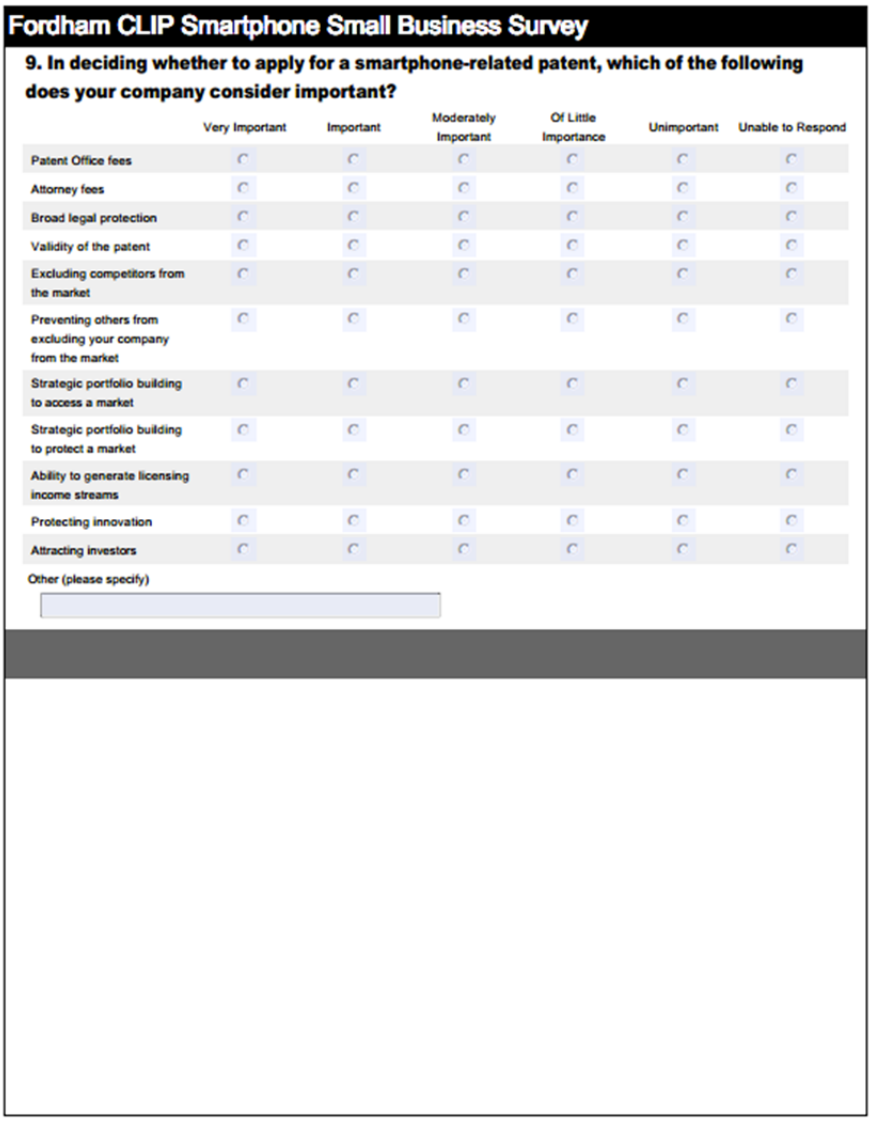


Fordham CLIP Smartphone Small Business Survey

8. Which of the following business strategies does your company use?

	Currently doing	Currently planning to do	Currently considering	Has rejected	Never considered	Unable to Respond
Seeking investments for your company						
Investing in other companies						
Leveraging smartphone-related patents for an IPO, buyout, or merger						
Licensing smartphone-related patents to other parties						
Licensing smartphone-related patents from other parties						
Cross licensing smartphone-related patent portfolios						
Patent pooling of smartphone-related patents						
Selling smartphone-related patents						
Buying smartphone-related patents						
Donating smartphone-related patents						
Asserting smartphone-related patents against others						
An alliance, partnership, or joint venture other than a patent pool						

Page 3



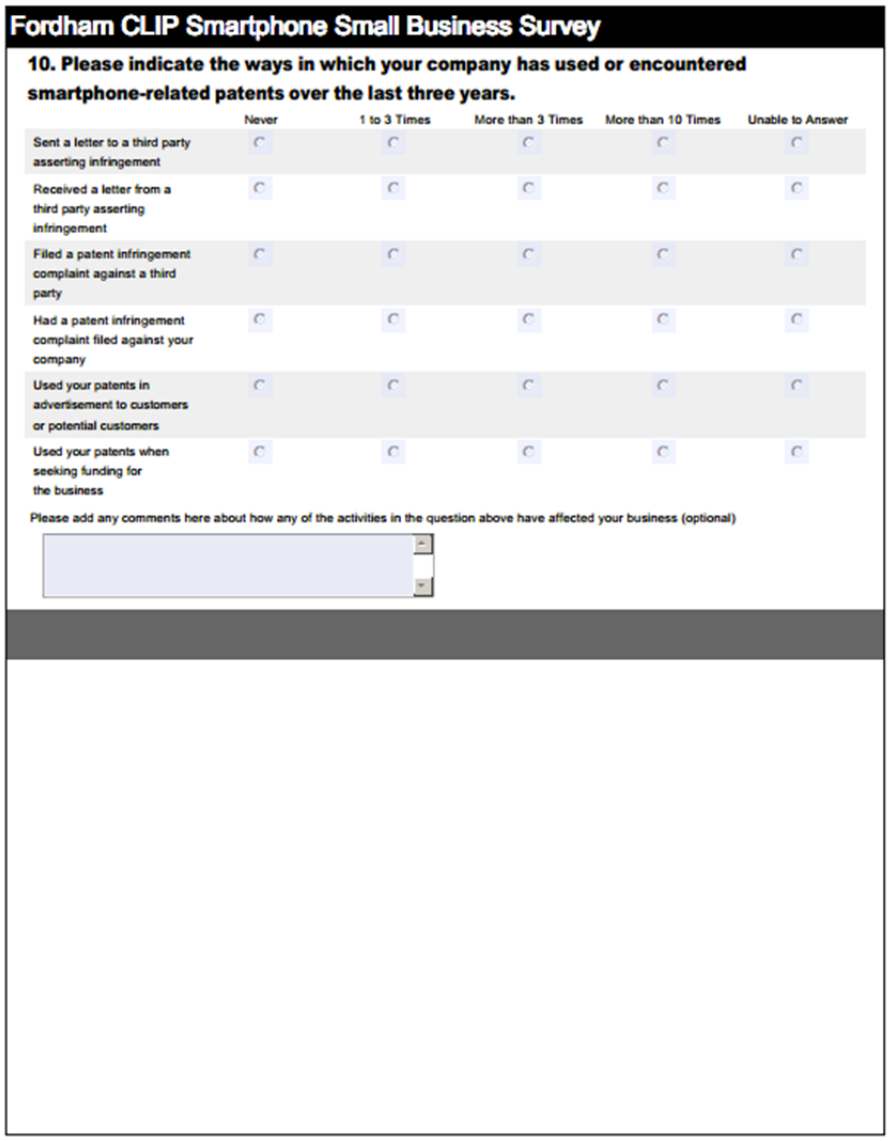
Fordham CLIP Smartphone Small Business Survey

9. In deciding whether to apply for a smartphone-related patent, which of the following does your company consider important?

	Very Important	Important	Moderately Important	Of Little Importance	Unimportant	Unable to Respond
Patent Office fees	○	○	○	○	○	○
Attorney fees	○	○	○	○	○	○
Broad legal protection	○	○	○	○	○	○
Validity of the patent	○	○	○	○	○	○
Excluding competitors from the market	○	○	○	○	○	○
Preventing others from excluding your company from the market	○	○	○	○	○	○
Strategic portfolio building to access a market	○	○	○	○	○	○
Strategic portfolio building to protect a market	○	○	○	○	○	○
Ability to generate licensing income streams	○	○	○	○	○	○
Protecting innovation	○	○	○	○	○	○
Attracting investors	○	○	○	○	○	○

Other (please specify)

Page 4



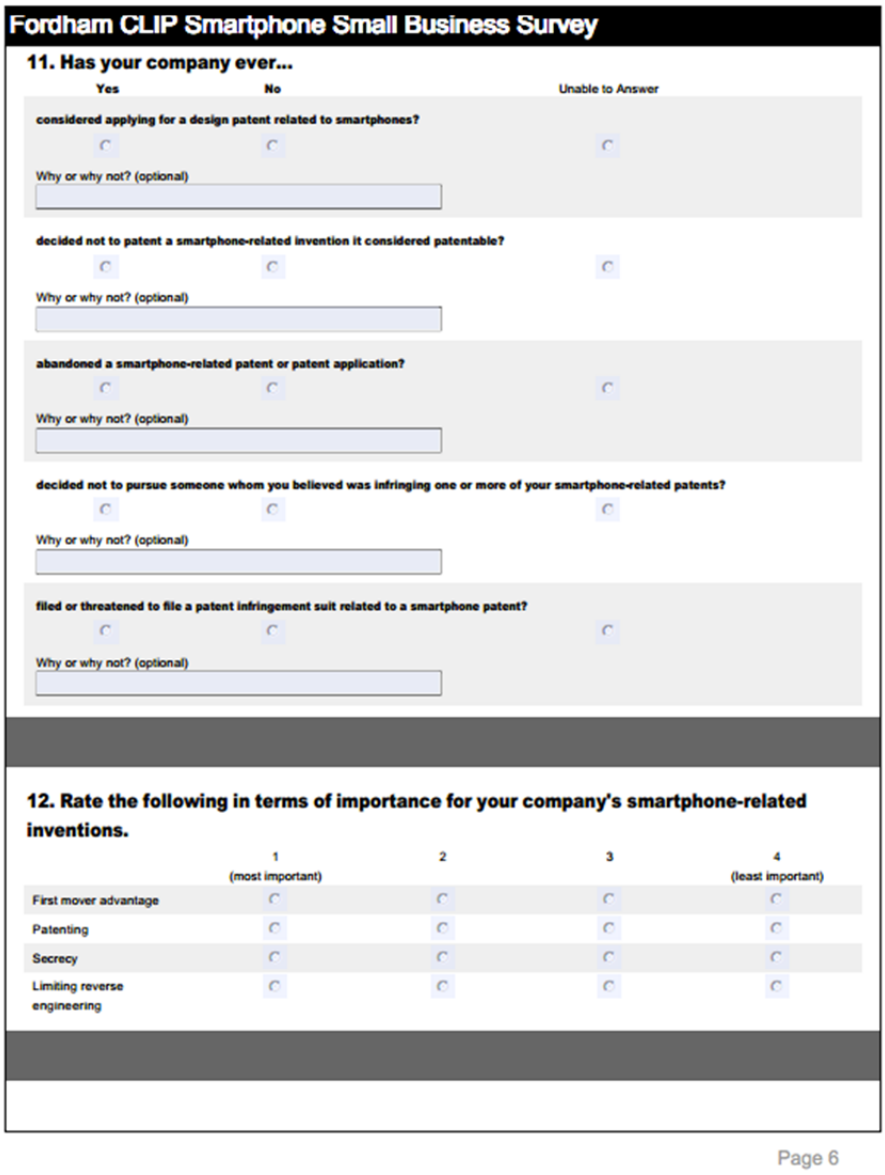
Fordham CLIP Smartphone Small Business Survey

10. Please indicate the ways in which your company has used or encountered smartphone-related patents over the last three years.

	Never	1 to 3 Times	More than 3 Times	More than 10 Times	Unable to Answer
Sent a letter to a third party asserting infringement	○	○	○	○	○
Received a letter from a third party asserting infringement	○	○	○	○	○
Filed a patent infringement complaint against a third party	○	○	○	○	○
Had a patent infringement complaint filed against your company	○	○	○	○	○
Used your patents in advertisement to customers or potential customers	○	○	○	○	○
Used your patents when seeking funding for the business	○	○	○	○	○

Please add any comments here about how any of the activities in the question above have affected your business (optional)

Page 5



Fordham CLIP Smartphone Small Business Survey

11. Has your company ever...

	Yes	No	Unable to Answer
considered applying for a design patent related to smartphones?	○	○	○
Why or why not? (optional)			
decided not to patent a smartphone-related invention it considered patentable?	○	○	○
Why or why not? (optional)			
abandoned a smartphone-related patent or patent application?	○	○	○
Why or why not? (optional)			
decided not to pursue someone whom you believed was infringing one or more of your smartphone-related patents?	○	○	○
Why or why not? (optional)			
filed or threatened to file a patent infringement suit related to a smartphone patent?	○	○	○
Why or why not? (optional)			

12. Rate the following in terms of importance for your company's smartphone-related inventions.

	1 (most important)	2	3	4 (least important)
First mover advantage	○	○	○	○
Patenting	○	○	○	○
Secrecy	○	○	○	○
Limiting reverse engineering	○	○	○	○

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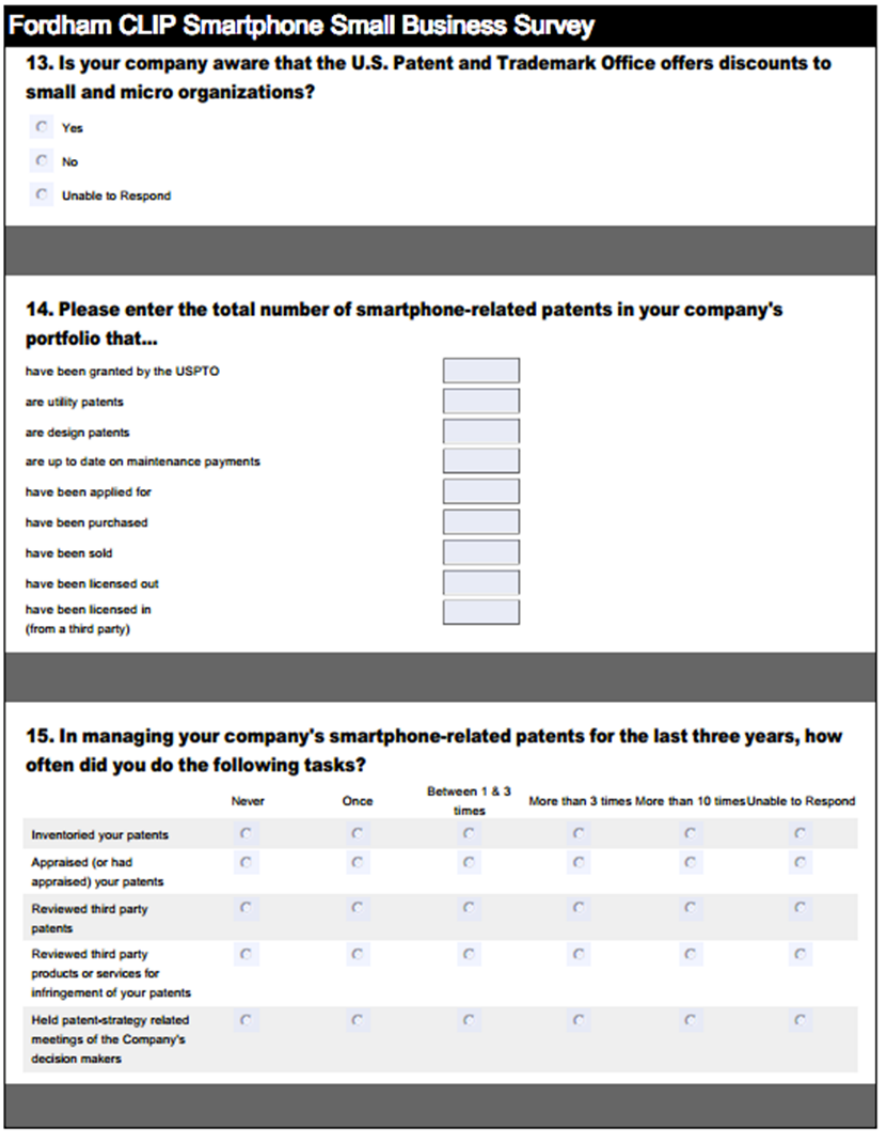

Fordham CLIP Smartphone Small Business Survey

13. Is your company aware that the U.S. Patent and Trademark Office offers discounts to small and micro organizations?

- ○ Yes
- ○ No
- ○ Unable to Respond

14. Please enter the total number of smartphone-related patents in your company's portfolio that...

have been granted by the USPTO	
are utility patents	
are design patents	
are up to date on maintenance payments	
have been applied for	
have been purchased	
have been sold	
have been licensed out	
have been licensed in (from a third party)	

15. In managing your company's smartphone-related patents for the last three years, how often did you do the following tasks?

	Never	Once	Between 1 & 3 times	More than 3 times	More than 10 times	Unable to Respond
Inventoried your patents	○	○	○	○	○	○
Appraised (or had appraised) your patents	○	○	○	○	○	○
Reviewed third party patents	○	○	○	○	○	○
Reviewed third party products or services for infringement of your patents	○	○	○	○	○	○
Held patent-strategy related meetings of the Company's decision makers	○	○	○	○	○	○

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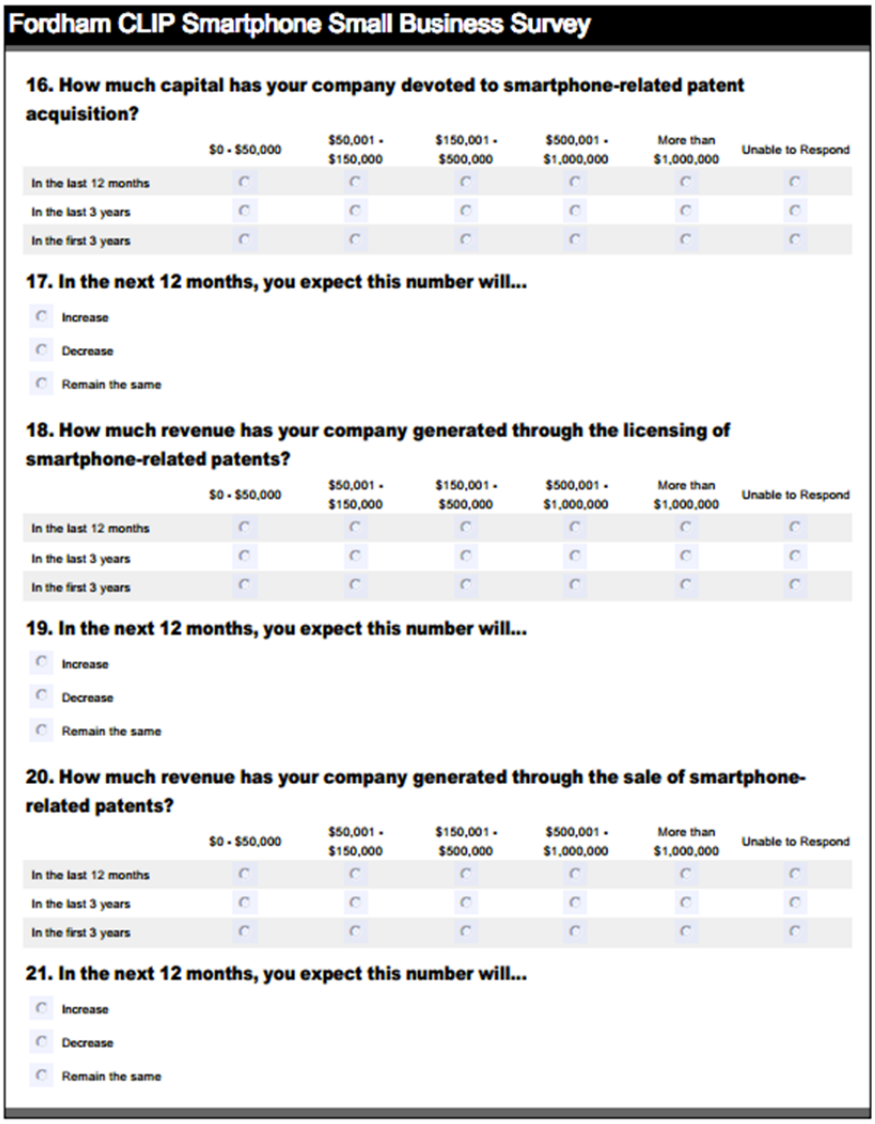

Fordham CLIP Smartphone Small Business Survey

16. How much capital has your company devoted to smartphone-related patent acquisition?

	$0 - $50,000	$50,001 - $150,000	$150,001 - $500,000	$500,001 - $1,000,000	More than $1,000,000	Unable to Respond
In the last 12 months	○	○	○	○	○	○
In the last 3 years	○	○	○	○	○	○
In the first 3 years	○	○	○	○	○	○

17. In the next 12 months, you expect this number will...

- ○ Increase
- ○ Decrease
- ○ Remain the same

18. How much revenue has your company generated through the licensing of smartphone-related patents?

	$0 - $50,000	$50,001 - $150,000	$150,001 - $500,000	$500,001 - $1,000,000	More than $1,000,000	Unable to Respond
In the last 12 months	○	○	○	○	○	○
In the last 3 years	○	○	○	○	○	○
In the first 3 years	○	○	○	○	○	○

19. In the next 12 months, you expect this number will...

- ○ Increase
- ○ Decrease
- ○ Remain the same

20. How much revenue has your company generated through the sale of smartphone-related patents?

	$0 - $50,000	$50,001 - $150,000	$150,001 - $500,000	$500,001 - $1,000,000	More than $1,000,000	Unable to Respond
In the last 12 months	○	○	○	○	○	○
In the last 3 years	○	○	○	○	○	○
In the first 3 years	○	○	○	○	○	○

21. In the next 12 months, you expect this number will...

- ○ Increase
- ○ Decrease
- ○ Remain the same

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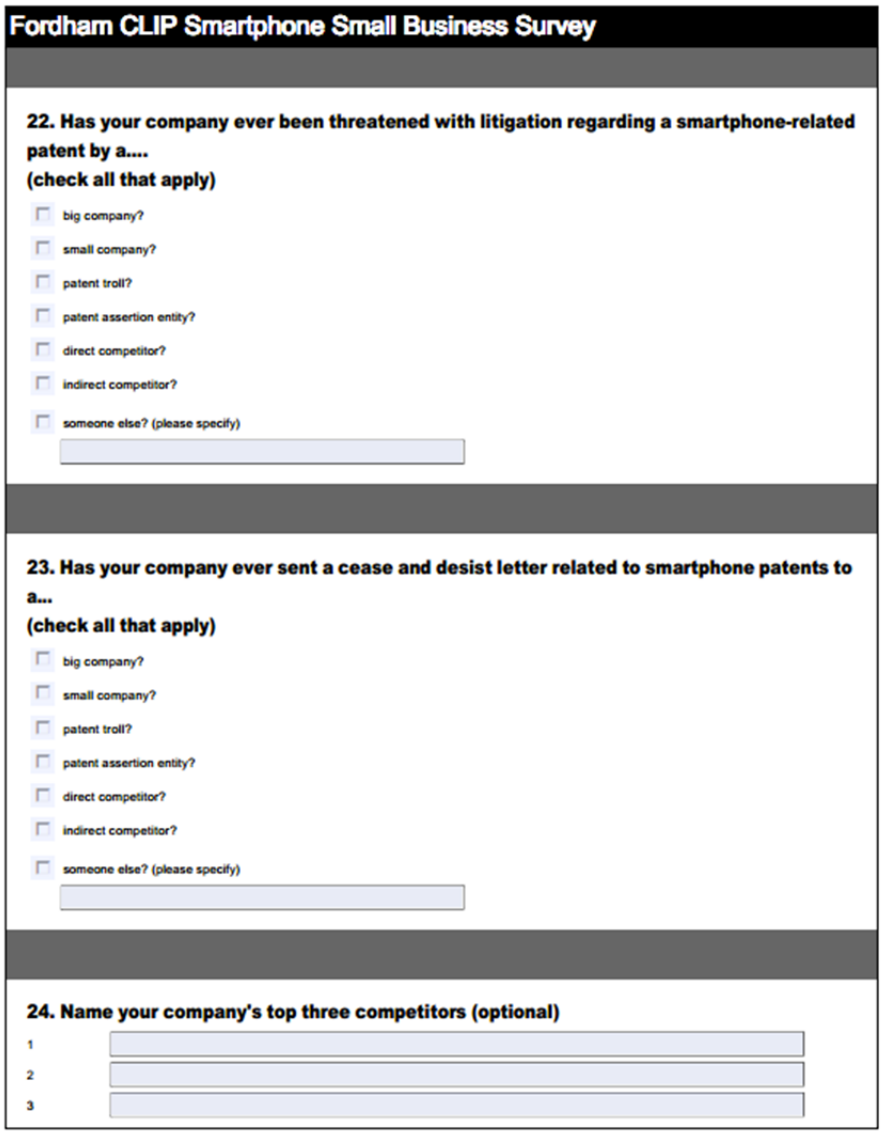

Fordham CLIP Smartphone Small Business Survey

22. Has your company ever been threatened with litigation regarding a smartphone-related patent by a....
(check all that apply)

- ☐ big company?
- ☐ small company?
- ☐ patent troll?
- ☐ patent assertion entity?
- ☐ direct competitor?
- ☐ indirect competitor?
- ☐ someone else? (please specify)

23. Has your company ever sent a cease and desist letter related to smartphone patents to a...
(check all that apply)

- ☐ big company?
- ☐ small company?
- ☐ patent troll?
- ☐ patent assertion entity?
- ☐ direct competitor?
- ☐ indirect competitor?
- ☐ someone else? (please specify)

24. Name your company's top three competitors (optional)

1
2
3

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TEVA, *NAUTILUS*, AND CHANGE WITHOUT CHANGE

Jason Rantanen*

CITE AS: 18 STAN. TECH. L. REV. 430 (2015)

ABSTRACT

Over the past several years, the Supreme Court has been remarkably active in patent law. Out of all those decisions which have touched almost every aspect of patent law, the ones with the greatest potential to shake its foundations were the Court's opinions addressing claim meaning. "The name of the game is the claims," after all. Almost everything in patent law flows from the claims. Thus, when the Supreme Court granted certiorari in Nautilus v. Biosig, and then three months later in Teva v. Sandoz, the expectation was that great change was afoot.

On the surface, the Court's opinions bore out that expectation. In both Nautilus and Teva, the Supreme Court expressly rejected the Federal Circuit's approach and replaced it with its own. But in the months since, the doctrines the Court addressed in Nautilus and Teva have changed very little. It seems to be business as usual at the Federal Circuit. The Federal Circuit continues to routinely reject indefiniteness challenges and grant no formal deference to district courts in reversing their claim constructions. Meanwhile, its formal doctrinal analyses look virtually identical to those before the Supreme Court intervened.

This "change without change" raises two important questions: first, how has the Federal Circuit accomplished this from a formal, legal perspective? In other words, how is it that the Federal Circuit, seemingly constrained by the express instructions of the Supreme Court, nonetheless manages to avoid any meaningful change to the doctrines of claim meaning? Second, what does the future hold, particularly for claim construction, as the district courts rely on Teva and adapt their claim construction opinions to expressly rely on factual findings?

This Essay examines the Federal Circuit's jurisprudence following Nautilus and Teva to answer these questions.

* Associate Professor, University of Iowa College of Law. I thank Josh Sarnoff and Jake Linford for valuable discussion on this project; Tim Holbrook, Oskar Liivak, and the participants in the 2015 Drake IP Roundtable for helpful comments; and John Allison and Lisa Larrimore Ouellette for data from their study of §112. I also thank my capable research assistants, Alex Lodge and Rajul Patel for their diligent work.

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INTRODUCTION

The Supreme Court's extraordinary interest in patent law over the last few years is well known. In the 2013-2014 term alone, the Court reviewed six decisions involving issues of patent law, many of them substantive.[1] From *Akamai* to *Teva*, procedural to core doctrines, the Court has pushed and pulled on patent law.[2] While the Federal Circuit has performed relatively well when measured by reversals,[3] the Court has roundly criticized the "patent court's" doctrinal frameworks[4] and has, in places, struck them down entirely.

But none of the Court's decisions had the potential to be as earthshattering as its opinions addressing claim meaning—"The name of the game is the claims,"[5] after all. Almost everything in patent law flows from the claims:

1. During that same term, the Supreme Court issued just seventy opinions, meaning that nearly nine percent of its opinions involved patent law. Since 2010, the Court has issued eighteen patent-related opinions, and is currently posed to issue another two this term. *See* http://writtendescription.blogspot.com/p/patents-scotus.html (listing Supreme Court patent cases since 1952). In contrast, the Court reviewed only five patent cases in the first *fifteen years* of the Federal Circuit's existence. *See* Robin Feldman, *Coming of Age for the Federal Circuit*, 18 GREEN BAG 2d 27, 28 (2014).

2. *See* Timothy Holbrook, *Explaining the Supreme Court's Interest in Patent Law*, 3 IP THEORY 61 (2013) (discussing the Supreme Court's heightened interest in patent law).

3. *See* Jason Rantanen, *Is the Federal Circuit Really Worse than the Cubs?*, PATENTLY-O (June 3, 2014), http://patentlyo.com/patent/2014/06/federal-circuit-really.html (noting that out of the thirteen patent cases arising from the Federal Circuit since *Bilski v. Kappos*, the Supreme Court has affirmed the outcome in whole or part seven times even as it maintained a seventy seven percent reversal rate for all circuits).

4. *See* Limelight Networks, Inc. v. Akamai Technologies, Inc., 134 S. Ct. 2111, 2117, 189 L. Ed. 2d 52 (2014) ("The Federal Circuit's analysis fundamentally misunderstands what it means to infringe a method patent.").

5. A phrase famously attributable to Giles Rich. *See In re* Hiniker Co., 150 F.3d 1362, 1369 (Fed. Cir. 1998) (quoting Giles Sutherland Rich, *Extent of Protection and Interpretation of Claims—American Perspectives*, 21 INT'L REV. INDUS. PROP. & COPYRIGHT

infringement, novelty, nonobviousness, and more. Thus, when the Supreme Court granted certiorari in *Nautilus v. Biosig*, and then three months later in *Teva v. Sandoz*—two cases addressing claim meaning—the expectation was that great change was afoot.[6]

On the surface, the Court's opinions bore out that expectation. In both *Nautilus* and *Teva*, the Supreme Court expressly rejected the Federal Circuit's approach. First, in *Nautilus*, the Supreme Court held that the Federal Circuit's legal standard was not even "probative of the essential inquiry" for claim definiteness.[7] Rather, the Court replaced the appellate court's requirement for definiteness—that a claim is definite unless the challenger establishes that it is "not amenable to construction" or "insolubly ambiguous"—with its own: that a claim is indefinite if it fails "to inform, with reasonable certainty, those skilled in the art about the scope of the invention."[8] Then, in *Teva*, it concluded that the Federal Circuit was wrong in its *de novo* approach to all aspects of claim construction and must instead give district courts deference on factual determinations.[9] Ultimately, it did not merely remand *Teva* back to the Federal Circuit; it reversed one aspect of the Federal Circuit's decision outright.

But in the months since those opinions, the doctrines the Court addressed in *Nautilus* and *Teva* have changed very little. It seems to be business as usual at the Federal Circuit. The Federal Circuit continues to routinely reject indefiniteness challenges and grant no formal deference to district courts in reversing their claim constructions. Indeed, with one exception, the Federal Circuit has not held a single claim indefinite under the *Nautilus* standard,[10] and

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L. 497, 499 (1990)).

6. *See, e.g.*, John R. Allison et al., *Understanding the Realities of Modern Patent Litigation*, 92 TEX. L. REV. 1769, 1784 (2014) (commenting that in *Nautilus*, "[t]he Supreme Court . . . seems poised to broaden the doctrine considerably"); Randy Lipsitz et al., *Supreme Court Takes Another Bite Out of Federal Circuit Exceptionalism*, 27 NO. 3 INTELL. PROP. & TECH. L.J. 18, 18 (2015) (commenting that the Supreme Court in *Teva* "ruled . . . that the Federal Circuit must apply the 'clear error' standard, rather than *de novo* review, in evaluating . . . patent claim construction proceedings"). The Court granted Nautilus's petition on January 10, 2014 and Teva's petition on March 31, 2014.

7. Nautilus, Inc. v. Biosig Instruments, Inc., 134 S. Ct. 2120, 2130 (2014). Under 35 U.S.C. § 112, ¶ 2 (now 112(b)), a patent specification must "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as [the] invention." This requirement is typically referred to as the definiteness requirement. A claim that fails the requirement is invalid due to indefiniteness.

8. *Id.* at 2124. Claims are, of course, read in light of the document of which they are a part, and so the full standard reads: "A patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention."

9. Teva Pharm. USA, Inc. v. Sandoz, Inc., 135 S. Ct. 831, 832 (2015) ("When reviewing a district court's resolution of subsidiary factual matters made in the course of its construction of a patent claim, the Federal Circuit must apply a 'clear error,' not a *de novo*, standard of review.").

10. *See* Eidos Display, LLC v. Au Optronics Corp., 779 F.3d 1360, 1368 (Fed. Cir. 2015) (holding claims not indefinite); Warsaw Orthopedic, Inc. v. Nuvasive, Inc., No. 2013-1576, 2013-1577, 2015 WL 859503 (Fed. Cir. Mar. 2, 2015) (not indefinite); Lexington Luminance LLC v. Amazon.com Inc., No. 2014-1384, 2015 WL 524270 (Fed. Cir. Feb. 9,

even that one exception would almost certainly have been indefinite under the standard that the Supreme Court held was too low in *Nautilus*.[11]

This "change without change" of *Nautilus* and *Teva* raises two important questions: First, how has the Federal Circuit accomplished it from a formal, legal perspective? In other words, how is it that the Federal Circuit, seemingly constrained by the express instructions of the Supreme Court, nonetheless managed to avoid any meaningful change to the doctrines of claim meaning? Second, what does the future hold, particularly for claim construction, as the district courts rely on *Teva* and adapt their claim construction opinions to expressly rely on factual findings?

This Essay examines the Federal Circuit's jurisprudence following *Nautilus* and *Teva* to answer these questions.

I. NAUTILUS: AN EXPECTATION OF CHANGE

In *Nautilus v. Biosig*, the Court confronted the Federal Circuit's use of a legal standard for claim indefiniteness that even petitioner's counsel would not touch during oral argument[12]—that "[a] claim is indefinite only when it is 'not amenable to construction' or 'insolubly ambiguous'" as construed.[13] This standard set a low bar for meeting the definiteness requirement. As Robin Feldman observed, it "ensured that very few patents could ever be overturned for indefiniteness."[14] Craig Nard described the indefiniteness requirement as not being a "significant hurdle for patentees" for "some time,"[15] while noting that perhaps the court's decision in *Halliburton Energy Services, Inc. v. M-I LLC* would change that.[16] It did not.[17] And in his thorough exploration of the

2015) (not indefinite); DDR Holdings, LLC v. Hotels.com, L.P., 773 F.3d 1245, 1259-60 (Fed. Cir. 2014) (not indefinite). While it has held claims indefinite in the context of "means plus function" claims, as discussed below, those claims involve their own, special set of rules and are not analyzed under the general framework for claim definiteness. *See infra* at Part III.2.c. In addition, in *H-W Technology, L.C. v. Overstock.com, Inc*., the Federal Circuit held a claim indefinite. 758 F.3d 1329, 1336 (2014). However, the court did not analyze indefiniteness under *Nautilus*.

11. Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364, 1374 (Fed. Cir. 2014) (finding the phrase "in an unobtrusive manner that does not distract the user" indefinite).

12. The transcript is rife with attempts from the Justices to pin down respondent's counsel on the insolubly ambiguous standard. *See e.g.*, Transcript of Oral Argument at 24:17-23, Nautilus, Inc. v. Biosig Instruments, Inc., 134 S. Ct. 2120 (2014) (No. 13-369).

13. Biosig Instruments, Inc. v. Nautilus, Inc., 715 F.3d 891, 898 (Fed. Cir. 2013) (reversed by *Nautilus v. Biosig*, 134 S. Ct. 2120 (2014)).

14. Robin Feldman, *Coming of Age for the Federal Circuit*, 18 GREEN BAG 2d 27, 34 (2014).

15. CRAIG NARD, THE LAW OF PATENTS 154 (3d ed. 2014). The heading of this comment was "No Longer a Perfunctory Requirement?", implying that the requirement prior to *Halliburton* was precisely that.

16. 514 F.3d 1244 (Fed. Cir. 2008) (noting that functional language in claims is permissible, but cautioning against its use on indefiniteness grounds).

17. The Federal Circuit specifically rejected a functional-language-is-indefinite argument in *Biosig Instruments, Inc. v. Nautilus, Inc.*, 715 F.3d 891 (Fed. Cir. 2013), *cert.*

history of the definiteness inquiry in an amicus brief in *Nautilus*, Peter Menell concluded that the Federal Circuit's "insolubly ambiguous" standard "falls well short" of the requirements of Section 112, Paragraph 2.[18]

Indeed, considering what the Federal Circuit said about its own standard, it is difficult to view it as anything other than a mere threshold. In *Datamize v. Plumtree Software*, for example, the Federal Circuit expounded on what "not amenable to construction" or "insolubly ambiguous" meant: "The definiteness of claim terms depends on whether those terms can be given *any* reasonable meaning."[19] Nor was difficulty in claim construction a bar: a finding of indefiniteness was only appropriate "if reasonable efforts at claim construction prove *futile*"[20] (emphasis added) or if the claim, once construed, failed to "provide sufficient particularity and clarity to inform skilled artisans of the bounds of the claim,"[21] which apparently meant that the construction itself "remains insolubly ambiguous."[22] One member of the court even observed that "the general conclusion from our law seems to be this: if a person of ordinary skill in the art can come up with a plausible meaning for a disputed claim term in a patent, that term, and therefore the claim, is not indefinite."[23]

The quantitative empirical evidence supports the characterization of the pre-*Nautilus* indefiniteness standard as low, albeit with the caveat of potential selection effects.[24] Using data provided by John Allison and Lisa Larrimore

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granted, 134 S. Ct. 896, 187 L. Ed. 2d 702 (2014), *vacated*, 134 S. Ct. 2120, 189 L. Ed. 2d 37 (2014). As discussed below in Part V, the Supreme Court's decision in *Nautilus* opens up the door for the Federal Circuit to revisit the functional language issue without the precedent of the original *Biosig* opinion.

18. Brief for Peter F. Menell as Amicus Curiae Supporting Neither Party, Nautilus, Inc. v. Biosig Instruments, Inc., 134 S. Ct. 896 (2014) (No. 13-369). *See also* Patti B. Saris, *The Indefinite Role of the Trial Judge in Patent Litigation*, 18 LEWIS & CLARK L. REV. 751, 763 (2014) (observing that "[u]nder the "insolubly ambiguous" test, even if the scope of a claim is not plain on its face, even if the task to discern the scope is "formidable," even if "some experimentation may be necessary," and even if "reasonable persons will disagree," the claim still may not be indefinite!").

19. Datamize, LLC v. Plumtree Software, Inc., 417 F.3d 1342, 1347 (Fed. Cir. 2005) (emphasis added).

20. *Id. See also* Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 655 F.3d 1364, 1373 (Fed. Cir. 2011) ("This court has held that a claim term may be definite even when discerning the meaning is a 'formidable [task] and the conclusion may be one over which reasonable persons will disagree.'").

21. Biosig Instruments, Inc. v. Nautilus, Inc., 715 F.3d at 898 (reversed by *Nautilus, Inc. v. Biosig Instruments*, Inc., 134 S. Ct. 2120 (2014)).

22. *Id.*

23. Enzo Biochem, Inc. v. Applera Corp., 605 F.3d 1347, 1348 (Fed. Cir. 2010) (Plager, J., dissenting from denial of rehearing en banc).

24. I recognize the limitations of drawing conclusions from outcomes in court decisions. *See, e.g.*, Jason Rantanen & Lee Petherbridge, *Disuniformity*, 66 FL. L. REV. 2007, 2011-13 (2014) (discussing limitations of outcome measures). In particular, outcomes may be affected by various selection effects that can shape the composition of what I have referred to as the "substrate" of decisionmaking, and by other factors such as the standard of review. *See* Jason Rantanen, *The Federal Circuit's New Obviousness Jurisprudence*, 16 STAN. TECH. L. REV. 709, 740 (2013). Nevertheless, outcomes do give us an important clue

Ouellette from their recent study of Section 112,[25] I calculated the rate at which the Federal Circuit found challenged claims indefinite during the ten years preceding the grant of certiorari in *Nautilus* to be 29%.[26] In other words, the court routinely rejected indefiniteness challenges during this era.

The effect was not limited to the Federal Circuit: in their study on patent disclosure and claim definiteness, Allison and Ouellette found that over the course of the 30-year period from 1982-2012, "the average patent in our study contested for indefiniteness received a ruling above the level of 'fact issue followed by a validity ruling.'"[27] In other words, the average patent tended to survive indefiniteness challenges quite readily.[28]

In light of the court's low standard for claim definiteness and the low rate

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as to what is happening in a given doctrine, particularly when combined with deeper analysis of the content of judicial opinions and with qualitative analysis of those opinions. *Id.* Here, I consider both additional levels.

25. *See* John R. Allison & Lisa Larrimore Ouellette, *How Courts Adjudicate Patent Definiteness and Disclosure*, 65 DUKE L.J. (forthcoming). In a separate study of the period 1998-2008, Christa Laser found that the Federal Circuit held claims indefinite 45% of the time in a final determination (including those involving a means-plus-function element). *See* Christa J. Laser, *A Definite Claim on Claim Indefiniteness: An Empirical Study of Definitness Cases of the Past Decade with a Focus on the Federal Circuit and the Insolubly Ambiguous Standard*, 10 CHI.-KENT. J. INTELL. PROP. 25, 32 (2010). Laser's dataset contained just 33 cases, however possibly because it was limited to "those indexed in the U.S.P.Q (BNA) under 115.1109, 'claim indefiniteness.," an approach that may not capture all indefiniteness decisions issued by the Federal Circuit. *Id.* at 30 n.29. Over the same period, Allison and Ouellette's data indicate a 26% indefiniteness rate in 86 final indefiniteness determinations at the Federal Circuit. To give a point of comparison (which I do with some hesitancy), over the ten-year period prior to the grant of certiorari in *KSR v. Teleflex*, the Federal Circuit held challenged patents invalid due to obviousness 46% of the time. *See* Jason Rantanen, *The Federal Circuit's New Obviousness Jurisprudence: An Empirical Study*, 16 STAN. TECH. L. REV. 709, 737 (2013).

26. Allison and Ouellette found 86 final indefiniteness determinations during that period. In 27 of them, the Federal Circuit concluded that the claims were indefinite—all as a matter of law. When indefiniteness challenges involving means-plus-function claims were removed, the rate dropped to 23% (16/69 determinations). E-mail from John R. Allison, Spence Centennial Professor of Business Administration and Professor of Intellectual Property, McCombs School of Business, University of Texas at Austin, to Jason Rantanen, Associate Professor of Law, The University of Iowa College of Law Professor of Law (Mar. 19, 2015, 9:50 AM CST) (on file with author) (data set forthcoming in Duke Law Scholarship Repository).

27. John R. Allison & Lisa Larrimore Ouellette, *Are Patent Disclosure and Definiteness Technology Specific?* (Hoover IP², Working Paper No. 15007, Jan. 23, 2015). In contrast, "patents involving all technologies performed less well on enablement and written description than on definiteness." *Id.* Allison and Ouellette looked at ultimate outcomes on a patent-case level across both the district court and Federal Circuit levels. *See also* John R. Allison, Mark A. Lemley & David L. Schwartz, *Understanding the Realities of Patent Litigation*, 92 TEX. L. REV. 1769, 1787 (2014) (finding that accused infringers won on indefiniteness 17.7% of the time for lawsuits filed in 2008-2009).

28. Allison & Ouellette's study also confirmed the means-plus-function effect: claims written with a means-plus-function element were "far more likely to succumb to an indefiniteness challenge." John R. Allison & Lisa Larrimore Ouellette, *Are Patent Disclosure and Definiteness Technology Specific?* 28 (Hoover IP², Working Paper No. 15007, Jan. 23, 2015).

at which definiteness challenges succeeded at the Federal Circuit, the court was sending a clear signal: don't bring definiteness challenges except in the most extreme of cases.

Against this landscape, it was no surprise when the Supreme Court soundly rejected the Federal Circuit's indefiniteness standard, holding "that the Federal Circuit's formulation, which tolerates some ambiguous claims but not others, does not satisfy the statute's definiteness requirement."[29] Nor did the court accept the argument that the Federal Circuit was merely using the terms as "shorthand": "[T]he expressions 'insolubly ambiguous' and 'amenable to construction' permeate the Federal Circuit's recent decisions concerning § 112, ¶2's requirement. We agree with Nautilus and its *amici* that such terminology can leave courts and the patent bar at sea without a reliable compass."[30] Thus, "we must ensure that the Federal Circuit's test is at least 'probative of the essential inquiry.'"[31] In that regard, it fell short.[32]

Instead, the Court replaced the Federal Circuit's standard with its own: "A patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with *reasonable certainty* those skilled in the art about the scope of the invention."[33] This standard, the Court noted, more correctly balanced the inherent limitations of language against the need for patents to be precise enough to "afford clear notice of what is claimed" and the need to avoid "[a] zone of uncertainty which enterprise and experimentation may enter only at the risk of infringement claims."[34] Tellingly, the Court referred to the amount of uncertainty that must be tolerated as "some modicum," implying only a small amount.[35] The new standard, in the Court's eyes, also fit better with its older precedent, which spoke in terms of the reasonableness of the degree of certainty required in light of the subject-matter.[36]

Given the Court's blunt overruling of the Federal Circuit, an observer might have predicted the dawn of a new age of successful definiteness challenges. After all, the Court raised the bar for establishing claim definiteness.[37] In addition, the Court granted the Federal Circuit the

29. Nautilus, Inc. v. Biosig Instruments, Inc., 134 S.Ct. 2120, 2124 (2014).

30. *Id.* at 2130 (internal footnotes omitted).

31. *Id.* (quoting Warner-Jenkinson Co. v. Hilton Davis Chemical Co., 520 U.S. 17, 40 (1997)).

32. *Id.*

33. *Id.* (emphasis added).

34. *Id.* (quoting United Carbon Co. v. Binney & Smith Co., 317 U.S. 228, 236 (1942)).

35. *Id.*

36. *Id.* (citing *United Carbon Co.*, 317 U.S. at 389 and Minerals Separation, Ltd. v. Hyde, 242 U.S. 261, 270 (1916)).

37. *See, e.g.*, Allison & Ouellette, *supra* note 25, at 6 ("Toward the end of its 2014 term, however, the Supreme Court arguably abrogated this lax standard by instituting one calling for the language of a patent claim to delineate the invention such that a PHOSITA can understand its scope with 'reasonable certainty.' Although the Court's language seems to call for imposition of a stricter definiteness requirement, the extent to which it actually does

opportunity to revisit its own approach, start afresh, and clean up some of its jurisprudence.[38] Particularly concerning to many was the internal contradiction of the Federal Circuit's assertion that indefiniteness was a matter of law, while at the same time relying on factual determinations.[39]

II. *TEVA*: A HOPE FOR CHANGE

Even as the Court issued its opinion in *Nautilus*, it had already granted certiorari in another appeal involving claim meaning, this one with the potential for an even greater impact. *Teva v. Sandoz* involved a fundamental question of claim construction that had troubled the Federal Circuit since *Markman v. Westview Instruments* in 1996: when reviewing a district court claim construction, how much—if any—deference should be granted to the district court? Since *Cybor Corp. v. FAS Tech., Inc.*, issued by a divided Federal Circuit shortly after *Markman*, the answer to that question had been "none."[40] But dissatisfaction with *de novo* review remained, percolating up to the full

largely remains to be seen."); Kevin R. Casey & Kevin B. Anderson, *The Supreme Court's Six-Pack of Patent Cases*, 27 INTEL. PROP. & TECH. L.J. 9, 10 (2015) ("In *Nautilus, Inc. v. Biosig Instruments, Inc.*, the U.S. Supreme Court gave powerful ammunition to companies seeking to invalidate patents as being overly vague."); *cf.* Camilla Hrdy & Ben V. Picozzi, *Claim Construction or Statutory Construction?: A Response to Chiang & Solum*, 124 YALE L.J. FORUM 208, 217 (2014) ("Instead, the Court announced a different, apparently stricter standard and held that a claim is invalid if it 'fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.'"); David Mika, *Interval Licensing: Determining Indefiniteness Post-*Nautilus, 27 NO. 2 INTEL. PROP. & TECH. L.J. 7, 8-9 (2013), available at http://files.bakerbotts.com/file_upload/IPReport201411-IntervalLicensingDeterminingIndefinitenessPost-Nautilus.htm ("It is still too early to develop a full picture of the *Nautilus* decision and its effects . . . however, it appears that *Nautilus* has strengthened significantly the ability of accused infringers to challenge definiteness."). *But see* EDWARD D. MANZO, CLAIM CONSTRUCTION IN THE FEDERAL CIRCUIT § 0:5 (2015) (noting that "after Nautilus, it remains unclear what degree of post-grant ambiguity should be found excessive and will render a claim indefinite" and pointing to policy differences that the Court did not resolve in *Nautilus*); Greg Reilly, *Completing The Picture of Uncertain Patent Scope*, 91 WASH. U. L. REV. 1353, 1363 (2014) ("The Supreme Court faced the unenviable choice in Nautilus of either affirming the Federal Circuit's rampant uncertainty in patent scope or tightening the standard and imperiling large numbers of patents. The result was an opinion that did not say particularly much.").

38. John M. Golden, *The Supreme Court as "Prime Percolator"*, 56 UCLA L. REV. 657, 705 (2009).

39. *See Nautilus*, 134 S.Ct. at 2130 n.10 (identifying the deference issue and leaving the question for another day); Saris, *supra* note 18, at 763 ("Like claim construction, the Federal Circuit treats indefiniteness as a question of law subject to *de novo* review even though it relies on findings of fact, such as the level of skill in the art and the degree of 'experimentation.'"); *id.* at 764 ("The [Federal Circuit's legal conclusion in *Biosig*], however, was based on the appellate court's extensive review of the facts, including both intrinsic and extrinsic evidence regarding these 'variables.'").

40. At least as a formal matter. *See* J. Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 NORTHWESTERN L. REV. 1 (2013) (arguing that the Federal Circuit increased its informal deference to district court claim constructions following *Phillips*).

court in *Phillips v. AWH Corp.*[41] and, more recently, in *Lighting Ballast v. Philips Electronics.*[42] Throughout it all, a majority of the Federal Circuit held the line: the court reviews all aspects of claim construction *de novo*, including subsidiary factfinding by the district court.[43]

In *Teva*, the Supreme Court disagreed. When reviewing a trial judge's resolution of an underlying factual dispute in claim construction, "the appellate court must apply a 'clear error,' not a *de novo*, standard of review."[44] Federal Rule of Civil Procedure 52(a)(6) compels this result: "The Rule requires appellate courts to review all such subsidiary factual findings under the 'clearly erroneous' standard."[45] Determinations based solely on the intrinsic evidence (the patent claims, written description, and prosecution history), on the other hand, amount solely to a determination of law, reviewed *de novo*,[46] as is the overall question of construction.[47]

The crux of the Court's decision thus rested on the distinction between "subsidiary factfinding," reviewed with deference, and the remaining issues of claim construction, reviewed *de novo*. To provide guidance to the Federal Circuit, *Teva v. Sandoz* is filled with examples of distinctions between factual and legal determinations.

The first is the Court's differentiation between "ordinary meaning" and "technical words or phrases not commonly understood." When words are used in their "ordinary meaning," the question is one of law.[48] But "when a written instrument uses 'technical words or phrases not commonly understood,' those words may give rise to a factual dispute. If so, extrinsic evidence may help to 'establish a usage of trade or locality.'"[49] The latter is a factual determination that must be reviewed for clear error.

A second distinction is between district court determinations resting on intrinsic evidence alone and those that "need to look beyond the patent's

41. *See* Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005) (Mayer, J., dissenting) ("[T]hat claim construction is dependent on underlying factual determinations has been verified by our experience, which shows that reviewing these questions *de novo* has not clarified the law . . . . Our purely *de novo* review of claim interpretation also cannot be reconciled with the Supreme Court's instructions regarding obviousness.").

42. *See* Lighting Ballast Control LLC v. Philips Elec. N. Am. Corp., 744 F.3d 1272, 1302-03 (Fed. Cir. 2014) (O'Malley, J., dissenting) (discussing that the Supreme Court in *Markman* "said nothing to suggest that a *de novo* standard of review would be appropriate" in evaluating claim construction issues).

43. *Id.* at 1284 ("We are not persuaded that we ought to overturn the en banc *Cybor* decision and replace its clear *de novo* standard with an amorphous standard . . . to engender threshold litigation over whether there was or was not a fact at issue.").

44. Teva Pharm. USA, Inc. v. Sandoz, Inc., 135 S. Ct. 831, 835 (2015).

45. *Id.* at 838.

46. *Id*. at 841.

47. *Id.* at 842.

48. *Id.* at 837 ("Construction of written instruments often presents a 'question solely of law,' at least when the words in those instruments are 'used in their ordinary meaning.'") (quoting Great Northern R. Co. v. Merchants Elevator Co., 259 U.S. 285, 291 (1922)).

49. *Id.* at 837.

intrinsic evidence and to consult extrinsic evidence in order to understand, for example, the background science or the meaning of a term in the relevant art during the relevant time period."[50] Such determinations are "the 'evidentiary underpinnings' of claim construction that we discussed in *Markman*, and this subsidiary factfinding must be reviewed for clear error on appeal."[51] Here, the Court offered up an example: a district court might make "a factual finding that, in general, a certain term of art had a particular meaning to a person of ordinary skill in the art at the time of the invention."[52] But then, the district court must "conduct a legal analysis: whether a skilled artisan would ascribe that same meaning to that term *in the context of the specific patent claim under review*."[53]

As a third example, the Court addressed the *Teva* case directly. When the district court made a finding about "how a skilled artisan would understand the way in which a curve created from chromatogram data reflects molecular weights," that was a factual finding. The legal conclusion, on the other hand, was that because of this finding, "figure 1 did not undermine Teva's argument that molecular weight referred to the first method of calculation (peak average molecular weight)." Given this distinction, "the Federal Circuit should have accepted the District Court's finding unless it was 'clearly erroneous.'"[54]

On its face, *Teva v. Sandoz* unquestionably altered the standard of review for claim construction, shifting it towards greater deference to the district courts. The Court did not simply signal to the Federal Circuit that it should grant more deference to the district court. It expressly instructed the appellate court to do so. And the Court provided numerous examples of instances involving subsidiary factual determinations.

With all this, the rational expectation would be that the Federal Circuit would change its ways. Thus far, however, that expectation has not even begun to manifest.

III. THE REALITY: CHANGE WITHOUT CHANGE

A. *Nautilus v. Biosig*

A reality of change has not manifested. The Federal Circuit's post-*Nautilus* decisions do not even hint at a raised standard, either formally or in application. Indeed, if anything, the court's application of *Nautilus* suggests a *lowered* bar for claim definiteness. In only one written opinion since the Supreme Court decided *Nautilus* has the Federal Circuit found a challenged claim to be

50. *Id.* at 841.
51. *Id.*
52. *Id.*
53. *Id.*
54. *Id.* at 843.

indefinite under the *Nautilus* "reasonable certainty" standard.[55] And in that one instance, the claim was indefinite under the pre-*Nautilus* approach as well. At the same time, the Federal Circuit has repeatedly rejected indefiniteness challenges, including those in which the district court found claims to be indefinite under the insolubly ambiguous standard.[56]

1. *The Formal Legal Framework of Indefiniteness*

The Federal Circuit's formal legal standard provides one illustration of the court's marginalization of *Nautilus.* The most detailed discussion of the *Nautilus* standard by far is in *Interval Licensing v. AOL*, in which Judge Chen of the Federal Circuit described the contours of the *Nautilus* standard. And yet, even as it explored those boundaries in *Interval*, the Federal Circuit harkened back to its own precedent, citing *Enzo Biochem v. Applera*,[57] *Invitrogen v. Biocrest*,[58] and *Halliburton Energy Services v. M-I LLC.*[59] Ultimately, the court's analysis of the indefiniteness of the claim element "unobtrusive manner" was performed under the auspices of *Datamize v. Plumtree Software*,[60] the very case to which the original standard of "insolubly ambiguous" is often attributed.[61]

The legal framework of the court's other indefiniteness cases further marginalizes *Nautilus*. In *Eidos Display*, for example, while the Federal Circuit acknowledged the Supreme Court's standard in *Nautilus* in its initial statement of law, that was the only time the opinion was mentioned other than in a non-substantive footnote.[62] All other citations to precedent drew upon the Federal Circuit's own jurisprudence. Missing is even the modest recognition from *Interval* that *Nautilus* allows for a "modicum of uncertainty" that must be balanced against the requirement for "clear notice of what is claimed, thereby appris[ing] the public of what is still open to them."[63] The court's other post-*Nautilus* decisions follow the same pattern: a boilerplate recitation of *Nautilus*

55. *See* Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364 (Fed. Cir. 2014) (finding the phrase "in an unobtrusive manner that does not distract the user" to be indefinite).

56. *See* Eidos Display, LLC v. AU Optronics Corp., 779 F.3d 1360 (Fed. Cir. 2015) (reversing district court's grant of summary judgment under pre-*Nautilus* "insolubly ambiguous" standard).

57. Enzo Biochem, Inc. v. Applera Corp., 599 F.3d 1325, 1335 (Fed. Cir. 2010).

58. Invitrogen Corp. v. Biocrest Mfg., L.P., 424 F.3d 1374, 1384 (Fed. Cir. 2005).

59. Halliburton Energy Servs., Inc. v. M-ILLC, 514 F.3d 1244, 1251 (Fed. Cir. 2008).

60. Datamize, LLC v. Plumtree Software, Inc., 417 F.3d 1342, 1351 (Fed. Cir. 2005).

61. *Id.* at 1347 ("Only claims 'not amenable to construction' or 'insolubly ambiguous' are indefinite."); *see also In re* Packard, 751 F.3d 1307, 1318 (Fed. Cir. 2014) ("In *Datamize* the court cited to the *Exxon* 'insolubly ambiguous' language . . . .").

62. Eidos Display, LLC v. AU Optronics Corp., 779 F.3d 1360, 1364 n.3 (Fed. Cir. 2015)

63. Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364, 1370 (quoting *Nautilus*, 134 S.Ct. at 2128, 2129).

followed by actual analysis under its own precedent.[64]

Indeed, if anything, the Federal Circuit seems to be implicitly characterizing *Nautilus* as *lowering* the definiteness standard, at least in some respects. Consider footnote 3 in *Eidos*, which the court placed in connection with its discussion of the "reasonable certainty" standard from *Nautilus*:

> The district court granted summary judgment on January 22, 2014, without the benefit of the Supreme Court's guidance in *Nautilus*. The magistrate judge recommended that summary judgment of indefiniteness be granted because he determined, under the pre-*Nautilus* standard, that the asserted claim was "insolubly ambiguous."[65]

With the Federal Circuit having reversed the district court's determination that the claims are indefinite, the implication of this language is that the district court might, perhaps, have found the claim to be definite if it were operating under the Supreme Court's new standard in *Nautilus*—in other words, that the *Nautilus* standard is *lower* than the "insolubly ambiguous" standard.

Nor has the Federal Circuit taken the opportunity of *Nautilus* to address the inconsistency of holding indefiniteness to be a purely legal question, reviewed *de novo*, that involves evidentiary determinations. It continues to play both sides of this contradiction without expressly addressing it.[66]

2. *The Framework as Applied*

The court's actual analysis of indefiniteness challenges further reinforces the conclusion that nothing has changed. Two pairings illustrate the Federal Circuit's post-*Nautilus* analysis of indefiniteness. In the first pair, *Eidos Display*[67] and *Lexington Luminance v. Amazon.com*,[68] the Federal Circuit addressed claim terms with two possible meanings and concluded that the claims are not indefinite because a person of skill in the art would know to pick one of those meanings. The second pairing, *Interval Licensing* and *DDR Holdings v. Hotels.com*,[69] contrasts two arguably subjective claim terms: "unobtrusive manner" and "look and feel." Under *Datamize*, the court

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64. *See* DDR Holdings, LLC v. Hotels.com, L.P., 773 F.3d 1245, 1259-61; Lexington Luminance LLC v. Amazon.com, Inc., 2015 WL 524270 at *4-5 (Fed. Cir. Fed. 9, 2015); Warsaw Orthopedic, Inc. v. Nuvasive, Inc., No. 2013-1576, 2013-1577, 2015 WL 859503 at *3 (Fed. Cir. Mar. 2, 2015).

65. *Eidos*, 779 F.3d at 1364 n.3.

66. *Compare Lexington*, 2015 WL 524270 at *3 ("Indefiniteness is a question of law that we review *de novo*."), *with DDR Holdings*, 773 F.3d at 1260 ("the evidence demonstrates that 'look and feel' had an established, sufficiently objective meaning in the art"). As required by *Teva*, the Federal Circuit now reviews extrinsic evidence in claim construction under a clear error standard. *See Eidos*, 779 F.3d at 1364-65. But, as *Eidos* itself indicates, that standard of review only applies in those instances where the Federal Circuit concludes that it's necessary to reach the extrinsic evidence

67. *Eidos*, 779 F.3d at 1364.

68. *Lexington*, 2015 WL 524270 (Fed. Cir. Feb. 9, 2015) (nonprecedential).

69. *DDR Holdings*, 773 F.3d at 1266 (Fed. Cir. 2014).

concluded, the former is indefinite, the latter definite.

a. *Multiple Proposed Constructions*

One of the key holdings of *Nautilus* was that "[i]t cannot be sufficient that a court can ascribe *some* meaning to a patent's claims; the definiteness inquiry trains on the understanding of a skilled artisan at the time of the patent application, not that of a court viewing matters *post hoc*."[70] One place where an observer might expect movement—or at least, rigorous grappling with the *Nautilus* standard—is in those cases where multiple plausible constructions are at issue.

One such case is *Eidos Display*,[71] in which the Federal Circuit was faced with a claim element that required "a contact hole for source wiring and gate wiring connection terminals." The usual meaning of a singular noun is to indicate the singular: here, a single hole. But, the court reasoned, it could also mean "many contact holes."[72] The latter meaning, the court determined, was more consistent with the specification and the practice in the art at the time of the patent. In the end, the Federal Circuit reached a construction of "a contact hole" to mean two "separate and distinct contact holes."[73]

Eidos is noteworthy because there were two plausible meanings. But, the court concluded, a person of skill in the art would have been able to choose between them. Moreover, he would be able to not merely choose between them, but also pick the one that was seemingly counterintuitive.

In *Lexington*, the Federal Circuit addressed the term "comprising." The challenger contended that the use of this word rendered the claim indefinite, because its meaning indicates an open group: one that is not limited to just the recited elements. The Federal Circuit disagreed: a person of skill in the art would interpret the term "comprising" to mean "must contain one or more of the enumerated members of the claimed group."[74]

The challenge the court faced in arriving at this construction was that

70. *Nautilus*, 134 S.Ct. at 2130.

71. *Eidos*, 779 F.3d at 1363.

72. *Id.* at 1365. This move was truly a feat of interpretative gymnastics. The only reasoning supporting this move was an analogy: "A person familiar with cars, when reading the sentence 'I am going to create an electric car for the United States and United Kingdom,' would likely expect different electric cars to be created, one set with the steering wheel located on the left for driving in the United States, and another set with the steering wheel on the right for driving in the United Kingdom." *Id.* at 1365. I will leave the parsing of this analogy to others, other than to note that I am reasonably familiar with cars, and I would interpret the sentence to mean that the person is still creating a single car, perhaps with an adjustable steering wheel position such as a Unimog, or possibly as a single car that could be manufactured in two configurations (i.e., most cars). *See* Wikipedia, *Unimog*, http://en.wikipedia.org/wiki/Unimog#Design. In both instances, the meaning of "car" would refer to a single thing, not two separate and distinct cars.

73. *Eidos*, 779 F.3d at 1363.

74. *Lexington*, 2015 WL 524270 at *4.

"comprising" is a term of art, familiar to patent attorneys, who generally contrast it with "consisting of." "Consisting of" is a term that indicates restriction and exclusion, while "comprising" indicates an open-ended construction.[75] "In simple terms, a drafter uses the phrase 'consisting of' to mean 'I claim what follows and nothing else.' A drafter uses the term 'comprising' to mean 'I claim at least what follows and potentially more.'"[76]

In *Lexington*, the patent included an element that involved a substrate "selected from the group comprising group II-V, group IV, group II-VI elements and alloys, ZnO, spinel and sapphire." The challenger argued that a person of ordinary skill in the art would read "comprising" to have its usual legal meaning, rendering the claim indefinite because it would encompass both the specified materials and any others. But, the Federal Circuit concluded, the intrinsic record was "reasonably definite"[77] because "the specification lays out a considerable list of exemplary substrates" and the "reasonably ascertainable meaning of the contested claim language is that the substrate must contain one or more of the enumerated members of the claimed group."[78] By reaching the result that a person of skill in the art would interpret "comprising" to mean what "consisting of" does, the court avoided two indefiniteness pitfalls: first, that the ordinary legal meaning of "comprising" produced an indefinite claim, and second, that a person of skill in the art who was faced with the choice of two meanings would pick one over the other.

The Federal Circuit's application of the indefiniteness standard in these two appeals suggests that the Supreme Court's language about "*some meaning*" being insufficient to avoid definiteness has very little teeth at the Federal Circuit. In both, the district court found that the claims were indefinite; in both the Federal Circuit reversed. In both, multiple plausible meanings of the words were available; in both, the court looked to the examples provided in the intrinsic record to conclude that not only one meaning was preferable, but that the less intuitive meaning was the one that a person of ordinary skill in the art would choose. When it comes to the "some meaning" requirement, the standard applied by the Federal Circuit appears to be whether it can construe the claim, not whether there are multiple reasonable meanings.

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75. Vehicular Technologies Corp. v. Titan Wheel Int'l, Inc., 212 F.3d 1377, 1383 (Fed. Cir. 2000); ROBERT C. FABER, FABER ON MECHANICS OF PATENT CLAIM DRAFTING § 2:5 (6th ed. 2014) (discussing the meaning of "comprising").

76. *Vehicular*, 212 F.3d 1377, 1383 (Fed. Cir. 2000). This case applies when the term is used in places other than between the preamble and the body of the claim. *See* FABER § 2:5 ("Although the foregoing discussion was directed at transitions following a preamble, it applies to transitional phrases throughout a claim, wherein any claim element is defined as comprising other elements.").

77. Since *Lexington* is a nonprecedential case, the substitution of "reasonably definite" for "reasonably certain" could simply be a case of sloppy drafting. But the "sloppy drafting" explanation can only get so much traction when it comes to legal articulations before it renders formal requirements meaningless.

78. *Id.* at *4.

b. *Subjective claim elements*

Subjective claim elements—those that only depend "on the subjective opinion of a person"[79]—pose the problem that a person of skill in the art is unable to ascertain any objective boundary of the claim. Everyone may interpret the claim differently. In *Datamize v. Plumtree Software*, for example, the Federal Circuit concluded that the claim term "aesthetically pleasing" rendered the claim indefinite because it lacked any "objective anchor."[80] "In the absence of a workable objective standard, 'aesthetically pleasing' does not just include a subjective element, it is completely dependent on a person's subjective opinion."[81] As with words of degree, the specification must supply "*some* standard for measuring the scope of the phrase."[82]

Here, too, the Federal Circuit's post-*Nautilus* jurisprudence remains unchanged. In *Interval*, the court found the claim element "in an unobtrusive manner that does not distract a user" indefinite. While Judge Chen acknowledged the *Nautilus* decision, the analysis itself was performed almost entirely under the court's own pre-*Nautilus* precedent: *Datamize*, *Chimie v. PPG Indus*,[83] *In re Hammack*,[84] and *Enzo Biochem*.[85] The only reference to *Nautilus* in the analysis was a brief mention towards the end.[86]

Indeed, as the court recognized, the term "unobtrusive manner" in *Interval Licensing* bears a remarkable resemblance to the indefinite "aesthetically pleasing" term in *Datamize*. "The patents' 'unobtrusive manner' phrase is highly subjective and, on its face, provides little guidance to one of skill in the art."[87] As in *Datamize*, "[t]he hazy relationship between the claims and the written description fails to provide the clarity that the subjective claim language needs."[88]

Contrast *Interval* with *DDR Holdings*,[89] another opinion by Judge Chen just a few months later. At issue were the terms "look and feel" and "visually perceptible elements," which the appellant contended were indefinite because "they [were] impermissibly subjective and fail[ed] to notify the public of the bounds of the claimed invention."[90] After the requisite recitation of the *Nautilus* standard, the court analyzed indefiniteness solely under *Datamize* and *Enzo*, supported by *Interval*, before concluding that *here* the term was not

79. *Datamize*, 417 F.3d 1342, 1350.
80. *Id.*
81. *Id.*
82. *Id.* (emphasis added).
83. Chimie v. PPG Indus. Inc., 402 F.3d 1371, 1385 (Fed. Cir. 2005).
84. 427 F.2d 1378, 1383 (C.C.P.A. 1971).
85. 599 F.3d 1325, 1343 (Fed. Cir. 2010)
86. *Interval*, 755 F.3d at 1373-74.
87. *Id.* at 1371.
88. *Id.* at 1372.
89. *DDR Holdings*, 773 F.3d 1245, 1266.
90. *Id.* at 1259.

fatally subjective.

DDR Holdings adds another layer to the changelessness of indefiniteness post-*Nautilus*, by maintaining the tension between indefiniteness as question of law, reviewed *de novo*, and the highly factual nature of indefiniteness inquiries such as here. To reach its determination that the term "look and feel" was not indefinite, the Federal Circuit found that "the evidence demonstrates that [it] had an established, sufficiently objective meaning in the art, and that the '399 patent used the term consistent with that meaning."[91] With a straight face, it enthusiastically dug into the evidence at trial, citing pages of testimony, before concluding that "the term had an established meaning in the art by the relevant timeframe,"[92] even while insisting on the purely legal nature of the indefiniteness inquiry.[93]

c. *Means-plus-function elements*

Means-plus-function elements involve a completely different form of indefiniteness analysis, one that prior to *Nautilus* did not apply the "insolubly ambiguous" standard and which continues to remain a separate category. Beginning at least as early as 2002, with *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*,[94] the Federal Circuit has required that there must be a corresponding structure within the written description of a patent for claim elements that invoke §112(f).[95] This is because these so-called "means plus

91. *Id.* at 1260.

92. *Id*. To be fair to Judge Chen, the court did not have the benefit of *Teva v. Sandoz* at the time that *DDR Holdings* was written. Yet, the evidentiary determinations about what the word meant to a person of skill in the art would surely be entitled to deference post-*Teva*. Or, perhaps not as the next section discusses.

93. *Id*. What is frustrating about the Federal Circuit's refusal to acknowledge and address the tension is that the reconciliation of these two positions is not an insurmountable problem. It just requires the acknowledgement that there are factual components to the indefiniteness inquiry and those factual components require deference. *Eidos* seemingly adopts this position, but only to the extent that claim construction is involved in the indefiniteness analysis.

94. 296 F.3d 1106, 1114 (Fed. Cir. 2002).

95. 35 U.S.C. § 112(f) (previously § 112 ¶ 6) states that "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." By presumption, Section 112(f) is invoked when the words "means" or "step" are used in a claim. Similarly, claim language that does not use the words "means" or "step" is presumed not to invoke § 112(f). *See* Inventio AG v. ThyssenKrupp Elevator Am. Corp., 649 F.3d 1350, 1360 (Fed. Cir. 2011) (discussing that "the presumptions that flow from" claim language that uses or does not use the term "means" determines "whether claim language invokes [§ 112(f)]"). At the time this Essay was written, there existed substantial disagreement at the Federal Circuit over the strength of these presumptions. *See* Jason Rantanen, Williamson v. Citrix*: Means-plus-function, Presumptions, and "Nonce" Words*, PATENTLY-O (Dec. 3, 2014), http://patentlyo.com/patent/2014/12/williamson-function-presumptions.html. While this Essay was in final editing, the Federal Circuit resolved that split, eliminating the "strong"

function" elements are "construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof."[96] "If, however, this inquiry reveals that no embodiment discloses corresponding structure, the claim is invalid for failure to satisfy the definiteness requirement of §112, ¶2."[97]

The effect of this alternate framework was to make it much easier to challenge such a claim for indefiniteness. Indeed, the real battle largely revolved around whether the claim language triggered §112(f). If it did not—in other words, if the presumption due to the use of "means" or "step" was rebutted or the presumption due to non-use was not—the analysis effectively ended.[98] But when §112(f) was actually invoked, the Federal Circuit frequently found claims indefinite.[99] In the 10 years prior to *Nautilus*, the Federal Circuit found means-plus-function claims indefinite 65% of the time when indefiniteness was argued, compared with non-means claims which were indefinite only 23% of the time.[100]

This approach to functional claim language remains unchanged after *Nautilus.* In *Williamson v. Citrix*, the Federal Circuit applied the now-established indefiniteness §112(f) jurisprudence; there was no mention of *Nautilus* at all.[101] Rather, once the original panel concluded that §112(f) was not triggered, the indefiniteness challenge was over. The court arrived at the opposite result in *Bosch v. Snap-On*, issued a month and a half earlier, but only

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presumption against invocation of § 112(f) when "means" is not used. *See* Jason Rantanen, Williamson v. Citrix*: En Banc Opinion on § 112, para. 6*, PATENTLY-O (Jun. 16, 2015), http://patentlyo.com/patent/2015/06/williamson-citrix-opinion.html. Applying the now weakened presumption, the panel reached the opposite conclusion on the § 112, ¶ 6 question: that it was invoked. Williamson v. Citrix Online, LLC, No. 2013-1130, 2015 WL 3687459, at *9 (Fed. Cir. June 16, 2015). Because the specification failed to disclose a corresponding structure, the court reached the same result as in *Bosch v. Snap-On*: the claim was indefinite.

96. 35 U.S.C. § 112(f).

97. 296 F.3d 1106, 1114.

98. *See Inventio AG*, 649 F.3d at 1356 ("The use of the term 'means' triggers a rebuttable presumption that [§ 112(f)] governs the construction of the claim term. . . . [W]here . . . the claim language does not recite the term 'means,' we presume that the limitation does not invoke [§ 112(f)]."); Jason Rantanen, Williamson v. Citrix*: Means-plus-function, Presumptions, and "Nonce" Words*, PATENTLY-O (Dec. 3, 2014), http://patentlyo.com/patent/2014/12/williamson-function-presumptions.html ("Under the court's precedent, the failure to use the word 'means' in a claim limitation creates a strong presumption that 35 U.S.C. [§ 112(f)] does not apply.").

99. *See also* John R. Allison, Mark A. Lemley & David L. Schwartz, *Understanding the Realities of Patent Litigation*, 92 TEX. L. REV. 1769, 1783 n.54; 1784 (contrasting the Federal Circuit's approach to means-plus-function claims with its approach to those analyzed under the "insolubly ambiguous" approach); Laser, *supra* note 25 (observing that the Federal Circuit uses a different analysis for means-plus-function claim elements than for other types of claim elements); Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905 (2013).

100. I calculated these rates based on the data provided by Allison & Ouellette.

101. *See generally* Williamson v. Citrix Online, LLC, 770 F.3d 1371, 1384 (Fed. Cir. 2014).

because there it concluded that §112(f) *was* triggered.[102] The key issue in those cases was—and remains—whether §112(f) is invoked at all.[103] It is not about the *Nautilus* approach. Indeed, the two standards could not be more different: under the *Nautilus* standard as applied by the Federal Circuit, the patent challenger faces an uphill battle that is rarely successful. When §112(f) is invoked, however, the burden effectively shifts to the patent holder to point to the corresponding structure. If it does, the claim will be limited to that structure; if it does not, then the claim is indefinite. And, consistent with its pre-*Nautilus* practice, the Federal Circuit has routinely found means-plus-function claims indefinite after *Nautilus*.[104] That one can point to such invalidations says nothing about the *Nautilus* standard.[105]

The Supreme Court's ruling in *Nautilus*, in short, appears to have produced no change at all. Plucked from the context of the *Nautilus* opinion itself, the "reasonable certainty" language imposes no more meaningful a limitation than the "insolubly ambiguous or not amenable to construction" standard. In applying the *Nautilus* standard, the Federal Circuit is still treating claims as reasonably certain as long as the person construing the claim can arrive at a reasonable construction. And, although the Federal Circuit has not come out and said it (nor is it likely to), the only claims for which one cannot arrive at a reasonable construction are those that are not amenable to construction or are insolubly ambiguous.

B. *Teva v. Sandoz*

A similar trend is emerging with the Federal Circuit's post-*Teva* review of claim constructions. Despite the Supreme Court's holding that deference to district courts on factual determinations was necessary, and its outright reversal of one of the Federal Circuit's determinations (and remand of the rest), the immediate response to *Teva* among commentators was surprisingly tepid.[106]

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102. *See* Robert Bosch, LLC v. Snap-On Inc., 769 F.3d 1094, 1101 (Fed. Cir. 2014) (discussing that although the patentee's claims lacked the use of the term "means," the presumption was rebutted as being a means-plus-function claim term invoking § 112(f)).

103. Although it is beyond the scope of this Essay, I have written elsewhere about the presumption. Rantanen, *supra* note 98 (discussing the internal split within the Federal Circuit's "algorithmic approach to indefiniteness," which explains case precedent providing two different approaches to interpreting means-plus-function claim language when rebutting).

104. *See generally* Robert Bosch, LLC v. Snap-On Inc., 769 F.3d 1094 (Fed. Cir. 2014); Augme Techs., Inc. v. Yahoo! Inc., 755 F.3d 1326 (Fed. Cir. 2014); Triton Tech of Texas, LLC v. Nintendo of America, Inc., 753 F.3d 1375 (Fed. Cir. 2014).

105. Importantly, even if the claim element does not invoke § 112(f), it should still be analyzed under § 112(b).

106. Jeffrey Lefstin, Professor of Law at UC Hastings College of Law for example, commented that "[u]ltimately it will make no difference, since the CAFC can review without deference the district court's assignment of that meaning "in the context of the specific patent claim under review." The opportunities for the CAFC to frame construction as a contextual inquiry are so pervasive that *Teva* will serve only to generate pointless disputes

The general expectation was that it would be business as usual at the Federal Circuit.

While it is still early, those tepid predictions have borne out. So far, the Federal Circuit has unabashedly asserted its continued dominance over claim construction. It has done exactly what it did pre-*Teva*: reverse district court claim constructions under a *de novo* standard of review, brushing aside extrinsic evidence where it contradicts, relying on it where it supports and not giving so much as a whiff of formal deference.[107]

How has the Federal Circuit managed to marginalize *Teva v. Sandoz*? Timothy Holbrook's immediate reaction to the opinion hit the nail on the head. "The Federal Circuit will continue to use the *Phillips* hierarchy, turning to extrinsic evidence only when the intrinsic evidence is ambiguous. I think, in the main, the Federal Circuit will view the intrinsic evidence as determinative, retaining *de novo* review in the vast majority of cases."[108]

This is precisely what has happened. Two aspects of *Teva* allow the Federal Circuit the freedom to effectively retain *de novo* review. First, the court has honed in on language that supports *de novo* review of particular aspects of claim construction as well as the ultimate determination. Second, the Federal Circuit's methodological framework for claim construction—which the Supreme Court did not address in *Teva*—has thus far allowed it to avoid addressing any evidentiary determinations at all. Rather, it begins and ends the analysis with the contextual analysis of the claim element based on the "intrinsic" evidence of the patent.

Eidos Display, discussed above in the context of indefiniteness, concisely

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over the extrinsic/intrinsic and isolated/contextual boundaries." Dennis Crouch, *Giving Deference to the Supreme Court in Teva v. Sandoz*, PATENTLY-O (Jan. 21, 2015), http://patentlyo.com/patent/2015/01/deference-supreme-sandoz.html. Mark Janis observed that "A long-overdue ruling. But it's one that leaves CAFC judges ample room to defer (or not) in any given case." *Id.*; *see also* Manzo, *supra* note 37, at § 0:7 (discussing the impact of *Teva* on the claim construction framework used by the Federal Circuit).

107. I focus on those opinions where deference would be most likely, as opposed to those where deference is unlikely. Several of the court's post-*Teva* opinions contain some variation on the following:

[W]hen the district court reviews only evidence intrinsic to the patent (the patent claims and specification[], along with the patent's prosecution history), the judge's determination will amount solely to a determination of law, and the Court of Appeals will review that construction *de novo*. Teva Pharm USA Inc. v. Sandoz, Inc., 135 S. Ct. 831, 841 (2015).

Pacing Technologies, LLC v. Garmin Intern., Inc., 778 F.3d 1021, 1023 (Fed. Cir. 2015); *see generally* Mobilemedia Ideas LLC v. Apple Inc., 780 F.3d 1159 (Fed. Cir. 2015); Fenner Inc., Ltd. v. Cellco P'ship, 778 F.3d 1320 (Fed. Cir. 2015); FenF, LLC v. SmartThingz, Inc., 2015 WL 480392 (Fed. Cir. 2015); *In re* Papst Licensing Digital Camera Patent Litig., 778 F.3d 1255 (Fed. Cir. 2015). These cases are less interesting from a doctrinal perspective because if the district court did rely solely on the intrinsic evidence, then the Federal Circuit is faithfully applying *Teva*. Nevertheless, whether the Federal Circuit's characterization of what the district court did is accurate is potentially subject to debate.

108. Dennis Crouch, *Giving Deference to the Supreme Court in Teva v. Sandoz*, PATENTLY-O (Jan. 21, 2015), http://patentlyo.com/patent/2015/01/deference-supreme-sandoz.html.

demonstrates the Federal Circuit's emerging post-*Teva* approach to claim construction. The legal standard from *Eidos*:

> The indefiniteness inquiry here is intertwined with claim construction, see [*Atmel Corp.*], which, because the meaning of the claim at issue is clear in view of the intrinsic record and undisputed facts, we also review *de novo*, see [*Teva v. Sandoz*]. To the extent the district court considered extrinsic evidence in its claim construction order or summary judgment order, that evidence is ultimately immaterial to the outcome because the intrinsic record is clear. See [*Phillips v. AWH*] ("[A] court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent." (internal quotation marks omitted)).[109]

In this passage, the Federal Circuit makes both moves. First, it emphasizes the primarily *de novo* nature of its review of claim constructions: the intrinsic record and ultimate question of claim construction are, under *Teva*, reviewed *de novo*. Other post-*Teva* opinions contain similar language. In *Fenner Investments v. Cellco Partnership*, for example, the lead sentence of the Federal Circuit's discussion section is: "We review *de novo* the ultimate question of the proper construction of patent claims and the evidence intrinsic to the patent," followed by a quotation from that decision. [110] The sentence noting that "[t]he district court's determination of subsidiary facts based on extrinsic evidence is reviewed for clear error"[111] comes almost as an afterthought.

The court's emphasis of the *de novo* standard is significant, but it is especially meaningful in light of the second portion of the passage from *Eidos*, in which the court draws upon the *Phillips* framework. It is the *Phillips* claim construction methodology that permits the Federal Circuit to retain effective *de novo* control over claim construction. Under *Phillips*, "the words of a claim "are generally given their ordinary and customary meaning,"[112] that is, "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention."[113] This "ordinary meaning" must be understood in light of the patent document: "The person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification."[114] Evidence extrinsic to the patent is given a secondary role: "A court should discount any expert testimony 'that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written

109. Eidos Display, LLC v. AU Optronics Corp., 779 F.3d 1360, 1365 (Fed. Cir. 2015).

110. Fenner, 778 F.3d at 1322.

111. *Id.*

112. Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (quoting Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

113. *Id.* at 1313 (quoting Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc., 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

114. *Id.* at 1313.

record of the patent.'"[115] While a court is not "barred from considering any particular sources or required to analyze sources in any specific sequence," those sources may not be "used to contradict claim meaning that is unambiguous in light of the intrinsic evidence."[116]

Following *Teva*, the Federal Circuit's logic is as follows: (1) *Teva* held that the Federal Circuit reviews the intrinsic record and overall construction *de novo*, and extrinsic evidence for clear error; (2) in *Teva*, the Supreme Court did not touch the established methodology for construing claims outlined in *Phillips*; (3) in the *Phillips* framework, claim construction involves considering the ordinary meaning of a claim term to a PHOSITA in the context of the intrinsic evidence of the patent. In this approach, one only gets to the extrinsic evidence if the meaning remains ambiguous after this stage; (4) thus, deference is only appropriate if the Federal Circuit concludes that claim meaning is ambiguous after conducting a *de novo* review of the intrinsic evidence. It is only in these situations, where there is some (to purpose a term) "lingering ambiguity," that the Federal Circuit must grant deference to the district courts.

In none of its decisions since *Teva* has the Federal Circuit found such a lingering ambiguity. Nor would it, unless the panel, after its *de novo* review, concluded that the claim term remains ambiguous. In each of its post-*Teva* opinions thus far, the meaning of the claim term has been clear from the intrinsic evidence, and thus the court never turned to any factual issues where deference would be required.

Eidos Display offers a vivid example of this mechanism in operation. There, the opinion avoids confronting the deferential standard of review by concluding that "[t]o the extent the district court considered extrinsic evidence in its claim construction order or summary judgment order, that evidence is ultimately immaterial to the outcome because the intrinsic record is clear."[117] Yet, even as the opinion asserts that immateriality, it rings hollow. In the next few paragraphs, the court draws heavily not just on how the patent document itself shapes how a person of ordinary skill in the art would perceive the term "a contact hole," but on how industry knowledge would also shape that meaning.

Lexington Luminance LLC v. Amazon.com, Inc., a nonprecedential opinion, offers another example. In *Lexington*, "the district court construed 'trenches' as 'depressions bounded on the sides and bottom and open at top.'"[118] The Federal Circuit disagreed, concluding that "the district court erred by adopting a construction based on general-purpose dictionaries that is inconsistent with the intrinsic record," in accordance with the proposition that "[e]xtrinsic

115. *Id.* at 1318 (quoting Key Pharm. v. Hercon Labs. Corp., 161 F.3d 709, 716 (Fed. Cir. 1998)).

116. *Id.* at 1324.

117. *Eidos Display*, 779 F.3d 1360, 1365.

118. Lexington Luminance LLC v. Amazon.com, Inc., 2015 WL 524270 at *6 (Fed. Cir. 2015) (quoting Lexington Luminance LLC v. Amazon.com, Inc., 6 F. Supp. 3d 179, 197 (D. Mass. 2014)).

evidence, including dictionaries, can at times shed useful light on the relevant art; but extrinsic evidence is less significant than the intrinsic record in determining the meaning of claim language."[119] Although the language of *Lexington* is not binding on subsequent panels, it nevertheless illustrates a trend towards relegating extrinsic evidence—and thus deferential review—to the depths of the closet of claim construction tools.[120]

If it is really the case that the Federal Circuit intends to hew tight to its established methodology, then enhanced evidentiary findings by the district courts will have little effect, at least formally, as long as the Federal Circuit focuses its reviewing gaze predominantly on the intrinsic evidence.[121] Instead, what is needed is recognition by the Federal Circuit that extrinsic evidence too plays a significant role in the meaning of claim terms.

IV. WHAT THE FUTURE HOLDS: THE CRACK IN THE FEDERAL CIRCUIT'S FRAMEWORK

While I have described the Federal Circuit's post-*Nautilus* and *Teva* jurisprudence as change without change, it doesn't necessarily have to remain that way. And, perhaps there is still the potential for movement in the court's claim construction and indefiniteness jurisprudence.

For claim construction, the primary vehicle for change rests not in a focus on extrinsic evidence to resolve lingering ambiguities, but through the fundamental flaw in the court's current claim construction framework. The court's current methodology rests on the assumption that determining the starting meaning for the claim construction process—the "ordinary meaning" to a person of skill in the art—does not involve factual determinations. As discussed above, the Federal Circuit's methodological approach to claim construction envisions beginning with the ordinary meaning of a term to a

119. *Id.*

120. A third example is *Enzo Biochem Inc. v. Applera Corp.*, 780 F.3d 1149, 1158 (Fed. Cir. 2015) (Newman, J., dissenting), in which Judge Newman observed in dissent both the majority's elevation of intrinsic over extrinsic ("The rules of grammar and linguistics, even in legal documents, do not establish that 'at least one' means two or more."), and the majority's disregard of the district court's factual finding, which should have been entitled to deference under *Teva* ("In *Teva,* the Court established that, when construing claims, appropriate deference must be given to the findings of the district court. The district court received some conflicting testimony, along with concessions on cross-examination, from which the court concluded that "at least one component" may include "the whole signaling moiety."). *Id.* at 1159.

121. In fact, I agree fully with the suggestions for greater clarity and articulation of claim construction determinations for which Jonas Anderson and Peter Menell call. *See* J. Jonas Anderson & Peter S. Menell, *Restoring the Face/Law Distinction in Patent Claim Construction*, 109 NW. U.L. REV ONLINE 187 (2015). I am just skeptical that they will have any meaningful impact on the Federal Circuit's claim construction review unless the court allows extrinsic evidence to play a greater role. And perhaps rigorously laying out the claim construction analysis as Anderson and Menell suggest will make the flaw in the Federal Circuit's analytical framework more apparent.

person of skill in the art, then looking to the intrinsic evidence, and then, only if the meaning is still ambiguous, considering the extrinsic evidence.[122]

This approach ignores how a reader actually obtains meaning from words. In particular, as is well recognized, point of view matters.[123] How I read *Anne of Green Gables*, to pick a story at almost random, and the meaning that I take from that text, differs greatly from the meaning that others take from that text.[124] To give an even more extreme example, the meaning I obtain from *Les Trois Mousquetaires* is unquestionably different from that of other readers.[125] Our collective experiences define the perspective from which we understand texts. Interpreting patent claims is particularly tricky because the judge does not just look at them from her perspective; she must look at them from the perspective of a person of skill in the art of the patent.[126] Figuring out the starting meaning of a claim term necessitates first determining the perspective that one must look from.

But the issue of starting meaning is not just a question of identifying the person of skill in the art, as others have recognized.[127] There are also other sources of potential linguistic disagreement that take more the form of lenses rather than vantage points. A word's "ordinary meaning" is not something that readers pluck out of the air from some shared, universal dictionary.[128] Rather, everyone comes to a text with his or her own personal lexicon: his own linguistic lenses, as it were, through which he looks.[129] When we read a word,

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122. *C.f.* Timothy Holbrook, *Patents, Presumptions, and Public Notice*, 86 IND. L. J. 779, 782 (2011) ("If this publicly available intrinsic evidence is clear, the court will refuse to consult other extrinsic evidence.").

123. *See* Oskar Liivak, *The Unresolved Interpretive Ambiguity of Patent Claims: A Response to Solum and Chiang* (unpublished manuscript), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2559958.

124. Some might see it as a book of great sorrow and childhood trauma, about a young girl whose parents died when she was very young, and who still lives a hard and challenging life. Others see it as a work of beauty and hope, where each day is filled with more life than the one before it.

125. In case it's not apparent, this is because I am not very good at reading French. I understand a bit, but certainly not in nearly as much depth as a fluent reader.

126. Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) ("We have made clear, moreover, that the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention . . . ."); Peter S. Menell et al., *Patent Claim Construction: A Modern Synthesis and Structured Framework*, 25 BERKELEY L.J. 711, 722 (2010). A third perspective is possible as well, as John Golden has argued: a patent attorney with access to the knowledge of an ordinary artisan. *See* John Golden, *Construing Patent Claims According to Their "Interpretive Community": A Call for an Attorney-Plus-Artisan Perspective*, 21 HARV. J.L. & TECH. 321, 383 (2008).

127. *See, e.g.*, Kristin Osenga, *Linguistics and Patent Claim Construction*, 38 RUTGERS L.J. 61, 62 (2006); Golden, *supra* note 126, at 330.

128. From this perspective, *Lexington Luminance* is all the more troubling, because it involved a word for which there was supposedly a well-settled meaning.

129. Osenga, *supra* note 127, at 62 (2006); Golden, *supra* note 126, at 330 ("It is well known that how a person—or an interpretive community—understands a legal document can depend strongly on that person's mental framework and background knowledge.").

for example, we don't see its meaning in a vacuum; we see its meaning beginning with our starting lexicon and flowing outward through the context of the word (which is viewed through our grammatical lexicon). Interpreting patent claims is particularly tricky because the judge doesn't just look through her own personal lexical lens; she has to manufacture a second pair of lenses to try and see it as a PHOSITA might. The end result, though, is that linguistic meaning isn't just a choice of perspectives, as it's also a function of the personal lenses that we wear.

If everyone wore the same lenses, of course, then interpretation wouldn't be a problem. But just as in the real life version of the analogy, we don't. So a major challenge with linguistic meaning is trying to align those lenses so that we all arrive at the same meaning. Worse, we often don't realize that we're not seeing what everyone else is seeing. We can't comprehend how someone else can see the dress as blue and black (or white and gold).[130]

Rather than grapple with this challenge of lexical meaning, the Federal Circuit almost invariably jumps right into the second stage of determining meaning: understanding words in context. But, context alone doesn't provide the full meaning. Context just helps to refine meaning. When we see the word "card," we have a range of possibilities: greeting card, computer card, credit card, etc. Context can help us understand which of these meanings is appropriate: "She gave her mother a card on Mother's day" implies that the word "card" carries its greeting card context. But context alone rarely gives us a starting point for that meaning. We know, for example, that "card" doesn't possibly mean "rose," even though the context provides only minimal clues that it does not. By elevating context over everything else, the Federal Circuit misses the very challenging question of starting meaning.

Fenner v. Cellco provides an example of how the Federal Circuit's approach misses the issue of starting meaning entirely. Even as Judge Newman recognizes the challenges of claim construction, and specifically acknowledges that Fenner's argument rested on the "plain meaning" of "personal information number," she launches directly into a contextual analysis of the word: in other words, understanding what the word means based on the context in which it is being used. Absent entirely is any discussion of the point from which the court is starting.[131]

Perhaps the closest attempt to grapple with this issue of starting meaning is Judge Bryson's opinion in *Phillips*. Even while pushing back against the use of

130. I can't see it as either. I see it as a light blue and tan dress. For the reference, see Jonathan Corum, *Is that Dress White and Gold or Blue and Black?*, N.Y. TIMES (Feb. 27, 2015), http://www.nytimes.com/interactive/2015/02/28/science/white-or-blue-dress.html?_r=0.

131. *See* Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 Northwestern Law Review 1, 5 (2014) (finding that the Federal Circuit rarely identified the applicable person of skill in the art). If the Federal Circuit rarely identifies even the perspective from which it is starting, it follows that it even more rarely considers the meaning that that person starts from.

extrinsic sources such as dictionaries, Judge Bryson observed that judges would inevitably come across words that they did not know the meaning of: "For example, a judge who encounters a claim term while reading a patent might consult a general purpose or specialized dictionary to begin to understand the meaning of the term, before reviewing the remainder of the patent to determine how the patentee has used the term."[132] So too, "extrinsic evidence in the form of expert testimony can be useful to a court for a variety of purposes, such as to provide background on the technology at issue, to explain how an invention works, to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field."[133] Yet, even as the court acknowledged the tension, it had no easy answers in *Phillips*: "There is no magic formula or catechism for conducting claim construction."[134]

To date, the Federal Circuit has largely been able to sidestep the tension between starting meaning and contextual meaning due to its application of *de novo* review. It could review the entire claim construction as if it were one big multi-factored inquiry. But now that factual determinations are reviewed for clear error, the tension identified in *Phillips* will take on a critical importance.

Indeed, what is so surprising about the Federal Circuit's post-*Teva* jurisprudence isn't its adherence to the *Phillips* framework. It's that the Federal Circuit has kept its blinders on as to the factual nature of starting meaning even as the Supreme Court's opinion repeated that point again and again. In *Teva*, the Court repeatedly endorsed a claim construction process where the judge begins by making a factual determination about the meaning of a claim term to a person of skill in the art and then considers the intrinsic evidence of the patent to arrive at a legal conclusion as to its meaning in the patent. Each of the three examples of the fact/law distinction discussed above involve precisely this process. The Court could only have been more clear when it said "[t]he district judge, after deciding the factual dispute, will then interpret the patent claim in light of the facts as he has found them"[135] if it had emphasized the word "after."

Of the Federal Circuit's post-*Teva* jurisprudence thus far, *Enzo Biochem Inc. v. Applera Corp.* comes the closest to recognizing the problem of starting meaning and the implications of *Teva*. There, Judge Prost, writing for the majority, stated that "when the district court looks beyond the intrinsic evidence and consults extrinsic evidence, for example to understand the relevant science, these subsidiary fact findings are reviewed for clear error," and that the court must look to "the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific

132. Phillips v. AWH Corp., 415 F.3d 1303, 1324 (Fed. Cir. 2005)

133. *Id.* at 1318.

134. *Id.* at 1324.

135. Teva Pharm. USA Inc. v. Sandoz, Inc., 135 S. Ct. 831, 841 (2015).

principles, the meaning of technical terms, and the state of the art" to determine the meaning of a claim term.[136] Ultimately, however, the majority followed the ingrained methodology and "beg[a]n with the language of the claims,"[137] before concluding that the only factual determination by the district court that might be entitled to deference did not matter because that fact "does not override our analysis of the totality of the specification, which clearly indicates that the purpose of this invention was directed towards indirect detection, not direct detection."[138]

What about *Nautilus*? The ship seems to have sailed on any meaningful doctrinal changes to the indefiniteness doctrine at the Federal Circuit in appeals in infringement suits.[139] But the court's §112(f) indefiniteness jurisprudence holds the potential to be a potent weapon for patent challengers, particularly given the en banc Federal Circuit's recent rejection of a "strong" presumption against applying § 112, ¶ 6 when the words "means" or "step" are not used.[140]

Nor has the discussion of functional language in *Halliburton* seen its last, I suspect. The Federal Circuit decision that limited *Hallburton* was *Biosig v. Nautilus*, and that opinion was the very opinion vacated by the Court. This, too, could be an area where the Federal Circuit will be called upon to address patents that draw upon the ambiguity of results-oriented language as a tool for seeking broad claim scope.

In the end, however, the greatest possibility for change likely lies with the gatekeeping role of the patent office. Even as it has demonstrated resistance to indefiniteness challenges to issued patents, the Federal Circuit has maintained the heightened definiteness standard for examining patent claims that it affirmed in *In re Packard.* And it may be the patent office that is best suited to addressing issues of ambiguity up front.

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136. Enzo Biochem Inc. v. Applera Corp., 780 F.3d 1149, 1153-54 (Fed. Cir. 2015); *see also* FenF, LLC v. SmartThingz, Inc., 2015 WL 480392 at *2 (Fed. Cir. 2015) ("The district court's claim construction relied only on intrinsic evidence, not on any testimony by one of ordinary skill in the art about the meaning of separators in the relevant art during the relevant time period.").

137. *Enzo* at 1154. What the court literally said in *Enzo* was: "We begin with the language of the claims."

138. *Id*. at 1156.

139. Indeed, while this Essay was being prepared for publication, the Federal Circuit issued its opinion on remand in *Biosig Instruments, Inc. v. Nautilus, Inc.* 2015 WL 1883265 (Fed. Cir. April 27, 2015). To the extent that there was any doubt as to my premise that *Nautilus* changed nothing, that opinion should dispel them. *See* Jason Rantanen, *Biosig v. Nautilus: Indefiniteness on Remand*, PATENTLY-O (May 6, 2015), http://patentlyo.com/patent/2015/05/nautilus-indefiniteness-remand.html.

140. *See* Jason Rantanen, Williamson v. Citrix*: En Banc Opinion on § 112, para. 6*, PATENTLY-O (Jun. 16, 2015), http://patentlyo.com/patent/2015/06/williamson-citrix-opinion.html; Williamson v. Citrix Online, LLC, No. 2013-1130, 2015 WL 3687459, at *9 (Fed. Cir. June 16, 2015).

FEDERAL AND STATE AUTHORITY FOR BROADBAND REGULATION

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ABSTRACT

Verizon's challenge to the Federal Communications Commission's 2010 Open Internet Order voided the substance of those rules. But even as the Commission lost the authority to enforce those rules, it gained substantial new regulatory powers. The D.C. Circuit expressly affirmed the Commission's interpretation of section 706 of the Telecommunications Act of 1996, granting it general regulatory authority to promote the deployment of broadband infrastructure. The significance of this power can hardly be understated. The Commission has relied on this authority to preempt state statutes, to subsidize broadband deployment, and even to support, together with Title II of the Communications Act, new network neutrality rules. And the reach of section 706 extends beyond the federal commission and into state regulatory bodies: The statute explicitly vests state commissions with the authority to encourage the deployment of broadband to all Americans. Like the FCC, the states have pounced on this authority, using it to engage in substantive merger reviews, and to impose regulatory requirements on telecommunications companies.

This concurrent grant of jurisdiction to the FCC and to state commissions thus has important implications for the unique brand of federalism that has dominated telecommunications regulation. Section 706's dual grant of authority to federal and state regulators embraces an experimentalist approach to telecommunications regulation, allowing states to serve as laboratories of regulatory experiments, while empowering the FCC to generalize their successes.

* Julius Silver Research Fellow, Columbia Law School. I thank Scott Hemphill, Bert Huang, Khushali Narechania, members of the Federal Communications Commission, and audiences at TPRC42: The Research Conference on Communications, Information, and Internet Policy for many helpful comments and suggestions on this project.

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INTRODUCTION

The Federal Communications Commission has engaged in an extended dialogue with the D.C. Circuit regarding network neutrality regulation.[1] In *Comcast v. FCC*, the court held that the FCC failed to articulate a jurisdictional basis for its ruling against Comcast.[2] The Commission responded by issuing a set of rules supported by a new source of statutory authority—section 706 of the Telecommunications Act. The court's decision in *Verizon v. FCC* affirmed the FCC's view of its jurisdiction—but nevertheless struck down those rules as exceeding the bounds of that authority.[3]

This ruling will hardly be the last chapter. Before the ink had dried on *Verizon*, the White House urged the FCC to "vindicate the notion of a free and open internet,"[4] and the Commission launched another network neutrality

1. *See* Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. TELECOMM. & HIGH TECH. L. 141, 142 (2003) [hereinafter Wu, *Network Neutrality*] (explaining motivations for network neutrality regulation).

2. Comcast Corp. v. FCC, 600 F.3d 642, 661 (D.C. Cir. 2010).

3. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 649, 657-59 (D.C. Cir. 2014).

4. Jon Brodkin, *Obama on Net Neutrality: I Wouldn't Be President Without an Open Internet*, ARSTECHNICA (Jan. 31, 2014, 1:15 PM), http://arstechnica.com/tech-policy/2014/01/obama-on-net-neutrality-i-wouldnt-be-president-without-an-open-internet/. *See also Net Neutrality*, THE WHITE HOUSE, https://www.whitehouse.gov/net-neutrality (last visited May 11, 2015) (reproducing memorandum dated November 10, 2014); Gene Sperling & Todd Park, *Official White House Response to Restore Net Neutrality By Directing the FCC to Classify Internet Providers as Common Carriers: Reaffirming the White House's Commitment to Net Neutrality*, WE THE PEOPLE, https://petitions.whitehouse.gov/petition/restore-net-neutrality-directing-fcc-classify-internet-providers-common-carriers/5CWS1M4P (last updated Feb. 26, 2015) ("White House vigorously supports" having the FCC "use the full authority granted by Congress to maintain a robust, free and open Internet").

proceeding, inviting public input and proposals for regulations.[5] Nearly four million citizens, corporations, and public interest organizations offered their views, forcing the FCC to confront a record larger than had ever before been amassed in its history.[6] The Commission concluded that proceeding by promulgating rules largely similar to those it had previously issued.[7] This time, however, it also invoked its authority to regulate common carriers under Title II of the Communications Act. And the Commission's conversation with the courts may not yet be over: as before, broadband carriers and trade organizations have sued to strike down the FCC's regulations.[8]

Although the Commission's *2015 Open Internet Order* relies on its authority under Title II and section 706, one of its initial proposals focused on rules based on section 706 alone.[9] A closer look suggests that section 706 gives the Commission the power to promulgate regulations that are only slightly narrower than the rules it issued through the *2015 Open Internet Order*. Stated more generally, section 706 gives the FCC broad authority to regulate broadband internet access service, including the authority to issue network neutrality-like rules.

Perhaps even more significant than the breadth of authority granted to federal regulators is the new power conferred to state utility commissions. Section 706 of the Telecommunications Act, properly read, endows state commissions with federal power.[10] An unintended effect of Verizon's challenge to the Commission's *2010 Open Internet Order* is thus the broad delegation of federal authority to local regulators. This new authority to use virtually any means to promote investment in broadband infrastructure has significant implications for the model of "cooperative federalism" that has governed federal and state relations in telecommunications regulation.[11]

In this Essay, I elaborate on the implications of the authority now vested in federal and state regulators by section 706. I begin by describing the Federal Communications Commission's history with network neutrality regulation in particular, starting with the proceedings that gave rise to the *Comcast* decision and through the assertion of its authority to regulate common carriers under Title II of the Communications Act.

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5. New Docket Established to Address Open Internet Remand, 29 FCC Rcd. 1746 (2014) (public notice).

6. Protecting and Promoting the Open Internet (*2015 Open Internet Order*), 30 FCC Rcd. 5601 (2015) (report and order on remand), ¶ 6.

7. *Compare 2015 Open Internet Order*, *supra* note 6, *with* Preserving the Open Internet (*2010 Open Internet Order*), 25 FCC Rcd. 17905 (2010) (report and order); *see also* 47 C.F.R. § 8.1 *et seq.*

8. *E.g.*, U.S. Telecomm. Ass'n v. FCC, No. 15-1063, 2015 WL 1476449 (D.C. Cir. Mar. 23 2015).

9. Notice of Proposed Rulemaking, 29 FCC Rcd. 5561 (2014), ¶ 142.

10. *See infra* Part III.

11. *E.g.*, Philip J. Weiser, *Towards a Constitutional Architecture for Cooperative Federalism*, 79 N.C. L. REV. 663 (2001) [hereinafter Weiser, *Constitutional Architecture*].

This Essay's second part describes how section 706 alone can support a set of rules designed to enforce many basic network neutrality norms. To be sure, the rules that combine the Commission's section 706 authority with its Title II powers are broader. But an examination of an alternative, though purely hypothetical, set of rules that rely on section 706 alone helps to demonstrate the vast scope of authority endowed by the statute.[12]

Lastly, I survey the effects of section 706 on the relationship between federal and state regulators. Drawing predominantly from two examples—state regulation of infrastructure necessary for broadband deployment, and federal preemption of state laws limiting broadband competition—I show how the striking breadth of section 706's jurisdictional grant alters the already novel scheme of federalism that is built into telecommunications regulation. Section 706 supersedes state law limitations on the jurisdiction of state commissions, and gives them the authority to regulate where the FCC has declined to do so. Moreover, federal regulators can use section 706 as a source of preemptive authority, enabling the FCC to supersede decisions typically subject to state and local discretion. Section 706 thus has substantial implications for the model of federalism that has dominated telecommunications regulations.

I. NETWORK NEUTRALITY AT THE FCC

A. *Network Neutrality Before Verizon*

The FCC has a lengthy tradition of network neutrality regulation, beginning in the 1960s.[13] The most recent chapter of this legacy features a dialogue between the FCC and D.C. Circuit over the Commission's regulatory jurisdiction. In 2007, the Associated Press, along with internet policy advocates, discovered that Comcast was selectively interfering with the traffic

12. *See* Wu, *Network Neutrality*, *supra* note 1, at 142 ("Government regulation . . . invariably tries to help ensure that the short-term interests of the owner do not prevent the best products or applications becoming available to end-users.")

13. A significant history predates the story told here, beginning with the FCC's three *Computer Inquiries*. *See* Amendment of Sections 64.702 of the Commission's Rules and Regulations (*Third Computer Inquiry*), 104 FCC 2d 958 (1987) (report and order); Amendment of Section 64.702 of the Commission's Rules and Regulations (*Second Computer Inquiry*), 77 F.C.C. 2d 384, 417-423 (1980) (final decision); Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, 28 F.C.C. 2d 267, 269 (1971) (final decision and order); *see also 2010 Open Internet Order*, *supra* note 7, at 18,045 (Copps, Comm'r, concurring) (referring to the Computer Inquiries). These proceedings are also described in more detail in Tejas N. Narechania & Tim Wu, *Sender Side Transmission Rules for the Internet*, 66 FED. COMM. L.J. 467 (2014). For present purposes, I fast-forward to 2007, noting only that this lengthy history is relevant to D.C. Circuit's analysis of Verizon's argument invoking *FDA v. Brown & Williamson Tobacco Corp.*, 529 U.S. 120 (2000). *See infra* note 55 and accompanying text (describing Verizon's argument that relies on *Brown & Williamson*).

of some of its customers.[14] According to these investigations, Comcast was purposely "throttling"[15] traffic associated with peer-to-peer networks, despite lacking any indication that the traffic was illicit or harmful to Comcast's network.[16] The Commission investigated the matter and, after a period of public comment, issued an order asserting authority over Comcast's broadband service and deemed Comcast's practices illegal as contrary to a Commission Policy Statement.[17]

By the time the Commission was contemplating the *Comcast Order*, it had, in a decision upheld by the Supreme Court in *Brand X*, classified the transmission of broadband internet traffic as an "information service" rather than as a "telecommunications service."[18] This decision had the significant consequence of limiting the Commission's authority to regulate broadband.[19] In particular, the "information service" designation disabled the Commission from relying on its authority under Title II of the Communications Act to regulate broadband carriers as common carriers.[20]

The Commission thus needed an alternative jurisdictional basis for the *Comcast Order*. It thought it had found one in its "ancillary authority."[21] That is, the FCC conceded that although the *Comcast Order* did not fall within any of its express statutory mandates, it was nevertheless "reasonably ancillary" to the "effective performance" of its other statutory responsibilities.[22]

Specifically, the Commission argued that the *Comcast Order* was ancillary to the policies contained within section 706 of Telecommunications Act of

14. Comcast Corp. v. FCC, 600 F.3d 642, 644 (D.C. Cir. 2010).

15. In this context, throttling means slowing. *See* 47 C.F.R. § 8.7 (2015).

16. Peer-to-peer traffic is sometimes associated with copyright infringement. In the *Comcast* case, however, the complainants tested Comcast's network practices with materials that were out of copyright, such as The Bible and open-source software. *See* Formal Complaint of Free Press & Pub. Knowledge Against Comcast Corp. for Secretly Degrading Peer-to-Peer Applications (*Comcast Order*), 23 FCC Rcd. 13028, 13051-052 & n.192 (2010) (memorandum opinion and order).

17. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities (*Internet Freedoms Policy Statement*), 20 FCC Rcd. 14986 (2005) (policy statement); *see also Comcast*, 600 F.3d at 644.

18. Nat'l Cable and Telecomm. Ass'n v. Brand X Internet Serv's, 545 U.S. 967, 974 (2005) (affirming FCC order finding "cable companies that sell broadband Internet service do not provide 'telecommunications servic[e]' as the Communications Act defines that term, and hence are exempt from mandatory common-carrier regulation under Title II"); *see also* High-Speed Access to the Internet Over Cable and Other Facilities (*Cable Modem Order*), 17 FCC Rcd. 4798, 4802 (2002).

19. 47 U.S.C. § 153(51) (2014) ("A telecommunications carrier shall be treated as a common carrier . . . only to the extent that it is engaged in providing telecommunications services."). *See also Brand X*, 545 U.S. at 997.

20. *Brand X*, 545 U.S. at 997.

21. *See, e.g.*, United States v. Midwest Video Corp., 406 U.S. 649 (1972); United States v. Sw. Cable Co., 392 U.S. 157, 178 (1968).

22. *Comcast*, 600 F.3d at 646 (quoting American Library Ass'n v. FCC, 406 F.3d 689, 691 (D.C. Cir. 2005)).

1996.[23] Section 706(a), for example, directs the Commission to "encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans," and authorizes it to use a variety of regulatory approaches to achieve this end.[24] Likewise, section 706(b) asks the Commission to "take immediate action" whenever it finds that broadband is not being deployed to "all Americans in a reasonable and timely fashion."[25] Altogether, section 706 of Telecommunications Act of 1996 embodies the heart of Congress's policies favoring broadband deployment.

The Commission argued that the *Comcast Order* promoted these statutory objectives in two discrete ways.[26] First, the Commission determined that degrading the consumer broadband experience "effectively . . . limit[ed]" the deployment of broadband because it imposed artificial restrictions on existing network capability.[27] Second, and more importantly, the Commission found that "prohibiting network operators from blocking or degrading consumer access to desirable content and applications on-line will result in increased consumer demand for high-speed Internet access and, therefore, increased deployment to meet that demand."[28]

The D.C. Circuit was unpersuaded by the Commission's assertion of regulatory authority. To be sure, the court held open the possibility that the Commission had accurately described the causes and effects of consumer demand for broadband. But the court ruled that a provision that did not itself grant regulatory power could not serve as a basis for ancillary authority. Section 706 *could* be read as a grant of agency jurisdiction, the court suggested,[29] but the Commission had previously interpreted the statute as not granting any regulatory authority.[30] Thus, the court ruled that the Commission

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23. 47 U.S.C. § 1302(a) (2014) (originally codified as a note to 47 U.S.C. § 157, before being amended and recodified by the Broadband Data Improvement Act of 2008, Pub. L. No. 110-385, 122 Stat. 4096 (2008)).

24. § 1302(a). The breadth of the regulatory tools the Commission is authorized to use include "price cap regulation, regulatory forbearance," and, more generally, "other regulating methods." Furthermore, "[a]dvanced telecommunications capability" refers to broadband internet access. Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, 14 FCC Rcd. 2398, ¶ 20 (1999).

25. 47 U.S.C. § 1302(b) (2014).

26. *Comcast Order*, *supra* note 16, at 13038 n.81.

27. *Id.* at 13038-039

28. *Id.*

29. Comcast Corp. v. FCC, 600 F.3d 642, 658 (D.C. Cir. 2010) ("[S]ection 706 does contain a direct mandate . . . ."). Indeed, as I describe *infra* Part I.B, the court seems to think that this is the better reading of the statute. *Verizon Commc'ns Inc. v. FCC*, 740 F.3d 623, 637 (D.C. Cir. 2014) (new interpretation is "more logical").

30. The Commission vigorously contested this reading of its previous order, Deployment of Wireline Services Offering Advanced Telecommunications Capability (*Advanced Services Order*), 13 FCC Rcd. 24012 (1998) (memorandum opinion and order), arguing that it did "not opin[e] more generally on the effect of section 706 on ancillary

could not now issue the *Comcast Order* as ancillary to its section 706 authority—authority that the Commission had itself disavowed.[31]

This view of section 706 proved to be critical to the Commission's second attempt at enforcing network neutrality norms. As the FCC forged a path forward from the *Comcast* decision, it noted that most observers "ha[d] focused on two principal options."[32] First, many suggested that the FCC stay the course and "adapt its policies to the restrictions announced by the *Comcast* court." That is, the Commission could attempt to rely on its ancillary authority and miscellaneous sources of agency jurisdiction to issue rules governing broadband service. Alternatively, the Commission could "reclassify broadband internet access services as telecommunications services," subjecting them to the full board of common carrier regulations that apply under to Title II of the Telecommunications Act.[33]

Neither option seemed satisfactory to the FCC. The first faced continuing "risks of failure in court" and "would involve a protracted, piecemeal approach to defending essential policy initiatives."[34] The second would "subject the providers of broadband communications services to extensive regulations," some of which seemed to be "ill-suited to broadband."[35]

The FCC found a third option in section 706.[36] In December 2010, the

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authority." *Comcast*, 600 F.3d at 658-59. The Commission tried to cabin its prior reading of section 706 to one that was limited to the question whether the statute supported *forbearance* authority—rather than statutory authority more generally. *Id.* This disagreement informs an extended dialogue between the Commission and the court that extends all the way into the *Verizon* decision. *See infra* notes 46, 50.

31. *Comcast*, 600 F.3d at 659.

32. Austin Schlick, Gen. Counsel, FCC, Speech: A Third-Way Legal Framework for Addressing the Comcast Dilemma (May 6, 2010) [hereinafter *Third Way Legal Framework*], https://www.fcc.gov/events/speech-third-way-legal-framework-addressing-comcast-dilemma; *see also* Julius Genachowski, *The Third Way: A Narrowly Tailored Broadband Framework*, OFFICIAL FCC BLOG, FCC (Apr. 18, 2012, 11:12 AM EDT), https://www.fcc.gov/blog/third-way-narrowly-tailored-broadband-framework [hereinafter *Third Way Chairman Statement*] (noting the two principal options described above).

33. *Third Way Legal Framework*, *supra* note 32.

34. *Third Way Chairman Statement*, *supra* note 32.

35. *Id.*

36. The Commission initially considered using section 706 as authority to forbear from applying some common carrier regulations after reclassifying the transmission of broadband traffic as a telecommunications service, while applying other rules to ensure network neutrality. *Third Way Legal Framework*, supra note 32; *see also* 47 U.S.C. § 160 (2014) (additional authority for forbearance). But the FCC's strategy evolved over time, and this shift in strategy was the subject of some consternation. *E.g.*, Press Release, Free Press, Is FCC Peddling Fake Net Neutrality? (Dec. 1, 2010), http://www.freepress.net/press-release/2010/12/1/fcc-peddling-fake-net-neutrality (The FCC "abandon[ed] [its] prior commitment to make new rules under Title II of the Communications Act, instead pursuing rules under the more legally precarious Title I."). These reservations notwithstanding, section 706 played a foundational role in the Commission's *2010 Open Internet Order*, as described *infra*.

Commission adopted the *2010 Open Internet Order*,[37] which contained three principal rules.[38] First, the *Order* requires that broadband providers "disclose accurate information regarding the network management practices, performance, and commercial terms" of its service offering.[39] Second, the *Order* prevented broadband providers from "block[ing] lawful content, applications, services, or non-harmful devices."[40] Finally, the *Order* required that providers "not unreasonably discriminate in transmitting lawful network traffic."[41] Elaborating on the third rule, the Commission noted that use-agnostic discrimination would be "likely reasonable," whereas "a commercial arrangement . . . [to] favor some traffic over other traffic . . . (i.e., 'pay-for-priority') would raise significant cause for concern."[42]

In describing its authority to issue these rules, the Commission relied principally on section 706. The Commission carefully explained its position that section 706(a) "necessarily invested the Commission with the statutory authority" necessary to promote the deployment of broadband.[43] Furthermore, it argued that section 706(b) *required* the Commission to take action to promote "infrastructure investment" and "competition" in the broadband market.[44] As in the *Comcast Order*, the Commission found that the *2010 Open Internet Order* was tethered to these statutory goals because it encouraged broadband deployment by "enabl[ing] a self-reinforcing cycle of investment and innovation in which new uses of the network lead to increased adoption of broadband, which drives investment and improvements in the network itself."[45] But, unlike its previous attempt in *Comcast*, the FCC explicitly disavowed its earlier reading of section 706, asserting that the statute affirmatively granted authority to regulate.[46]

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37. Although the Order was adopted in December 2010, the rules did not go into effect until after publication in the Federal Register. Federal Register publication was delayed until September 23, 2011, and the rules became effective on November 20, 2011. *Preserving the Open Internet*, 76 Fed. Reg. 59192 (FCC Sept. 23, 2011) (codified at 47 C.F.R. § 8.1 *et seq.*).

38. *2010 Open Internet Order*, *supra* note 7. These rules are based in part on the Commission's 2005 Policy Statement. *See Internet Freedoms Policy Statement*, *supra* note 17. Notably, the rules varied slightly in their application to providers of broadband service over mobile (cellular) networks. *See 2010 Open Internet Order*, *supra* note 7, at ¶¶ 99-104; *infra* notes 40-41.

39. *2010 Open Internet Order*, *supra* note 7, at ¶ 54. This rule is still in effect. *Verizon Commc'ns Inc. v. FCC*, 740 F.3d 623, 659 (D.C. Cir. 2014) (upholding transparency rule).

40. *2010 Open Internet Order*, *supra* note 7, at ¶ 63; *see also id*. at ¶ 99 (different scope for mobile broadband).

41. *Id.* at ¶ 68; *see also id.* at ¶ 104 (rule not applicable to mobile broadband).

42. *Id.* at ¶¶ 73, 76.

43. *Id.* at ¶ 120.

44. 47 U.S.C. § 1302(b) (2014); *see also infra* note 56 (describing section 706(b)).

45. *2010 Open Internet Order*, *supra* note 7, at ¶ 3.

46. In this second part of an ongoing conversation between the Commission and the D.C. Circuit, *supra* note 30, the *Open Internet Order* does explicitly "reject" any "reading of

B. *Verizon v. Federal Communications Commission*

The *2010 Open Internet Order* did not go unchallenged. In July 2012, Verizon sought review of the Commission's Order in the D.C. Circuit, arguing that the rules were unlawful for two primary reasons; first, because the rules "effectively" imposed a common carriage regime, they exceeded the Commission's authority to regulate any service not classified as a telecommunications service;[47] and second, because the Commission lacked the jurisdiction to adopt the regulations.[48]

The Commission prevailed on its jurisdictional argument. To be sure, the D.C. Circuit noted that the Commission had previously tried (and failed) to rely on section 706(a) for the "authority to regulate broadband providers."[49] But because the Commission had reconsidered its interpretation of the statute and had "offered a reasoned explanation for its changed understanding,"[50] the court found "the Commission's current understanding of section 706(a) as a grant of authority" to be "a reasonable interpretation of an ambiguous statute."[51] As it originally suggested in *Comcast*, the court explained that the language of the statue can bear a reading that grants agency authority.[52] Furthermore, the court found the legislative history, which refers to section 706 as a "necessary fail-

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the statute" that does not view section 706 as a grant of authority. *2010 Open Internet Order*, *supra* note 7, at ¶ 119 n.370. In doing so, however, it did not quietly acquiesce to the D.C. Circuit's reading of the *Advanced Services Order*, *supra* note 30. Instead, the Commission doubled-down on the reading of its prior order that it advanced in the *Comcast* case, explicitly stating that the "*Advanced Services Order* is . . . consistent with our present understanding" that the statute acts as a grant of regulatory jurisdiction. *2010 Open Internet Order*, *supra* note 7, at ¶ 119. *But see* Framework for Broadband Internet Serv., GN Docket No. 10-127, at ¶ 36 (FCC June 17, 2010) (notice of inquiry), https://apps.fcc.gov/edocs_public/attachmatch/FCC-10-114A1.pdf (seeming to accept the D.C. Circuit's conclusion in *Comcast* and seeking comment "on whether the Commission should revisit and change its conclusion that section 706(a) is not an independent grant of authority").

47. Joint Brief for Verizon and MetroPCS at 17-18, Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014), 2012 WL 9937411.

48. *Id.* at 21.

49. *Verizon*, 740 F.3d at 636. Recall that the FCC had previously relied on Section 706(a) not as a stand-alone source of authority, but rather as a crutch for ancillary authority.

50. *Id.* In this last chapter of the ongoing dialogue between the FCC and the D.C. Circuit, the court notes the Commission's "palpable reluctance" to accept the D.C. Circuit's reading of the *Advanced Services Order, supra* note 30. *Id*. at 636; *see also supra* notes 30, 46. In fact, the court suggests that the Commission, in the *2010 Open Internet Order*, "inaccurately describes" its own previous interpretation of section 706 (as the court so characterized it in *Comcast*). *Verizon*, 740 F.3d at 637. The court forgives the Commission for its "pride," however, and concludes that the Commission's more recent conclusion regarding section 706 was "more logical" than its first one, *Verizon*, 740 F.3d at 637, and defers to its interpretation. *Infra* notes 51-55 and accompanying text.

51. *Verizon*, 740 F.3d at 637.

52. *Verizon*, 740 F.3d at 637-38. Interestingly, Judge Tatel wrote the opinion in both *Comcast* and *Verizon*, as well as *Cellco Partnership v. FCC*, 700 F.3d 534 (D.C. Cir. 2012), discussed *infra* notes 75, 78, 85 and accompanying text.

safe," to support such a reading:[53] "[I]t would be odd to characterize section 706 as a fail-safe that ensures the Commission's ability to promote advanced services if it conferred no actual authority."[54] And the court concluded that the revised interpretation of the statute is consistent with the Commission's lengthy history of regulating internet traffic.[55]

The court's decision in *Verizon* thus awarded the Commission an important victory by validating its jurisdictional approach.[56] Of course, as has been detailed elsewhere at length,[57] the court accepted Verizon's arguments that the rules are nevertheless void because they exceed the Commission's authority to regulate information service providers.[58] That is, the Commission attempted to issue rules tantamount to common carrier regulation without revisiting its classification decision. But that the court specifically addressed the FCC's jurisdictional argument signals the extent to which it holds the general authority to regulate internet traffic under section 706.

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53. S. REP. NO. 104-23, at 50-51 (1995); *see also Verizon*, 740 F.3d at 639 (citing Senate Report).

54. *Verizon*, 740 F.3d at 639 (quoting *Open Internet Order* at ¶ 120).

55. More specifically, the court found *FDA v. Brown & Williamson*, 529 U.S. 120 (2000), to be inapplicable. Unlike the FDA, which "had not only disclaimed any authority to regulate tobacco products, but had done so for more than eighty years, and Congress ha[d] repeatedly legislated against this background," the FCC had a lengthy history of regulating network data traffic. This history is noted in note 13, *supra*, and recounted in more detail in Narechania & Wu, *supra* note 13.

56. In addition to affirming the Commission's view of section 706(a), it is worth noting that the court also validated the Commission's reading of section 706(b). Section 706(b) provides the Commission with jurisdiction only conditionally: if the Commission finds that broadband is not "being deployed to all Americans in a reasonable and timely fashion," then the Commission must "take immediate action to accelerate [such] deployment." 47 U.S.C. § 1302(b) (2014).

In July 2010, after revising its definition of broadband from data transfer speeds of 200 kilobits per second (kbps) up to 4 megabits per second (mbps), the Commission—for the first time in over ten years of issuing such reports—concluded that the section 706(b) condition was not met. Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act, 25 FCC Rcd. 9556 (2010) (memorandum opinion and order). The "suspicious" timing of the Commission's conclusion notwithstanding, the D.C. Circuit concluded that the Commission's "new threshold" for broadband was "more appropriate to current consumer behavior and expectations." *Verizon*, 740 F.3d at 641-42. It therefore concluded that the Commission has reasonably interpreted section 706(b) to empower it to take steps to accelerate broadband deployment." *Id*. at 641.

57. *E.g.*, Gautham Nagesh, *Appeals Court Strikes Down FCC's Net Neutrality Rules*, WALL ST. J. (Jan 14, 2014), http://www.wsj.com/articles/SB10001424052702304049704579320500441593462; Edward Wyatt, *Rebuffing F.C.C. in 'Net Neutrality' Case, Court Allows Streaming Deals*, N.Y. TIMES (Jan 14, 2014), http://www.nytimes.com/2014/01/15/technology/appeals-court-rejects-fcc-rules-on-internet-service-providers.html.

58. *Verizon*, 740 F.3d at 649.

C. *Network Neutrality After Verizon*

The reaction to *Verizon* was swift. The White House almost immediately called on the FCC to begin a process to promulgate new network neutrality rules, and the FCC issued a Notice of Proposed Rulemaking within only a few months. Notably, the FCC's initial proposal focused primarily (though not exclusively) on the authority conferred by section 706. Ultimately, the FCC—at the urging of the Obama Administration[59]—revisited its 2002 classification decision and ruled that broadband service is a form of "telecommunications service" subject to common carrier regulation, thereby enabling the Commission to issue rules that were substantially similar to those that the D.C. Circuit struck down in *Verizon*.[60] In particular, the FCC issued rules that:

1. Prohibit broadband carriers from "block[ing] lawful content, applications, services, [and] non-harmful devices;"[61]
2. Prohibit broadband carriers from "impair[ing] or degrad[ing] lawful Internet traffic;"[62]
3. Prohibit broadband carriers from "favor[ing] some traffic" either "in exchange for consideration" or "to benefit an affiliated entity;" and that[63]
4. Require broadband carriers to "publicly disclose accurate information regarding the network management practices, performance, and commercial terms."[64]

II. A PATH NOT TAKEN: SECTION 706 (ALONE)

Although the Commission ultimately invoked the authority granted by Title II of the Communications Act to support its *2015 Open Internet Order*, that regulatory choice is hardly a comment on the breadth of the jurisdiction conferred by section 706 of the Telecommunication Act. The FCC itself suggested, in its 2014 Notice of Proposed Rulemaking, that the statute can support rules that secure many of the norms of network neutrality. Indeed, one measure of the breadth of the authority granted by section 706 is the extent to which it can support rules that overlap with those that the FCC ultimately approved. Stated simply: What can section 706, standing alone, not provide?

In *Verizon*, a majority of the court agreed that "openness [as understood in the *2010 Open Internet Order*] is integral to achieving the statutory objectives

59. *Net Neutrality*, THE WHITE HOUSE (Nov. 10, 2014), https://www.whitehouse.gov/net-neutrality.

60. *2015 Open Internet Order*, *supra* note 6.

61. 47 C.F.R. § 8.5 (2015)

62. 47 C.F.R. § 8.7 (2015)

63. 47 C.F.R. § 8.9 (2015)

64. 47 C.F.R. § 8.3 (2015)

set forth in section 706."[65] The majority was also persuaded that a broadband carrier's position as a "terminating monopolist," or as a "gatekeeper,"[66] accords it a unique ability to restrict internet traffic.[67] Altogether, the majority credited the "Commission's prediction that the *2010 Open Internet Order* regulations will encourage broadband deployment."[68]

If the *2010 Open Internet Order*'s rules are consistent with the statutory aims of section 706, but exceeded the limits on the FCC's ability to impose common carrier-style regulation on information services, what could the Commission have done? The decision to exercise its authority under Title II

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65. *Verizon*, 740 F.3d at 645. *But see Verizon*, 740 F.3d at 663 (Silberman, J., dissenting) (The Commission's reasoning is based on "sheer speculation" and not grounded in "logic and evidence.").

66. On this point, it is important to draw a distinction between a traditional bottleneck and a gatekeeper (a term that the dissent accused the majority of "largely invent[ing]." *Id.* at 663 (Silberman, J., dissenting). A true bottleneck arises when a monopolist controls the single point of entry, thereby controlling access to that facility, as well as other products and services that use the facility. Howard A. Shelanski, *Information, Innovation, and Competition Policy for the Internet*, 161 U. PA. L. REV. 1663, 1676 n.55 (2013) (citing STUART MINOR BENJAMIN ET AL., TELECOMMUNICATIONS LAW AND POLICY 942-43 (3d ed. 2012)). Gatekeeper, on the other hand, refers to an entity with control over an intermediate facility (like a point of entry) that is significantly important—potentially so much so as to affect the ability of upstream products and services to enter—but that may not be a monopolist. In most contexts, the term refers to an intermediate retailer with buying power. *See* Warren S. Grimes, *Buyer Power and Retail Gatekeeper Power: Protecting Competition and the Atomistic Seller*, 72 ANTITRUST L.J. 563, 578 n.45 (2005) (citing FED. TRADE COMM'N, WORKSHOP ON SLOTTING ALLOWANCES AND OTHER MARKETING PRACTICES IN THE GROCERY INDUSTRY 58 (2001), https://www.ftc.gov/sites/default/files/documents/reports/report-federal-trade-commission-workshop-slotting-allowances-and-other-marketing-practices-grocery/slottingallowancesreportfinal_0.pdf) The court (via the Commission), however, adopts a more flexible use of the term, using it to refer to a broadband provider's status as an intermediary between a consumer and an upstream seller that can "impose restrictions" on the upstream seller without having the consumer be "fully responsive" to the restriction. *Verizon*, 740 F.3d at 646-48; *see infra* note 117 (example of such incomplete responsiveness).

67. *Verizon*, 740 F.3d at 646 ("The Commission also convincingly detailed how broadband providers' position in the market gives them the economic power to restrict edge-provider traffic . . . ."). *But see Verizon*, 740 F.3d at 663-64 (Silberman, J., dissenting) ("[G]atekeeper[]" and "so-called terminating monopoly" are terms that have been "largely invented," and the Commission did not "establish the economic power [such a position] would supposedly afford all broadband providers against all edge providers."). Judge Silberman would require the Commission to show that broadband providers have market power. *Verizon*, 740 F.3d at 664 (Silberman, J., dissenting). Scholars have noted how the policies and regulations of broadband carriers have important implications for access to media. *See, e.g.*, Jack M. Balkin, *Media Access: A Question of Design*, 76 GEO. WASH. L. REV. 933, 942 (2008) ("Telecommunications regulation—and, in particular, the debate over open access and network neutrality—has important consequences for media access."); *see also* Jack M. Balkin, *Old School/New School Speech Regulation*, 127 HARV. L. REV. 2296 (2014).

68. *Verizon*, 740 F.3d at 644 (The Commission's predictions are "both rational and supported by substantial evidence.")

certainly seems to have provided the Commission with its most secure set of regulatory options. But if, in a counterfactual world, the Commission chose not to revisit the question of the proper classification of consumer broadband internet access, its authority under section 706 would have allowed it to promulgate a revised set of network neutrality-like protections. Most importantly, section 706, standing alone, enables the Commission to issue rules that capture the critical essence of its policies while focusing their application on the most competitively harmful conduct, sanctioning conduct that "favor[ed] some traffic . . . to benefit an affiliated entity" (but excluding conduct that favored traffic "in exchange for consideration"). The extensive overlap between the rules issued under Title II and the hypothetical rules described below suggests that section 706 endows the Commission with an impressive breadth of regulatory authority.

A. *Blocking, Transparency, and Throttling*

Ensuring that broadband providers do not block access to content and applications has been critical to every iteration of the Commission's network neutrality policies. The Policy Statement underlying the Commission's enforcement action in *Comcast* explicitly stated that consumer are "entitled" to "run applications," "use services," and "connect . . . devices" of their own choice.[69] The "no blocking" rule was easily the most forceful prohibition in the *2010 Open Internet Order*. And the rule remains a mainstay of the *2015 Open Internet Order*.

Although *Verizon* voided the Commission's rule against "block[ing] lawful content, applications, services, or non-harmful devices,"[70] the decision gave strong hints that section 706 nevertheless gave the Commission the authority to issue this rule under a modified legal theory. According to the court, the "no-blocking" provision, which prevented broadband providers from denying subscribers access to "lawful content, applications, services, or non-harmful devices" altogether,[71] "appear on their face to impose per se common carrier obligations" because they "requir[e] all [content] providers receive [a] minimum level of access for free."[72]

Despite the court's inclination towards this facile reading of the rule, it was persuaded by an argument raised at oral argument: What if the no-blocking rule merely established a baseline level of broadband service, but providers were free to "negotiate different levels [of service] with different people" over-and-above that baseline?[73] That is, the Commission was free to require that

69. *Internet Freedoms Policy Statement*, *supra* note 17.
70. *2010 Open Internet Order*, *supra* note 7, at ¶ 63.
71. *Id.*
72. *Verizon*, 740 F.3d at 658.
73. *Id.*

broadband providers offer content providers "access to their subscribers generally," so long as there was an opportunity to offer forms of premium service. But because the blocking and discrimination provisions operated in tandem, the rules amounted to an illegal "zero-price rule."[74] The blocking provision can stand, however, if severed from a blanket proscription on prioritized service.[75]

Because oral argument was the first time such an argument was raised, the court declined to uphold the rule by severing it from the rest of the *Order*.[76] But the court did explicitly state that a no-blocking rule that merely "establish[ed] a lower limit" of access would "not . . . run afoul of the statutory prohibitions on common carrier treatment."[77] So long as the rule against blocking was not coupled with a rule that proscribed all forms of discrimination, the Commission might have used a rule ensuring basic access to content to define the service that broadband carriers must offer.[78]

This rule, together with the disclosure and transparency rules that survived review in *Verizon*, would give rise to a set of regulatory protections that equal those of the proscriptions against blocking and throttling issued in the *2015 Open Internet Order*. By treating each of a broadband provider's commercial relationships in the two-sided market as distinct—the delivery service to content providers; and the access subscriptions to retail consumers[79]—the Commission might have required consumer access to *any* content to be, at minimum, consistent with the commercial terms of the service sold, including the expected performance of the service (e.g., download bandwidth of 4 mbps, 50 mbps, etc.).[80]

Stated simply, the Commission might strictly enforce the transparency

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74. *Id.*; *see also* C. Scott Hemphill, *Network Neutrality and the False Promise of Zero-Price Regulation*, 25 YALE J. ON REG. 135 (2008). I should emphasize that a zero-price rule is not *per se* illegal. Rather, it is only illegal to the extent that it imposes a common carrier rule on a service not subject to common carrier regulation. *See* 47 U.S.C. § 153(51) (2014).

75. *Cf.* Cellco P'ship v. FCC, 700 F.3d 534, 542-43 (D.C. Cir. 2013) ("Verizon argues that the data roaming rule [requiring that wireless carrier offer roaming service] exceeds the bounds of [FCC authority] because instead of merely prescribing the nature of a service, the rule mandates the provision of service. Not so. Like any other entity, Verizon may choose not to provide mobile-internet service. Like other rules that govern Title III services, the data roaming rule merely defines the form mobile-internet service must take for those who seek a license to offer it.").

76. *Verizon*, 740 F.3d at 658-59 ("We are unable to sustain the Commission's action on a ground upon which the agency itself never relied.").

77. *Id.* at 658.

78. *Cellco*, 700 F.3d at 542-43.

79. *Verizon*, 740 F.3d at 652-54 ("It is true, generally speaking, that the 'customers' of broadband providers are end users. But that hardly means that broadband providers could not also be carriers with respect to edge providers."); Verizon Reply Brief, *Verizon*, 740 F.3d 623 (D.C. Cir. 2013) (Nos. 11-1355), 2013 WL 210111, at *6-8; *see also* Narechania & Wu, *supra* note 13 (explaining two distinct commercial relationships).

80. 47 C.F.R. 8.3; *see also 2015 Open Internet Order*, *supra* note 6; *2010 Open Internet Order*, *supra* note 7.

obligations that inhere to the sale of retail consumer broadband subscriptions. Where a provider sells a broadband package offering speeds of "15 mbps," the Commission could have simply clarified that 15 mbps[81] sets the floor for any and all content that a subscriber wishes to access.[82] The transparency rule, then, would give teeth to a revised minimum service requirement, and replicates the functions served by the blocking and throttling proscriptions that the Commission issued in the *2015 Open Internet Order*.

To be sure, a rule that relies on section 706 alone carries certain complications. First, and most importantly, the minimum service standard could not be set by administrative fiat. The Supreme Court has explicitly noted that a service provider is transformed into common carrier when an access rule transfers control over the use of the facility from its owner—in this case, the broadband carrier—to the content provider.[83] Enforcing these minimum standards through the agreements between the retail subscriber and broadband provider would ensure that this control is never divested from the facility owner. To the contrary, it is controlled by the broadband carrier that chooses what types of retail subscriptions to offer consumers.

Similarly, the D.C. Circuit in *Verizon* drew a distinction between offering content providers "access to . . . subscribers generally" and between offering "access to . . . subscribers at the minimum speed necessary to satisfy the anti-blocking rules."[84] But the Commission would not need to stipulate a minimum speed for the particular transaction between content providers and broadband providers. Rather, it would only have to require *both* that content providers have access to broadband subscribers generally *and* that broadband providers honor their consumer agreements to provide consumer service at specified speeds. Altogether, these hypothetical rules would not "mandate[] the provision of service;" instead, the rule would merely "define the form" of each service that is offered *if* it is offered.[85] Facilities owners would remain free to decline to sell broadband subscriptions at all, but would be unable to violate their commitments regarding service quality if they chose to enter the market. And they would have to offer content providers access to those subscribers. But severing these two separate (but related) requirements from a blanket nondiscrimination rule would ensure that providers can offer "individualized" services to both subscribers and content providers.[86]

Tacitly enforcing the minimum service standard for content providers through to a broadband provider's agreement with a retail subscriber would have several additional practical benefits. Such a minimum standard would

81. Fifteen mbps using best efforts under industry standards.

82. *Verizon*, 740 F.3d at 658.

83. FCC v. Midwest Video Corp. (*Midwest Video II*), 440 U.S. 689, 700-02 (1979).

84. *Verizon*, 740 F.3d at 652.

85. Cellco P'ship v. FCC, 700 F.3d 534, 542-43 (D.C. Cir. 2013).

86. *Midwest Video II*, 440 U.S. at 700-02; *Verizon*, 740 F.3d at 658; *Cellco*, 700 F.3d at 542.

allow service benchmarks to evolve naturally over time, in response to consumer demand and new technology, and without the need for affirmative regulatory intervention. And this regulatory approach would also ensure that each standard is responsive to the particular physical capabilities and engineering limitations of a particular network, thereby allowing for differentiation across providers. Furthermore, a hypothetical combination of the transparency rule and a minimum service standard could leverage the Commission's substantial broadband measurement infrastructure for enforcement purposes.[87]

Viewed together, tying a minimum service standard to the promised performance of a retail broadband subscription would allow a provider to define its own commercial offerings while protecting against the risk that providers will be tempted to degrade consumer experiences. That is, the combination of the minimum service and transparency rules that can be sustained by section 706 alone would ensure that broadband carriers do not block or throttle consumer access to lawful content.

B. *Anticompetitive Discrimination*

Importantly, the court in *Verizon* seemed amenable to such a proscription against blocking and throttling only to the extent that it was severed from a universal anti-discrimination rule. But section 706 alone gives the Commission the ability to craft a slightly circumscribed rule against discrimination, even when paired with a minimum service standard.

The *2010 Open Internet Order*'s anti-discrimination rule required that providers "not unreasonably discriminate in transmitting lawful network traffic."[88] In particular, that order announced *ex ante* that any "pay-for-priority" arrangement would be "significant cause for concern."[89] Weighing this arrangement against Supreme Court precedent defining the nature of common carrier regulations,[90] the *Verizon* court ruled that the provision "compels [broadband] providers to hold themselves out to 'serve the public indiscriminately'"[91] by forcing them to "carry the content th[at] edge providers

87. *See A Report on Consumer Wireline Broadband Performance in the U.S.*, FCC (2014), http://www.fcc.gov/reports/measuring-broadband-america-2014; *see also Measuring Mobile Broadband*, FCC (Sept. 29, 2014), http://www.fcc.gov/measuring-broadband-america/mobile (noting similar program for mobile program); *Technical Appendix*, *2014 Measuring Broadband America Report*, FCC (2014), http://www.fcc.gov/measuring-broadband-america/2013/February (noting that test results from a sample of nearly 6,000 broadband subscribers was used for the 2014 report).

88. *2010 Open Internet Order*, *supra* note 7, at ¶ 68.

89. *Id.* at ¶ 76.

90. *Verizon*, 740 F.3d at 651-55 (analyzing *United States v. Midwest Video* (*Midwest Video I*), 406 U.S. 649 (1972) and *Midwest Video II*, 440 U.S. 689.

91. *Verizon*, 740 F.3d at 656.

desire to transmit."[92] Thus, it violated the proscription on treating information service providers as common carriers.[93]

The court was especially concerned that the caution against "pay-for-priority" transactions eviscerated any space required for the sort of "individualized bargaining" that was the hallmark of private carrier service.[94] Critically, the court could find no way to differentiate "the Open Internet Order's 'no *unreasonable* discrimination' standard . . . from the nondiscrimination standard applied to common carriers generally."[95] After excluding prioritized service from the scope of reasonableness, the Court found practically nothing left, and certainly not enough to uphold the rule.

The challenge, under section 706, is to craft a rule against discrimination that would leave adequate room for "individualized bargaining" so as to fall short of the common carrier standard of nondiscrimination, while still ensuring robust competition among network applications.[96] Once again, the opinion in *Verizon* might be read to hint at the scope of a permissible rule. Section 706 provides the Commission with the authority to prevent specific forms of discrimination that bring about a discrete competitive harm.[97] That is, rather than proscribe all forms of discrimination, the Commission could have used its section 706 authority to prevent anticompetitive discrimination. Most notably, the Commission would have wide flexibility to define the nature of anticompetitive conduct under this hypothetical standard.

Citing to the *2010 Open Internet Order*, the D.C. Circuit identified at least three cases in which broadband carriers "utilize[d] their gatekeeper ability to restrict edge-provider traffic:" "[1] a mobile broadband provider blocking online payment services after entering into a contract with a competing service; [2] a mobile broadband provider restricting the availability of competing [voice-over-IP (VoIP)] and streaming applications; [and 3] a fixed broadband provider blocking VoIP applications . . . ."[98] In each of these examples, the broadband carrier's actions were directed at a competitor of an adjacent service:[99] The provider sought to restrict an independent application that

92. *Verizon*, 740 F.3d at 655 (citing *Midwest Video II*, 440 U.S. at 700).

93. 47 U.S.C. § 153(51) (2014) ("A telecommunications carrier shall be treated as a common carrier under this chapter only to the extent that it is engaged in providing telecommunications services . . . .").

94. *Verizon*, 740 F.3d at 657 (citing Cellco P'ship v. FCC, 700 F.3d 534, 548 (D.C. Cir. 2012)).

95. *Id*. at 656.

96. *E.g.*, Wu, *Network Neutrality*, *supra* note 1 (The "interest [that] animates the promotion of network neutrality [is] preserving a Darwinian competition among every conceivable use of the Internet so that the only the best survive.").

97. 47 U.S.C. § 1302(a) (2014) (Commission must "promote competition in the local telecommunications market."); 47 U.S.C. § 1302(b) (2014) (Commission can "promot[e] competition in the telecommunications market.").

98. *Verizon*, 740 F.3d at 648 (D.C. Cir. 2013).

99. The first and second examples explicitly refer to competitors. The court's

competed directly with an affiliated service.[100] Further examples of such "network nepotism"[101] have since proliferated.[102]

Such conduct echoes in antitrust cases like *United States v. Microsoft*, where Microsoft leveraged its dominance over a desktop platform, Windows, to restrict competitors to its own Internet Explorer, such as Netscape Navigator.[103] And they resemble other non-common-carrier regulatory

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description of the third example contains a missing detail: the broadband provider at issue was a subsidiary of a traditional telephone company. *2010 Open Internet Order*, *supra* note 7, at ¶ 35 (citing Madison River Commc'ns, LLC, 20 FCC Rcd. 4295 (2005) (consent decree)), and so the VoIP offering is best seen as competing with the parent corporation's traditional telephony product.

100. These examples highlight an often overlooked dichotomy in open internet proposals. *See* Hemphill, *supra* note 74, at 146-50 (drawing distinction between (1) extraction, which functions as a toll on content providers, and (2) exclusion, which "favor[s] rival content in which the access provider has an economic interest").

101. Tejas N. Narechania, *Network Nepotism and the Market for Content Delivery*, 6 STAN. L. REV. ONLINE 27 (2014).

102. The most high-profile example involves Verizon's blocking of so-called "tethering applications" (applications that allow a user to use her phone's wireless data connection on another device). Cellco P'ship, 27 FCC Rcd. 8932 (2012) (order & consent decree) ("Verizon Wireless asked an Application Store Operator to filter from its Application Store eleven tethering Applications that customers could use to tether without paying Verizon Wireless's monthly tethering fee."). Another example involves allegations that AT&T's restrictions (that have since been lifted) on the use of Apple's FaceTime application unduly favored its own voice and video products. Press Release, Free Press, Free Press Concerned About AT&T Plan to Charge for FaceTime (July 17, 2012), http://www.freepress.net/press-release/98878/free-press-concerned-about-att%E2%80%99s-plan-charge-facetime (expressing concern at plan to restrict competing voice and video application). Another example suggests that the mobile carriers that have entered into a joint venture named ISIS to build a mobile payment application (e.g., store and use credit cards directly from a cell phone) and are now blocking competitors to ISIS. *E.g.*, Karl Bode, *It's Clear Verizon Is Blocking Google Wallet Anti-Competitively*, DSLREPORTS (Dec. 21, 2012), http://www.dslreports.com/shownews/Its-Clear-Verizon-Is-Blocking-Google-Wallet-AntiCompetitively-122513. There are also other similar examples. *See, e.g.*, *infra* note 109.

103. United States v. Microsoft Corp., 253 F.3d 34, 64-65, 96-97 (D.C. Cir. 2001). To be sure, the precise nature of the conduct in *Microsoft* differs from the conduct described in the *Open Internet Order*, as the Order does appear to consider broadband providers' actions as driven to exclude potential *future* competitors (whereas Microsoft treated Navigator as a competitor not only to Internet Explorer but also as a future competitor to Windows). *But cf*. Drew Fitzgerald & Daisuke Wakabayashi, *Apple Quietly Builds New Networks*, WALL ST. J. (Feb. 3, 2014), http://www.wsj.com/articles/SB10001424052702304851104579361201655365302 (suggesting that content providers are beginning to dive down into facilities markets, and thereby compete with existing facilities owners). Nevertheless, in *Microsoft* as well as the examples cited in the Order, culpability (to the extent it exists) flows from actions taken to exclude an unaffiliated, platform-agnostic platform user by the platform owner. Whether and when a platform owner's action to exclude unaffiliated complements is efficient continues to be the subject of debate in the antitrust literature. *See, e.g.*, Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 133-34 (2003). Regardless of the standard in antitrust, communications regulations has staked out a position on the merits of such exclusionary behavior. The CTCPCA, for example, *requires* that the

programs at the FCC, including the Commission's program carriage rules.

The program carriage regime was promulgated according to the Commission's authority under the Cable Television Consumer Protection and Competition Act of 1992 (CTCPCA), which required that the FCC issue rules to prevent a cable TV operator (for example) "from engaging in conduct the effect of which is to unreasonably restrain the ability of an unaffiliated video programming vendor to compete fairly by discriminating in video programming distribution *on the basis of affiliation* or nonaffiliation."[104] In other words, the rules are designed to prevent a company like Comcast, for example, from unfairly restraining an independent TV channel from competing with a Comcast-owned channel in the markets for viewership and advertising revenue.[105] With regard to these rules, the Second Circuit noted that where "cable operators maintain significant shares [and] vertical integration remains pervasive . . . . the FCC could reasonably conclude that cable operators continue to 'have the incentive and ability to favor their affiliated programming vendors in individual cases, with the potential to unreasonably restrain the ability of an unaffiliated programming vendor to compete fairly."[106]

FCC investigate some forms of such exclusion in the cable television context. *Infra* note 104. This position is grounded in the theory that the "gatekeeper" power of a broadband carrier means that exclusionary behavior is both likely and likely to be harmful. *See* Philip J. Weiser, *Toward a Next Generation Regulatory Strategy*, 35 LOY.-CHI. L.J. 41 (2003) [hereinafter Weiser, *Next Generation*]; Wu, *Network Neutrality*, *supra* note 1; *supra* note 66 (explaining gatekeeper); *infra* notes 115-119 and accompanying text (explaining competitive harms). Furthermore, given the Commission's theory that robust competition in the market for content is the best way to drive growth in infrastructure, section 706 would seem to allow the Commission to target exclusionary conduct in the application layer in service of that regulatory goal. *See infra* notes 124-129 and accompanying text; *see also* Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 649 (D.C. Cir. 2014).

104. 47 U.S.C. § 536(a)(3) (2014). The Commission's rule implementing the statute, 47 C.F.R. § 76.1301 (2014), hews closely to the statute's language.

105. Comcast Corp.v. FCC, 717 F.3d 982, 983 (D.C. Cir. 2013).

106. Time Warner Cable Inc. v. FCC, 729 F.3d 137, 162 (2d Cir. 2013). The threat of foreclosure by cable TV operators is not merely theoretical. *See, e.g.*, Tasneem Chipty, *Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry*, 91 AM. ECON. REV. 428, 429 (2001) (surveying market evidence and finding empirically that integration does result in some degree of market foreclosure). Operators who own premium services offer, on average, one fewer premium service and one to two fewer basic services than do other operators. In particular, operators who own premium movie services are less likely to carry the rival basic movie service, American Movie Classics (AMC). In addition, TCI and Comcast, two operators who own the basic shopping service QVC, are less likely to carry rival shopping service Home Shopping Network (HSN), and they are less likely to carry both QVC and HSN. These results are statistically significant and establish that premium operators and certain basic operators are less likely to carry rival services. *See also* AUSTAN GOOLSBEE, VERTICAL INTEGRATION AND THE MARKET FOR BROADCAST AND CABLE TELEVISION PROGRAMMING 31 (2007), http://fjallfoss.fcc.gov/edocs_public/attachmatch/DA-07-3470A10.pdf ("[V]ertically integrated cable systems are more likely to carry their own channels except in places where there is sufficient competition . . . .").

More recent anecdotal evidence extends these findings. *See* Reply Comments of

Broadband carriers, like cable TV operators, similarly dominate local markets.[107] These carriers also offer a variety of vertically-integrated packages: In addition to broadband, they sell television, voice, and home security services—among other offerings. Each of these services is typically provisioned over the same infrastructure as the one used by competing independent services. Services like Aereo, as well as Netflix and Amazon Video, all compete with traditional linear television service.[108]

Section 706 gives the Commission the authority to issue rules that sanctions conduct favoring Comcast's (for example) own applications at the expense of these competitors.[109] Indeed, the D.C. Circuit expressly identified such conduct as a "limit" to openness that could depress demand for—and the concomitant deployment of—broadband.[110]

The Commission would have wide discretion to define the nature of "anticompetitive" conduct under such a hypothetical rule.[111] In particular, the

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Google Fiber, Inc., Revision of the Commission's Program Access Rules, MB Docket No. 12-68 (Fed. Commc'ns. Comm'n Jan 14, 2013) ("[T]he incumbent cable operator, [Time Warner Cable], is leveraging its control over a local [regional sports network, Metro Sports] to impede Google Fiber's entry into the marketplace.").

107. FCC, WIRELINE COMPETITION BUREAU, INTERNET ACCESS SERVICES: STATUS AS OF JUNE 30, 2011, at 8 fig.3(a), http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0614/DOC-314630A1.pdf (Nearly two-thirds of U.S. households have, at most, a choice of two providers offering broadband internet connections (at the minimum data transfer speed defined by the FCC)).

108. *Cf.* Promoting Innovation and Competition in the Provision of Multichannel Video Programming Distribution Services, 80 Fed. Reg. 2078 (FCC Jan. 15, 2015) (proposed rule).

109. *E.g.*, Thomas Catan & Amy Schatz, *U.S. Probes Cable for Limits on Net Video*, WALL ST. J. (June 13, 2012), http://online.wsj.com/news/articles/SB10001424052702303444204577462951166384624 (noting Department of Justice antitrust probe into potentially anticompetitive preferences for affiliated content at the expense of competitors).

110. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 649 (D.C. Cir. 2013); *see also id.* (explaining Commission's theory regarding relationship between content demand and broadband deployment); *infra* notes 124-129 and accompanying text (addressing argument that driving content demand might actually depress deployment).

111. In the program carriage context, at least one appellate judge has suggested that the CTCPCA requires that the FCC adopt the standards of antitrust law, and in particular, would require that FCC prove that the platform provider possesses market power. This is based on the view that the statute incorporates an antitrust "term of art," and so the canons of construction demand the application of antitrust scrutiny. Comcast Corp. v. FCC, 717 F.3d 982, 989-90 (D.C. Cir. 2013) (Kavanaugh, J., concurring). Of course, every canon has an "equal opposite." Landgraf v. USI Film Prods., 511 U.S. 244, 263-64 (1994) (citing Karl Llewellyn, *Remarks on the Theory of Appellate Decision and the Rules or Canons About How Statutes Are To Be Construed*, 3 VAND. L. REV. 395 (1950)). In this case, it is "one of the most basic interpretative canons, that a statute should be construed so that effect is given to all its provisions, so that no part will be inoperative or superfluous, void or insignificant." Friends of Blackwater v. Salazar, 691 F.3d 428, 447 (D.C. Cir. 2012) (quoting Corley v. United States, 556 U.S 303, 314 (2009)) (alterations and quotation marks omitted). But applying strict antitrust standards here might have the effect of rendering the statute superfluous to the antitrust laws themselves. *Cf.* Verizon Commc'ns Inc. v. Law Office of Curtis V. Trinko, 540 U.S. 398, 411 (preexisting regulatory structure "makes it unnecessary

Commission could use a provider's status as a "gatekeeper" as evidence of sufficient "economic clout to restrict edge-provider traffic."[112] Given this indicia of economic power, the Commission could, under section 706 alone, proscribe any conduct that disadvantages unaffiliated competitors to a provider's own content, and would be free to challenge and terminate conduct that is based on affiliation. That is, the FCC could apply a standard similar to[113] the one applicable in the program carriage context—and consistent with the *2015 Open Internet Order* proscribing conduct "favor[ing] some traffic . . . to benefit an affiliated entity"—without recourse to Title II. Regulation targeted at conduct by facilities owners to disadvantage competitors to its vertically affiliated content preserves the critical network neutrality goal of ensuring robust competition among network applications, and is consistent with the Commission's long-held regulatory aims in the computing and networking industries.[114]

This standard for targeting discriminatory conduct under a section 706 regime has several discrete benefits. Relying on a provider's status as a gatekeeper would account for the substantial economic power wielded by last-mile service providers against upstream content providers while easing

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to impose a judicial doctrine" under the antitrust laws).

In all, requiring antitrust scrutiny here also takes an overly restrictive view of the FCC's authority under the CTCPCA. The House Report accompanying Section 616 of the CTCPCA states that the statute "*provides new FCC remedies* and does not amend, and is not intended to amend, existing antitrust laws." H.R. REP. No. 102-628, at 111 (1992) (emphasis added); *cf.* McLean Trucking Co. v. United States, 321 U.S. 67, 85-87 (1944) (ICC had responsibility to consider the effect of motor carriers mergers on transportation policy, but need "not to measure proposals for all-rail or all-motor consolidations by the standards of the anti-trust laws."); Nat'l Broad. Co. v. United States, 319 U.S. 190, 223-24 (1943) ("While many of the network practices raise serious questions under the antitrust laws, ... [i]t is not [the FCC's] function to apply the antitrust laws as such."); Goldwasser v. Ameritech Corp., 222 F.3d 390, 399 (7th Cir. 2000) ("The fundamental fallacy in the plaintiffs' theory is that the duties the 1996 Act imposes on ILECs are coterminous with the duty of a monopolist to refrain from exclusionary practices. They are not.").

But even if one adheres to the view that the program carriage rules must be applied according to the standards of antitrust because the language of the CTCPCA demands it, the Commission faces no such statutory command in section 706(a). There is no antitrust term of art in that statute.

112. *Verizon*, 740 F.3d at 646-49; *supra* note 66 (explaining gatekeeper).

113. *But see supra* note 111 (need not apply standards of antitrust law).

114. Regulatory & Policy Problems Presented by the Interdependence of Computer & Commc'ns Serv's & Facilities, 28 F.C.C. 2d 267, ¶ 10 (1971) (final decision & order) (maintaining decision reached in its tentative decision. See 28 F.C.C.2d at ¶¶ 33, 36 (describing Commission goal to prevent carriers from "favor[ing] their own data processing activities by discriminatory services, cross subsidization, [and] improper pricing")); *see also* Narechania & Wu, *supra* note 13; Wu, *Network Neutrality*, *supra* note 1, ("Government regulation . . . invariably tries to help ensure that the short-term interests of the owner do not prevent the best products or applications becoming available to end-users. The same interest animates the promotion of network neutrality: preserving a Darwinian competition among every conceivable use of the Internet so that the only the best survive.")

administrability concerns. The possibility for intermodal competition—competition between cable, telephone, and fiber providers—might be seen as inconsistent with the existence of a true "bottleneck." But two-thirds of U.S. households have, at most, two options for broadband.[115] And even where consumers are served by duopoly or oligopoly, providers can engage in "abusive exercises" of their gatekeeper power.[116] In particular, so long as switching costs (among other costs) remain high, broadband providers retain the ability to discriminate against unaffiliated content—even including content that consumers strongly prefer:[117] A "broadband providers' ability to impose restrictions on edge providers simply depends on end users not being fully responsive to the imposition of such restrictions."[118] Altogether, a provider's status as a gatekeeper endows it with the potential to "obstruct others in competitive sectors, with an eye to gaining for themselves a large enough market share" in those adjacent markets, thereby making it an ideal candidate for regulatory intervention.[119]

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115. FCC, WIRELINE COMPETITION BUREAU, INTERNET ACCESS SERVICES: STATUS AS OF JUNE 30, 2011, at 8 fig.3(a), http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0614/DOC-314630A1.pdf.

116. Weiser, *Next Generation*, *supra* note 103, at 73 ("[T]here are instances in which a platform provider may use its gatekeeping role to 'hold up' the deployment of applications, thereby giving itself an additional source of revenue and deterring future innovation."); *cf.* Grimes, *supra* note 66, at 563-64 ("Abusive exercises of retailers' gatekeeper power can occur even if a retailer has a market share of 10 percent or less . . . .").

117. *See Verizon*, 740 F.3d at 663 n.7 (Silberman, J., concurring in part and dissenting in part) ("[A] consumers' willingness to switch to another available supplier depends on the prospective benefit measured against the transactions costs."). *Cf.* Shelanski, *supra* note 66, at 1682-84. This might be seen as generating a perverse incentive to raise switching costs, in order to raise the "prospective benefits" that any competitor would have to offer to justify the switch. Furthermore, such an analysis aggregates benefits of different forms to a consumer, without regard to the varying harms to an upstream supplier. Consider, for example, a slight incremental consumer preference for Gmail over a locally-provisioned [provider].net email address. If Gmail is blocked altogether (or slowed considerably), the user might switch to the bundled email service. This generates revenue for the broadband provider, diminishes a consumer's return by an amount not substantial enough to justify the switch, and imposes substantial aggregate losses on Google. *Verizon*, 740 F.3d at 648 ("[B]roadband providers' ability to impose [such] restrictions . . . simply depends on end users not being fully responsive to the imposition of such restrictions.").

118. *Id.* at 648.

119. This is especially true if we treat gatekeeper power as analogous to bottleneck power. Stephen G. Breyer, *Antitrust, Deregulation, and the Newly Liberated Marketplace*, 75 CALIF. L. REV. 1005, 1042-43 (1987) (Telecommunications bottlenecks "seem more amenable to regulatory control" than antitrust scrutiny because an agency can "supervise" their pricing behavior and "scrutiniz[e] their conduct to ensure that they do not take unfair advantage" of that power.); *see also* Brett M. Frischmann & Barbara van Schewick, *Network Neutrality and the Economics of an Information Superhighway: A Reply to Professor Yoo*, 47 JURIMETRICS 383, 415-16 (2007) ("[D]iscrimination will be a profitable strategy so long as it results in a higher number of sales of the complementary product."); Weiser, *Next Generation*, *supra* note 103, at 73, 74-78 (proposing an "antitrust-like" burden shifting framework for FCC regulation). *But see* Howard A. Shelanski, *Justice Breyer, Professor Kahn, and Antitrust Enforcement in Regulated Industries*, 100 CALIF. L. REV. 487 (2012)

Adopting this regulatory presumption would also ease administrative costs. Compared with the alternative of antitrust litigation, a regulatory presumption that affiliation-based discrimination by a gatekeeper has anticompetitive effects—a presumption that is consistent with both theory[120] and observed effects[121]—obviates the need to engage in lengthy, complicated, and expensive antitrust litigation that may not even bear fruit,[122] focusing instead in each violation of the hypothetical rule on the specific question of discrimination on the basis of affiliation.[123]

("The conclusions of Breyer's CLR article [that regulation is preferable to antitrust for bottlenecks] are subject to debate.").

120. *Supra* notes 115-119 and accompanying text; *see also, e.g.*, Barbara van Schewick, *Towards an Economic Framework for Network Neutrality Regulation*, 5 J. TELECOMM. & HIGH TECH. L. 329, 378 (2007) ("[I]t will often be profitable to exclude only those complementary products that directly compete with one of its own complementary products."); Weiser, *Next Generation*, *supra* note 103, at 73 ("[A] platform provider may use its gatekeeping role to 'hold up' the deployment of applications, thereby giving itself an additional source of revenue and deterring future innovation."); Wu, *Network Neutrality*, *supra* note 1.

121. *Supra* notes 98-102 and accompanying text; *see also Verizon*, 740 F.3d at 648 (gatekeeper effects not just "merely theoretical").

122. Indeed, several enforcement authorities and scholars have questioned the ability of the antitrust laws to reach this type of exclusionary conduct. *E.g.*, J. Thomas Rosch, Former Comm'r, FTC, Broadband Policy Summit IV: Navigating the Digital Revolution: Broadband Access Policy: The Role of Antitrust (June 13, 2008), https://www.ftc.gov/sites/default/files/documents/public_statements/broadband-access-policy-role-antitrust/080613broadbandaccess.pdf ("I doubt that antitrust can address many, if any, of the problems cited by network neutrality proponents."); J. Thomas Rosch, Former Comm'r, FTC, Some Reflections on the Future of the Internet: Net Neutrality, Online Behavioral Advertising, and Health Information Technology, Remarks for the U.S. Chamber of Commerce Telecommunications & Ecommerce Committee Fall Meeting (Oct. 26, 2009), https://www.ftc.gov/sites/default/files/documents/public_statements/some-reflections-future-internet-net-neutrality-online-behavioral-advertising-and-health-information/091026chamber.pdf; *see also* FED. TRADE COMM'N, BROADBAND CONNECTIVITY COMPETITION POLICY (June 2007) (concurring statement of Jon Leibowitz, Comm'r) ("[T]here is little chance that antitrust would prevent such a scheme [as the one in *Madison River* case, described *supra* note 99] except after a "rule of reason" analysis, which—at least in these types of cases—is likely to be drawn out, uncertain and expensive."); *cf.* Hemphill, *supra* note 74, at 157-60 (arguing that antitrust law would likely apply, but allowing for the possibility that those arguments may not "convince a court"). *But see* Joshua D. Wright, Comm'r, FTC, Remarks at the Information Economy Project's Conference on U.S. Broadband Markets: Broadband Policy and Consumer Welfare: The Case for an Antitrust Approach to Net Neutrality Issues (Apr. 19, 2013), https://www.ftc.gov/sites/default/files/documents/public_statements/broadband-policy-consumer-welfare-case-antitrust-approach-net-neutrality-issues/130423wright_nn_posting_final.pdf ("[A]ntitrust is particularly well suited for addressing the concerns raised in the longstanding debate surrounding net neutrality . . . .").

123. Hemphill, *supra* note 74, at 159; Weiser, *Next Generation*, *supra* note 103, at 73, 78 (under proposed framework, requiring that a party alleging violation provide a "provide a reasonably plausible theory" for the "purportedly anticompetitive conduct"); *cf.* Comcast Corp. v. FCC, 717 F.3d 982 (D.C. Cir. 2013) ("[T]he Commission has not provided evidence that Comcast discriminated against Tennis [Channel] on the basis of affiliation," under the

Furthermore, such a rule would be specifically directed at section 706's specific aim to "encourage the deployment" of broadband. Since *Comcast* and through *Verizon*, the Commission has repeatedly argued a robust and competitive content market will drive broadband deployment, and has thereby justified a rule that both protects competition in that market and subsidizes content creation.[124] Critics have noted that the subsidy for content comes by way of the facilities provider's inability to charge for carriage, and have questioned whether a rule that keeps money out of the hands of facilities providers can be squared with section 706's goal of spurring investment in broadband infrastructure.[125] The D.C. Circuit has been willing to defer to the Commission's judgment on this issue,[126] and under the narrower rule against anticompetitive discrimination hypothesized here,[127] these critiques have even less force. Given the option to impose a rule focusing on anticompetitive conduct, the relevant inquiry is whether new infrastructure deployment would be more likely through the investment of additional capital earned anticompetitively, or by growth in demand for broadband spurred by competitively priced content. The choice has no clearly superior alternative, and depends on the Commission's reasonable judgment about the tradeoff.[128] If the courts have been willing to defer to the Commission's judgment that earlier

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CTCPCA.).

124. For example, Frischmann & van Schewick, *supra* note 119, at 404-05, argue in favor of the subsidy ("[N]ondiscrimination is a rather blunt broad subsidy for users (uses) that produce positive externalities and it is justified in part by the difficulty in directing targeted subsidies to those user-producers."), and argue that the rule protects competition at 409 ("Calls for network neutrality regulation are based in part on the concern that, in the absence of such regulation, network providers will discriminate against unaffiliated providers of complementary products or exclude them from their network."). *See also* Robin S. Lee & Tim Wu, *Subsidizing Creativity Through Network Design: Zero-Pricing and Net Neutrality*, 23 J. ECON. PERSP. 61 (2009).

125. Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847, 1902-03 (2006).

126. *Verizon*, 740 F.3d at 644-45.

127. Proponents of the Commission's earlier rule will note that the narrower rule proposed here loses the subsidy for content creation. Two points bear mentioning. First, D.C. Circuit clearly held that the aspects of the rule that provided for the subsidy—a strict prohibition on blocking, coupled with a universal non-discrimination regime—are outside of the Commission's authority to regulate information service providers. *Verizon*, 740 F.3d at 657-58. Second, viewed from the perspective of section 706, a prohibition on only anticompetitive conduct seems more narrowly tailored to the Commission's statutory authority to encourage new infrastructure investment. While the content subsidy has other positive effects—effects that may even justify the imposition of such a rule—the argument that this broad rule leads directly to further broadband deployment may seem tenuous when compared to the argument that the narrower rule does so. *Cf*. Hemphill, *supra* note 74, at 160.

128. *Cf*. Nicholas Economides & Benjamin E. Hermalin, *The Strategic Use of Download Limits by a Monopoly Platform*, 46 RAND J. ECON. 297 (2015) (finding that monopoly platforms have incentives to set download limits lower than would be welfare maximizing, that setting limits increases incentives to invest broadband infrastructure, but deferring on analysis when the monopoly platform provider is also a content provider).

iterations of the rule are consistent with the aims of section 706, then a rule targeting only anticompetitive conduct would also surely be within its authority.[129]

Finally, this standard is analogous to existing non-common-carrier regulatory programs, including the CTCPCA,[130] and is thereby consistent with the Commission's authority to use "other regulating methods" in service of the statutory aims of section 706.

Thus, section 706, standing alone, enables the Commission to sanction conduct that favors affiliated content providers at the expense of competitors. Notably, this standard encompasses a significant portion of the FCC's 2015 rule against paid prioritization. Relying on Title II, the FCC proscribed conduct that prioritizes internet traffic on the basis of payment or on the basis of affiliation.

Altogether, section 706, standing alone, confers the authority to issue rules that are largely—but not completely—coterminous with the rules the Commission in fact promulgated under its Title II authority to regulate common carriers. *Table 1* suggests that the only rule that section 706 cannot support—and the rule that proved to be critical in *Verizon*—is a general total proscription against prioritizing content in exchange for payment or other consideration.[131] But beyond this limitation, section 706 could support rules against blocking, throttling, and prioritization on the basis of affiliation.

Table 1.

Conduct Rule	**Issued Under Title II**	**Supported by 706 Alone**
Mandated Transparency	**x**	**x**
No Blocking	**x**	**x**
No Throttling	**x**	**x**
No Prioritization		
on the basis of payment	**x**	
on the basis of affiliation	**x**	**x**

129. Even taking a narrow view of when vertical integration is anticompetitive, the Commission seems able to choose a slightly over-inclusive prophylactic rule, such the one proposed here, so long as the effect of the rule does not amount to common carrier regulation.

130. 47 U.S.C. § 522(7)(C) (2014); *Midwest Video II*, 440 U.S. 689, 708-709 (1979) ("The Commission may not regulate cable systems as common carriers . . . .").

131. Furthermore, the Commission has indicated that might be amenable to waiving this rule for certain arrangements, such as for zero-rating certain classes of applications. *2015 Open Internet Order*, *supra* note 6, at ¶¶ 151-53. Taking these exceptions into account, the space between the rule the FCC in fact issued under Title II, and the rules the section 706 could hypothetically support, narrows even further.

C. *Interconnection*

The *2010 Open Internet Order* focused on preserving the norm of non-discrimination over the "access network" that connects an individual broadband subscriber to the rest of the internet,[132] But this particular focus set aside issues related to the interchange of traffic *between* the various networks that comprise the Internet,[133] as the Commission expressly excepted "existing arrangements for network interconnection, including existing paid peering arrangements"[134] from the scope of those rules. The Commission's *2015 Open Internet Order*, however, bridges this gap by applying a general conduct standard to network interconnection.[135] While the Commission's rule relies on section 201 (a Title II provision) to support this rule, section 706 also provides similar authority.

Interconnection disputes in the form of disagreements over "peering" arrangements have become increasingly common.[136] In 2010, for example, a backbone provider, Level 3, was hired by a content provider, Netflix, to deliver video traffic to customers at various locations. Stated simply, Netflix would arrange to deliver bits to Level 3,[137] and would pay Level 3 to carry them the rest of the way. In this example, the identity of the content provider is critical: Netflix is responsible for roughly one-third of *all* downstream (*i.e.*, sent *to* broadband subscribers) traffic in North America.[138] As a result, once Level 3

132. *E.g.*, Kevin Werbach, *Only Connect*, 22 BERKELEY TECH. L.J. 1233, 1251-52 (2007) (describing "two types of internet networks"). "Access network" refers here to the networks owned by carriers that serve retail broadband subscribers. A simple example may help illustrate. User A wishes to connect to User B's server. A is Comcast's customer, B is Verizon's customer. When A sends a request over the Internet, it begins on Comcast's network, is (usually) transferred to Operator X's backbone network, may then be transferred to the backbone network of Operator Y's backbone network (and, also perhaps, Operator Z and so on), and is then finally transferred to Verizon's network for delivery to B. Any response from B to A might traverse the same path in reverse, or it may choose an alternate route. For present purposes, we can safely ignore the different algorithms that determine how traffic is routed. It suffices to note that these algorithms usually take account of two key factors: the technical question of the extent to which a particular provider is available or congested, and the economic cost to traverse a particular provider's backbone network.

133. *See* Tom Wheeler & Stacey Higginbotham, *Tom Wheeler on Internet Policy*, C-SPAN 17:45-18:00 (Jan 28, 2014), http://www.c-spanvideo.org/program/InternetCon (statement of Tom Wheeler, Chairman of the FCC) ("A lot of people seem to think that the whole peering and interconnection issue is the same as net neutrality. It's not. It's a different issue. It's a cousin; maybe a sibling.").

134. *2010 Open Internet Order*, supra note 7, at ¶ 67 n.209.

135. *2015 Open Internet Order*, supra note 6.

136. *See id.*; Wheeler & Higginbotham, *supra* note 133, at 13:30-14:00 (referring to "studies" noting an increase in interconnection issues over "the last twelve months").

137. This might be accomplished in any number of ways. Netflix could use another provider to send content over the Internet to a Level 3 destination. Alternatively, Netflix might locate a content server within a Level 3 facility.

138. SANDVINE, GLOBAL INTERNET PHENOMENA REPORT 6 tbl.2 (2013), https://www.sandvine.com/downloads/general/global-internet-phenomena/2013/2h-2013-global-internet-phenomena-report.pdf.

assumed responsibility for Netflix traffic, it began "sending" far more traffic than it received.[139] Comcast, which was connected directly to Level 3, became concerned by this new balance of traffic: According to Comcast, "where Network B sends traffic to Network A that is significantly out of balance with the traffic it receives from Network A . . . Network B is expected either to remedy the situation or to pay something to Network A to compensate for that imbalance."[140] After a public spat, Level 3 and Comcast eventually reached a commercial accord. But a similar dispute broke between Verizon, an access network, and Cogent Communications, a backbone provider,[141] among others.[142] These disputes have real impacts on the broadband subscriber experience,[143] and may therefore operate to undermine demand for—and concomitant investment in—new broadband infrastructure.

A notable feature of these disputes is that they typically arise between an access network and a backbone provider, rather than between two backbone providers. That is, these disputes seem to be increasingly common where two features are prevalent: First, disputes are more likely where the traffic is less likely to be balanced. Second, disputes appear where there is no "route-around" option. Where one backbone network connects with another backbone, those interconnection points are more likely to be balanced and, if one refuses to carry the traffic, other options are typically available.[144] By contrast, access networks that serve individual broadband users have traditionally imported more traffic than they exported: Broadband subscribers have consumed more content than they have produced.[145] And, most importantly, access networks

139. Letter from Joseph W. Waz, Jr., Senior Vice President—External Affairs, Comcast Corp., & Lynn R. Charytan, Vice President—Legal Regulatory Affairs, Comcast Corp., Re: Preserving the Open Internet, GN Docket No. 09-191 (Nov. 30, 2010) [hereinafter Waz Letter], http://corporate.comcast.com/comcast-voices/comcasts-letter-to-fcc-on-level-3.

140. *Id.*

141. Erin Mershon & Matthew S. Schwartz, *Verizon Peering Dispute Could Lead to Netflix Disclaimer on Slow Traffic, Cogent CEO Says*, COMM. DAILY, June 21, 2013.

142. Jon Brodkin, *Why YouTube Buffers: The Secret Deals that Make—and Break—Online Video*, ARSTECHNICA (Jul. 28, 2013, 6:00 PM PDT), http://arstechnica.com/information-technology/2013/07/why-youtube-buffers-the-secret-deals-that-make-and-break-online-video (noting disputes between Cogent and Orange, between Free and YouTube, and between Orange and Google).

143. Vishal Mishra, et al., *Interconnecting Eyeballs to Content: A Shapley Value Perspective on ISP Peering and Settlement*, 2008 ACM NETECON 61, 61 (Interconnection dispute "resulted in at least 15% of the Internet to be unreachable for the users who utilized either Level 3 or Cogent for Internet access"); Kevin Werbach, *The Centripetal Network: How the Internet Holds Itself Together, and the Forces Tearing It Apart*, 42 U.C. DAVIS L. REV. 343, 370 (2008) (Interconnection dispute "caused connectivity outages for customers of both networks."); Werbach, *supra* note 132, at 1288-89.

144. Werbach, *supra* note 132, at 1287 ("[C]ompetition and custom" have generally been "sufficient to produce an effective interconnection regime."). *But see id*. (recent trends undermining the stability of interconnection); *see also supra* note 143 (examples of interconnection breakdowns leading to disruptions).

145. *See* Mishra et al., *supra* note 143, at 61.

serve as a gatekeeper, controlling the sole available path to the user requesting that content. That is, if a user purchases broadband service from Verizon, then Verizon is responsible for carrying content, such as Netflix content, across the "last mile" to that user.

The justifications for regulating interconnection agreements between an access network and the rest of the internet, then, seem similar to those that support a targeted rule proscribing anticompetitive discrimination. Indeed, the minimum service, transparency, and affiliation-based discrimination rules described above can be made to apply easily not only to traffic travelling *across* a provider's network but also to traffic that comes *into* its network.

For example, Netflix and Comcast recently reached a high-profile interconnection accord.[146] While the Commission has, after reclassification, asserted its authority to examine such agreements under the general conduct standard of Title II, the authority granted by section 706 might also enable the Commission to scrutinize such arrangements. After all, a rule that requires a broadband provider to meet a baseline standard of service demands that the provider engineer interconnection points to meet that minimum requirement, and thereby honor its commitments to consumers. That is, where a provider guarantees that consumers will get speeds of 25 mbps, it has an obligation not only to ensure that its access network can sustain those promises, but also to ensure that its interconnection points can as well. Similarly, a rule that protects against discrimination on the basis of affiliation prevents a broadband provider from allowing its own content to travel freely while detaining unaffiliated content at the border.[147]

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The Federal Communications Commission's adjudication of Comcast's actions to throttle peer-to-peer traffic began an extended dialogue with the D.C. Circuit regarding the meaning of section 706 of the Telecommunications Act of 1996. In *Verizon*, the court and the Commission came to an accord, agreeing

146. *E.g.*, Jon Brodkin, *Netflix is Paying Comcast for Direct Connection to Network*, ARSTECHNICA (Feb 23, 2014 12:32 pm EST), http://arstechnica.com/business/2014/02/netflix-is-paying-comcast-for-direct-connection-to-network-wsj-reports/ ; *see also* Jon Brodkin, *Comcast Ends an Interconnection Fight Before Net Neutrality Takes Effect*, ARSTECHNICA (May 21, 2015, 10:30 am PDT) http://arstechnica.com/business/2015/05/comcast-ends-an-interconnection-fight-before-net-neutrality-takes-effect/

147. Similar conditions might apply to a broadband provider's own distributed networks of caches and competitors that seek to equally optimize their own content delivery. *See, e.g.*, *Overview: Netflix Open Connect*, NETFLIX, https://signup.netflix.com/openconnect (last visited May 24, 2015) ("ISPs can directly connect their networks to Open Connect for free. ISPs can do this either by free peering with us at common Internet exchanges, or can save even more transit costs by putting our free storage appliances in or near their network.").

that the statute conferred wide regulatory powers. Surprisingly, this authority appears to extend to a modestly revised set of network neutrality rules.[148] Returning to a regime in which the transmission of internet traffic is treated as a "telecommunications service" gives the Commission a secure and versatile set of tools to regulate broadband providers. But an approach under section 706 would have allowed the Commission to ensure a broadband subscriber receives, at minimum, her advertised rate of service when trying to access any online content, while simultaneously enabling the Commission to sanction particular anticompetitive conduct.

III. BEYOND NET NEUTRALITY: SECTION 706'S FEDERALISM IMPLICATIONS

Section 706 thus confers the authority to issue rules that are similar, in many respects, to those that the FCC promulgated in its *2015 Open Internet Order*. But the extent to which section 706, standing alone, allows the Commission to issue network neutrality-like rules is only one measure of the jurisdiction created by the new reading of the statute.

By interpreting section 706 as an affirmative grant of regulatory jurisdiction, the Commission has given itself—as well as state commissions—wide authority to "promote competition in the local telecommunications market" and to "remove barriers to infrastructure investment."[149] In this Part, I survey two representative policy suggestions against the statutory aims of section 706. The potential for regulatory action on these proposals not only demonstrates the breadth of authority available under section 706, but, more significantly, highlights the substantial implications for the future of federalism in telecommunications regulation.

The full text of section 706(a) provides that:

> The Commission and *each State commission* with regulatory jurisdiction over telecommunications services shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) by utilizing, in a manner consistent with the public interest, convenience, and necessity, price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment.[150]

The statute's reference to state commissions is best understood to

148. Even if these proposed rules are narrower than those the FCC promulgated in the *2015* and *2010 Open Internet Orders*, see *supra* Table 1, it is worth noting that they are consistent with network neutrality proposals that have been considered in other regions around the world. *E.g.*, Press Release, Neelie Kroes, Vice President, Eur'an Comm'n, Net Neutrality—Safeguarding the Open Internet for All (June 5, 2013) (proposing "a guarantee of access to the full and open internet" by proscribing the "blocking or throttling *of competing services*" (emphasis added)).

149. 47 U.S.C. § 1302(a) (2014) (emphasis added).

150. *Id.*

constitute a grant of jurisdiction to both the FCC as well as the state utility commissions that typically regulate intrastate telecommunications.[151] Indeed, the *2010 Open Internet Order* adopts such a reading of the statute, stating explicitly that "Section 706(a) authorizes . . . state commissions . . . to take actions . . . that encourage the deployment" of broadband.[152]

In its challenge to the *2010 Open Internet Order*, Verizon argued that this reading of the statute was itself proof that section 706 cannot be construed as a grant of agency jurisdiction, contending that "Congress would not be expected to grant both the FCC and state commissions the regulatory authority" that the Commission sought.[153] The D.C. Circuit disagreed, noting that Congress had granted such concurrent jurisdiction elsewhere in the Telecommunications Act, and it was reasonable to conclude that it had "done the same here."[154] Stated simply, section 706 contains a significant grant of authority to state commissions.

How can such concurrent federal and state regulatory authority be congruently exercised? I begin an initial exploration of this question by examining options for reducing infrastructure barriers to network deployment,[155] and by considering calls for the Commission to preempt state laws that restrain new competition in broadband markets.

A. *State Authority: The Case of Pole Attachments*

An integral component of deploying new broadband infrastructure, such as fiber optic cable, lies in "the ability to hang this fiber on existing utility poles."[156] While the matter of attaching cables to utility poles may appear

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151. *E.g.*, CAL. PUB. UTIL'S COMM'N, http://www.cpuc.ca.gov/puc (last visited May 24, 2015) ("The CPUC regulates privately owned . . . telecommunications . . . companies [among others].")

152. *2010 Open Internet Order*, *supra* note 7, at ¶ 119. The full quote reads "Section 706(a) authorizes the Commission (along with state commissions) to take actions, within their subject matter jurisdiction and not inconsistent with other provision of law, that encourage the deployment of advanced telecommunications capability." The particular choice of "along with" rather than, for example "as well as" might be read as requiring that state action be consistent with Commission prerogative. That question is explored further *infra* notes 180-184 and accompanying text. *See also* AT&T Corp. v. Iowa Util's Bd., 525 U.S. 366, 385 (1999).

153. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 638 (D.C. Cir. 2014).

154. *Id.* (citing 47 U.S.C. § 251(f) (2014) (state commission authority to exempt rural carriers from certain obligations imposed on other incumbents); 47 U.S.C. § 252(e) (2014) (requiring state commission approval for interconnection agreements between incumbent and competitive carriers)).

155. This is a favored cause of fiber-based broadband deployments. *See, e.g.*, *Field Hearing on Innovation and Regulation Before H. Comm. on Oversight and Gov't Reform*, 112th Cong. 126 (2011) [hereinafter *Medin 2011 House Testimony*] (testimony of Milo Medin, Vice President of Access Serv's, Google Inc.).

156. *Id.*

trivial, the lack of "reliable, timely, and affordable access" to utility poles "is a significant barrier to deploying broadband services."[157] Given the costs of the alternatives—erecting a separate pole, or digging and filling underground trenches—"there is often no practical alternative for network deployment except to utilize available space on existing poles."[158] But a "local monopoly in ownership or control of poles," places pole owners "in a position to extract monopoly rents . . . in the form of unreasonably high pole attachment rates."[159] As a result, the gross cost of negotiating pole attachments and rights-of-way can account for up to one-fifth of the total cost of a new broadband deployment.[160]

To address these significant costs, Congress has granted the FCC the authority to "regulate the rates, terms, and conditions for pole attachments."[161] In 2011, the FCC regulated the rates paid by telecommunications and wireless service providers seeking attachment rights, bringing those rates in line with the lower prices available to cable television operators under a separate subsection of the statute.[162] Although the new rates were challenged by the utilities that owned the poles,[163] they were welcomed by telecommunications service providers.

But information service providers were outside the scope of this proceeding. This had the practical effect (at the time) of excluding broadband subscription services from these favorable rates.[164] Companies such as Google,

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157. *Id.*

158. Implementation of Section 224 of the Act, et al. (*Pole Attachment Order*), 26 FCC Rcd. 5240, ¶ 4 (2011) (report and order) (quoting S. REP. NO. 95-580 (1977)).

159. Nat'l Cable & Telecomm's Ass'n v. Gulf Power Co., 534 U.S. 327, 330 (2002) ("Since the inception of cable television, cable companies have sought the means to run a wire into the home of each subscriber. They have found it convenient, and often essential, to lease space for their cables on telephone and electric utility poles. Utilities, in turn, have found it convenient to charge monopoly rents."); S. REP. NO. 95-580 (1977).

160. FCC, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN, § 6.1, at 127 (2010), https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf ("Collectively, the expense of obtaining permits and leasing pole attachments and rights-of-way can amount to 20% of the cost of fiber optic deployment."); *see also* COLUMBIA TELECOMM'S CORP., AN ENGINEERING ANALYSIS OF PUBLIC RIGHTS-OF-WAY PROCESSES IN THE CONTEXT OF WIRELINE NETWORK DESIGN AND CONSTRUCTION (2011), http://ctcnet.us/2011%20CTC_Study%20NationalLeagueCities%2011-59.pdf (costs of permits insignificant relative to pole and rights-of-way costs).

161. 47 U.S.C. § 224(b)(1) (2014).

162. 47 U.S.C. § 224(d) (2014).

163. Am. Elec. Power Serv. Corp. v. FCC, 708 F.3d 183, 185 (D.C. Cir. 2013) (denying petition to seek review of the FCC order).

164. Cable operators that provide *both* broadband service as well cable television service have access to regulated pole rates. *Gulf Power*, 534 U.S. at 342. The same is true for, for example, DSL providers that offer traditional telecommunications services. *Id.* But broadband providers that offer a voice product that is not strictly a "telecommunications service," or that provide an IPTV service rather than a cable-based TV product do not qualify for the favorable rate—or any rate at all.

which sells broadband service via Google Fiber, complained that despite the improvements in the FCC's pole attachment order, they still "do not have automatic attachment rights" even though "broadband providers are exactly the group [the FCC] wouldn't want to leave out," given the economic and social benefits from new broadband deployment and competition from new entrants.[165]

To be sure, reclassification has automatically swept broadband providers into the reach of section 224. But the Commission did not have to reach that far. Section 706 provides the authority necessary to extend pole attachment rights to broadband providers. Section 706 explicitly authorizes the Commission encourage broadband deployment through "regulating methods that remove barriers to infrastructure investment."[166] Just as a Commission rule that is based on an existing regulatory program falls within the scope of a "regulating method,"[167] such as the CTCPCA, so too would an order extending pole attachment rights to broadband providers. And the absence of automatic attachment rights, and delays associated with negotiating terms and engineering the poles to be "ready" for outside attachments, obstruct new infrastructure deployment.[168] Thus, the Commission could have exercised authority under section 706 to extend pole attachment rights to broadband providers.[169]

What is surprising, however, is that even if the Commission had declined to take such action, the states would have been able to do so themselves, even in the absence of reclassification. Subsection (c) of section 224 gives states the option to opt out of the federal pole attachment scheme. Provided that the state itself regulates pole attachment rates (and certifies to the Commission that it does so), the federal scheme is reversely "preempt[ed]" by the state

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165. *Medin 2011 House Testimony*, *supra* note 155.

166. 47 U.S.C. § 1302(a) (2014).

167. *See supra* Part II.C (proposing rule based on Commission's existing CTCPCA authority).

168. FCC, Gigabit City Challenge: Broadband Networks Workshop (Mar. 27, 2011) [hereinafter Medin 2011 FCC Statement] (Statement of Milo Medin, Vice President of Access Serv's, Google Inc.), http://www.fcc.gov/events/gigabit-workshop-1; *Pole Attachment Order*, *supra* note 158, at ¶ 5.

169. One might argue that Section 224 itself limits the Commission's authority to extend attachment rights to others. That is, by limiting its applicability to only certain classes of services, the statute has necessarily precluded any possibility of extending pole attachment rights to information services—even under another statute. Such a view would take an overly restrictive view of both the Commission's and D.C. Circuit's interpretations of section 706: Both have noted that section 706 gives the Commission authority "to take actions . . . not *inconsistent* with other provisions of law." Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 634 (D.C. Cir. 2014); *2010 Open Internet Order*, supra note 7, at ¶ 119. The *2010 Open Internet Order* exceeded this authority because it violated the Communications Act's command that a telecommunications carrier be treated as a common carrier "*only* to the extent that it is engaged in providing telecommunications services." 47 U.S.C. § 153(51) (2014) (emphasis added). Section 224 contains no similarly explicit language that necessarily confines its reach to only telecommunications carriers and cable system providers.

regulation.[170] Twenty-one states have invoked this option by exercising state-level regulatory authority over pole attachments.[171] But just as the Commission's *federal* authority under section 224 excepts information service providers, some instances of state-granted authority do not extend to broadband carriers.[172] Indeed, while section 706 refers explicitly to state commissions "with regulatory jurisdiction over *telecommunications services*," the authority granted in the statute extends to the regulation of information services.[173] Altogether, section 706 gives states the authority to use "regulating methods," such as grants of pole attachment rights, to "encourage" the deployment of broadband, even where the Commission might have declined to do so.[174]

This is not entirely unusual: As Philip Weiser has written extensively, the Telecommunications Act incorporates a robust form of "cooperative federalism."[175] What is exceptional about this circumstance, however, is the state's hypothesized ability to exercise federally-granted authority where the Commission has declined to exercise that regulatory power. This situation presents the inverse of existing models of cooperative federalism in Telecommunications Act: Generally, the FCC is granted the authority to supplement absent state action, not the other way around.[176]

The opportunity for state-originated regulation pursuant to federally-granted power—where the federal government has declined action, thus presents two questions. The first is for states "to decide how, if at all, to justify state agency action . . . outside those actions specifically authorized by state

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170. States that Have Certified that They Regulate Pole Attachments, 25 FCC Rcd. 5541 (2010), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-10-893A1.pdf.

171. See *id*.

172. *E.g.*, MASS. GEN. LAWS, ch. 166, § 25A (2014) (authority limited to "telegraph," "telephone," "television," or wireless provider of "telecommunications service.").

173. *Verizon*, 740 F.3d at 649 ("[S]ection 706 grants the Commission authority to promote broadband deployment by regulating how broadband providers treat edge providers . . . .").

174. This is potentially remarkably easy to achieve: In theory, a state commission could exercise its authority under section 706 to adopt a pole attachment regulation that is practically identical to the Commission's prevailing rule (or identical in only parts, such as the rate formula), except that it extends to information service providers. The authority FCC's *Pole Attachment Order* rests almost entirely on section 224. Assuming that a state's power to use "other regulating methods" under 706 encompasses the Commission's authority under section 224, the state can issue such a rule. Once it has done so, the state can exercise its opt-out authority under section 224, affirming that it has now regulated pole attachments (under its section 706 authority).

175. *See* Philip J. Weiser, Chevron*, Cooperative Federalism, and Telecommunications Reform*, 52 VAND. L. REV. 1 (1999) [hereinafter Weiser, Chevron]; Weiser, *Constitutional Architecture*, *supra* note 11; Philip J. Weiser, *Federal Common Law, Cooperative Federalism, and the Enforcement of the Telecom Act*, 76 N.Y.U. L. REV. 1692 (2001) [hereinafter Weiser, *Federal Common Law*].

176. *See*, *e.g.*, Weiser, Chevron, *supra* note 175, at 19; Weiser, *Constitutional Architecture*, *supra* note 11, at 665 n.3 (FCC provides "oversight" and "backup" to "state agencies.").

law."[177] On this point, Philip Weiser has argued in favor of reading "state limitation[s] on agency action" as "not . . . prevent[ing] state agency implementation of federal law."[178] In particular, this is achieved not through the preemption of state law limitations on state agency authority, but rather, through the application of "a reverse-*Erie* model," wherein a state commission adheres to its own procedures, but can exercise substantive federal power.[179]

The second matter, however, is unique to the scenario described here. Where states "superintend the implementation of federal law," "they are expected to do in compliance with federal law."[180] Such state actions are usually either explicitly authorized by the statute or by the Commission.[181] But how should we construe the effect of the Commission's silence on a regulatory question, such as—to stay with the present example—whether pole attachment rights extend to information service providers? The state exercise of federal power beyond the bounds of state law authorization seems permitted where it is consistent with federal law.[182] And it clearly contravenes the Supremacy Clause where it is inconsistent with federal law.[183] But where Congress has concurrently granted authority to a federal agency and to the states, the states are free to pick up the baton even if the federal agency declines to act.[184]

The scope of state authority to exercise federal power under the Telecommunications Act has traditionally been limited to a "few specified areas."[185] The Commission's interpretation of section 706 as a concurrent grant

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177. Weiser, *Constitutional Architecture*, *supra* note 11, at 674.

178. *Id.*

179. *Id.* at 680-81.

180. *Id.* at 672, 676.

181. Weiser, *Federal Common Law*, *supra* note 175 at 1740 (FCC authorizing state experimentation for slamming).

182. AT&T Corp. v. Iowa Util's Bd., 525 U.S. 366, 385 (1999); Weiser, *Constitutional Architecture*, *supra* note 11 at 676.

183. U.S. CONST. art. VI, cl. 2; *see also* 47 U.S.C. § 253 (2014) (FCC authority to preempt state laws and regulations).

184. *See AT&T*, 525 U.S. at 410-12 (1999) (Thomas, J., concurring in part and dissenting in part) (noting that Congress can grant states (and state agencies) authority to exercise federal power in spite of existing federal authority); *see also AT&T*, 525 U.S. at 385 n.10 (majority opinion) (commenting on Justice Thomas's concurrence and agreeing that "it is well settled that state officers may interpret and apply federal law" but noting the novelty of the Telecommunications Act); *cf.* Jessica Bulman-Pozen, *Federalism as a Safeguard of the Separation of Powers*, 112 COLUM. L. REV. 459, 489-90, 494 (2012) (describing how California took action to "vindicat[e] congressional intent" where the federal government had "abdicated its statutory duty to do so" under the Clean Air Act). *But see* Vonage Holdings Corp., 19 FCC Rcd. 22,404, 22,426-27 (2004) (preempting state regulation because "multiple disparate attempts to impose economic regulations" by the fifty states would "thwart . . . the goals and objectives of section 706").

To be sure, where a federal regulator has expressly forborne from applying certain regulations, a state regulator could not use its grant of federal authority to re-impose those same requirements. *Cf. 2015 Open Internet Order*, *supra* note 6.

185. *AT&T*, 525 U.S. at 385 n.10 (mentioning "ratemaking, interconnection

of federal and state jurisdiction transforms this limitation on the model of "cooperative federalism" that was adopted by the Telecommunications Act of 1996. The statute's grant of authority to use any "regulating method" to "remove barriers to infrastructure investment," combined with the willingness of courts to entertain broad theories on how to achieve this objective,[186] gives state commissions wide latitude to exercise federal power beyond the limits imposed by state legislatures. Until now, state commissions have invoked section 706 only rarely,[187] but the Commission's revised interpretation of the statute creates more opportunities for states to intervene on various policy matters,[188] including mergers of telecommunications companies.[189]

B. *Federal Power: Preempting State Regulation of Municipalities*

The FCC has interpreted section 706 to grant state commissions an unprecedented breadth of authority—beyond the limits imposed by state legislatures—to use varied regulation to "remove barriers to infrastructure investment."[190] Nevertheless, some have suggested that states have taken actions that have an opposite effect: Scholars and commentators argue that state laws prohibiting municipalities from developing and operating their own broadband networks are needless barriers to infrastructure investment, and they have thus urged the FCC to preempt those laws.

Some estimates suggest that over 150 municipalities own and operate broadband networks within their community.[191] Proponents of these networks

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agreements, etc.").

186. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 643 (D.C. Cir. 2014) (Commission's "triple-cushion shot" theory of economic demand for broadband deployment valid to exercise authority under section 706); *see also* Weiser, Chevron, *supra* note 175, at 4 (arguing that courts should defer, under *Chevron*, to state agency exercises of federal power).

187. *Reform of Intrastate Interexchange Telecommunications Market Structure and Regulations in Alaska, No. R-98-1*, REG. COMM'N OF ALA. 30 (Aug. 2, 2002), http://rca.alaska.gov/RCAWeb/Orders/OrderDetails.aspx?id=50394ad7-996a-44cc-a570-83e7fa46c512 (order adopting regulations, as amended) (stating that section 706 provides authority for state to require carriers to file reports regarding progress on state modernization plan).

188. Ill. Bell Tel. Co., 2009 WL 5503211, at *38 (Ill. C.C. Dec. 22, 2009) (order on rehearing) (stating that section 706 "supports" a state law requirement for telecom companies to deploy broadband capabilities to 80% of its customers); *see also* Weiser, *Constitutional Architecture*, *supra* note 11, at 671 ("[B]y the federal government's own admission, it is almost always unwilling and/or unable to take back the power to implement cooperative federalism programs.").

189. Comcast Corp., App. No. 14-04-013, at 11 (Cal. Pub. Util's Comm'n Feb. 13, 2015) (decision granting application with conditions), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M146/K376/146376008.PDF (asserting authority to review the proposed merger between Comcast and Time Warner Cable under section 706).

190. 47 U.S.C. § 1302 (2014).

191. Institute for Local Self-Reliance, *Community Broadband Map*, COMMUNITY

argue that they have significant "economic and social benefits" beyond those that regularly accompany broadband access, including many that result from a more successful and cohesive local community.[192] In Florida, for example, a locally-owned broadband deployment is estimated to save Martin County approximately $30 million over 20 years.[193] Similarly, the introduction of a competing community fiber network in Wilson, North Carolina spurred price and quality competition with Time Warner Cable, yielding an estimated $1 million per year in consumer savings.[194]

But advocates of municipal broadband service may have also occasionally miscalculated. There have been several optimistic reports regarding the fiber deployment in Lafayette, Louisiana,[195] but other analyses have suggested that the project is deeply indebted, losing approximately $45,000 per day.[196] Similarly, before selling its network to Google for one dollar,[197] estimates suggest that the municipal network in Provo, Utah had incurred over $8 million in debt.[198]

Viewed together, the results for municipal broadband are mixed. Some municipal broadband services have resulted in large losses to the communities they attempted to serve. But it also seems likely that at least some state

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BROADBAND NETWORKS, http://www.muninetworks.org/communitymap (last visited May 24, 2015).

192. Medin 2011 FCC Statement, *supra* note 168, at 65:00; *cf.* Joan Engebretson, *CFO: Google Fiber Network Boosted Kansas City's Bond Rating*, TELECOMPETITOR (Feb. 13, 2014), http://www.telecompetitor.com/cfo-google-fiber-network-boosted-kansas-citys-bond-rating ("Kansas City has received a higher bond rating as a result of Google's investment in an ultra-high-speed network in the city . . . .").

193. LISA GONZALEZ & CHRISTOPHER MITCHELL, INSTITUTE FOR LOCAL SELF-RELIANCE, FLORIDA FIBER: MARTIN COUNTY SAVES BIG WITH GIGABIT NETWORK 1 (2012), http://ilsr.org/wp-content/uploads/2012/06/martin-county-fiber.pdf.

194. TODD O'BOYLE & CHRISTOPHER MITCHELL, INSTITUTE FOR LOCAL SELF-RELIANCE, CAROLINA'S CONNECTED COMMUNITY: WILSON GIVES GREENLIGHT TO FAST INTERNET, at iii (2012), http://ilsr.org/wp-content/uploads/2012/12/wilson-greenlight.pdf.

195. SUSAN CRAWFORD, CAPTIVE AUDIENCE 255 (2013); Rick Jervis, *Louisiana City Blazes High-Speed Web Trail*, USA TODAY (Feb. 5, 2012, 12:28 PM), http://usatoday30.usatoday.com/news/nation/story/2012-02-01/broadband-telecom-lafayette/52920278/1 ("LUS Fiber has captured nearly one-third of the city's 45,000 residential and business subscribers, ... To compete, Cox has slashed its rates for some residents and business customers, lowering TV and Internet bills across the city.").

196. STEVEN TITCH, REASON FOUNDATION, POLICY STUDY 424, LESSONS IN MUNICIPAL BROADBAND FROM LAFAYETTE, LOUISIANA 7 (2013), http://reason.org/files/municipal_broadband_lafayette.pdf.

197. GOOGLE FIBER, INC. & PROVO CITY CORP., ASSET PURCHASE AGREEMENT 13 (2013) ("In consideration of the sale, assignment and transfer of the Acquired Assets . . . Purchaser (i) will pay to Seller in cash $1.00 (One Dollar) (the 'Purchase Price')"), http://www.provo.org/home/showdocument?id=2296.

198. STEVEN TITCH, REASON FOUNDATION, IPROVO REVISITED: ANOTHER YEAR AND STILL STRUGGLING 2 (2008), http://reason.org/files/0ed1e38947a206981804b66dfd19b9f7.pdf ("Aggregate losses for iProvo since 2003 total $8.4 million.").

legislatures have erred by restricting municipalities from developing their own networks. Despite the success of the network in Wilson, North Carolina, that state enacted legislation that prevents other towns from engaging similar projects. Similar statutes, enacted in nearly half of the states,[199] may have strangled other welfare-enhancing ventures, and some have suggested that these laws result from the political capture of state legislatures.[200]

In response, advocates of municipally-owned and operated networks called on the Commission to preempt such state legislation. Even the dissent to *Verizon* suggests that section 706 gives the Commission the authority to preempt such "paradigmatic barrier[s] to infrastructure investment."[201] Scholars have advanced similar arguments, noting that "Congress can delegate preemptive power to agencies," and courts rely on "the organic statute to discern whether Congress has done so."[202]

The Commission has heeded that call, striking down specific statutes in North Carolina and Tennessee that it found to contravene the express purpose of section 706.[203] To be sure, whether a statute so capacious and broadly worded as section 706 authorizes the Commission to preempt state laws is subject to debate.[204] But these reservations notwithstanding, the Commission has determined that the "regulating methods" within the scope of section 706 include preemptive regulation.[205] And, given that the contours of an agency's regulatory authority are subject to the agency's reasoned interpretation,[206] the

199. *Community Broadband Map*, *supra* note 191.

200. SUSAN CRAWFORD, CAPTIVE AUDIENCE 256 (2013) (noting lobbying efforts in Tennessee and North Carolina); *see also* TODD O'BOYLE & CHRISTOPHER MITCHELL, INSTITUTE FOR LOCAL SELF-RELIANCE, THE EMPIRE LOBBIES BACK: HOW NATIONAL CABLE AND DSL COMPANIES BANNED THE COMPETITION IN NORTH CAROLINA 1-2 (2013), http://ilsr.org/wp-content/uploads/2013/01/nc-killing-competition.pdf (suggesting that a $1 million lobbying campaign led to enactment of legislation to prevent municipal competition and preserve monopoly profits); Chloe Albanesius, *Georgia House Defeats Bill to Ban Municipal Broadband Networks*, PC MAGAZINE (March 8, 2013, 2:18 PM EST), http://www.pcmag.com/article2/0,2817,2416399,00.asp.

201. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 660 n.2 (D.C. Cir. 2014) (Silberman, J., dissenting) ("An example of a paradigmatic barrier to infrastructure investment [under section 706] would be state laws that prohibit municipalities from creating their own broadband infrastructure to compete against private companies.").

202. Matthew Dunne, *Let My People Go (Online): The Power of the FCC to Preempt State Laws that Prohibit Municipal Broadband*, 107 COLUM. L. REV. 1126, 1141-42 (2007).

203. City of Wilson, North Carolina Petition for Preemption of North Carolina General Statute Sections 160a-340 et seq. , 30 FCC Rcd. 2408 ¶181 (2015) (memorandum opinion and order).

204. *See* Rice v. Santa Fe Elevator Corp., 331 U.S. 218, 230 (1947) (requiring statute express a "clear and manifest purpose" to preempt state laws); *see also* Watters v. Wachovia Bank, N.A., 550 U.S. 1, 36-42 (2007) (Stevens, J., dissenting) ("No case from this Court has ever applied [*Chevron*'s] deferential standard to an agency decision that could so easily disrupt the federal-state balance."); *cf.* Gillian Metzger, *Federalism and Federal Agency Reform*, 111 COLUM. L. REV. 1, 32-33 (2011).

205. 47 U.S.C. § 1302(a) (2014).

206. City of Arlington v. FCC, 133 S. Ct. 1863 (2013). The decision in *City of*

Commission's interpretation of the statute may stand. Indeed, in other contexts, the Commission has invoked its authority under section 706, in conjunction with other powers, to preempt state regulation of internet-based voice services.[207] Altogether, preemptive regulation aimed at state laws restricting municipal broadband plausibly seems within the scope of the section 706,[208] suggesting yet again the impressive scope of the statute's grant of authority.

But the question of whether such regulation lies within the broad scope of the Commission's authority under section 706 is distinct from the question of whether the Commission ought to exercise that authority. The debate between proponents of state legislation to restrict municipal broadband and advocates for preemptive regulation is a gloss atop an essentially empirical question: Do municipally-provided broadband services increase social welfare? The most important feature of this question is that it cannot be answered universally.[209] Whether a municipal network will be successful depends on a variety of local factors. On costs, those questions include the presence of existing usable infrastructure (*e.g.*, so-called "dark fiber"). On revenue, those questions include the presence and number of existing broadband providers, and local demand for broadband. The answers to these questions vary not only state-by-state, but census block by census block.[210]

The Commission's approach to the exercise its preemptive power thus far seems to follow a middle course. To be sure, responsibility for determining whether a municipally owned-and-operated broadband network is in the interests of the community should lie, in the first instance, with the community itself. Indeed, communities frequently exercise such "real local legal authority,

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Arlington notwithstanding, the Supreme Court has been inclined to take a stricter view of an agency's authority to preempt state legislation, citing federalism interests. *See supra* note 204 and accompanying text. One way to reconcile these competing lines of cases may be to allow the agency deference in its interpretation of whether a statute delegates preemptive power, but require any preemptive agency action to be explicitly clear. See Wyeth v. Levine, 555 U.S. 555, 576-77 (2009) ("While agencies have no special authority to pronounce on pre-emption absent delegation by Congress, they do have a unique understanding of the statutes they administer and an attendant ability to make informed determinations about how state requirements may pose an obstacle to the accomplishment and execution of the full purposes and objectives of Congress.") (internal quotation marks omitted). *But see Wyeth*, 555 U.S. at 576-77. ("Even in such cases, however, we have not deferred to an agency's *conclusion* that state law is pre-empted. Rather, we have attended to an agency's explanation of how state law affects the regulatory scheme.").

207. Vonage Holdings Corp., 19 FCC Rcd. 22,404, 22,412, *aff'd sub nom.* Minn. Pub. Util's Comm'n v. FCC, 483 F.3d 570 (8th Cir. 2007).

208. *See supra* note 206 (reconciling strict standards for preemption with regulatory deference).

209. *Compare supra* note 195 (deployment in Lafayette successful), *with supra* note 196 (opposite).

210. *See generally* FCC, INDUS. ANALYSIS & TECH. DIV., INTERNET ACCESS SERVICES: STATUS AS OF JUNE 30, 2011 (2012), https://apps.fcc.gov/edocs_public/attachmatch/DOC-314630A1.doc.

notwithstanding the nominal rules of state supremacy."[211] As a matter of institutional competence, this is because the municipality is best able to assess the relative benefits of such a network, and is in the best position to determine costs of network deployment given local resources. Furthermore, because the costs and benefits of the deployment will be internalized by the municipality, locating the decision whether to build with the community itself is likely to lead to the most efficient allocation of its resources.[212]

But given a mandatory choice between state legislation or Commission regulation, a rule that preempts any and all state restrictions on municipal projects seems unwarranted. Turning again to institutional competence concerns, the state is more able than the Commission—though less able than the town—to value the costs and benefits of any individual municipal network. Furthermore, any losses incurred by the municipal entity beyond its ability to pay are likely to be borne by the state—and not the federal—government. That is, the state bears a *de facto* responsibility for insuring the municipality.[213] Thus, properly viewing the choice between state restrictions and federal preemption as a choice between Type I and Type II error, the state would seem entitled to take a risk-averse stance to shield its treasury, and a Commission rule that would preempt all such legislation endangers that choice.

The Commission, however, has thus far deployed its authority only in response to petitions from municipalities themselves, suggesting that the Commission is reacting to choices made by the municipality—the entity most competent to decide whether to undertake a broadband enterprise. And the Commission has focused the exercise of its preemptive power at state statutes aimed at increasing the costs of locally-provided broadband service, while preserving provisions that impose accounting requirements and require separation between the city's general fund and its commercial venture.[214] Such

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211. Dunne, *supra* note 202, at 1148 & n.168 (quoting Richard Briffault, *Our Localism: Part I—The Structure of Local Government Law*, 90 COLUM. L. REV. 1, 3, 24-58 (1990)) (internal quotation marks omitted).

212. Robert D. Cooter & Neil S. Siegel, *Collective Action Federalism: A General Theory of Article I, Section 8*, 63 STAN. L. REV. 115, 144 (2010) (assign responsibility to the smallest jurisdiction that internalizes regulatory benefits); Charles M. Tiebout, *A Pure Theory of Local Expenditures*, 64 J. POL. ECON. 416, 416 (1956).

213. *See, e.g.*, Christine Sgarlata Chung, *Municipal Securities: The Crisis of State and Local Government Indebtedness, Systemic Costs of Low Default Rates, and Opportunities for Reform*, 34 CARDOZO L. REV. 1455, 1472 (2013) (citing *Municipal Bond Turmoil: Impact on Cities, Towns, and States: Hearing Before the H. Comm. on Fin. Serv's*, 110th Cong. 25 (2008) (statement of Rep. Barney Frank, Chairman, H. Comm. on Fin. Serv's)).

214. *Compare* Interlocal Entity Service Prohibition, H.B. 60, 2014 Gen. Sess. (Utah 2014), 'http://le.utah.gov/~2014/bills/static/HB0060.html (blanket proscription on new construction of broadband infrastructure by an "interlocal entity") *with* ALA. CODE § 11-50B-1 *et seq.* (2015) (imposing constraints on funding sources before profitability). I treat these financial conditions in the Alabama code as distinct from the other restrictions contained within the Alabama code. I also do not view imputed cost requirements, as a general matter, among those financial conditions that seem possibly appropriate for a state to

narrowly scoped preemptive regulation under section 706 may preserve a municipality's local authority to build and operate a broadband network without intruding on the financial relationship between a state and its localities.

CONCLUSION: REGULATORY FEDERALISM AND EXPERIMENTALISM

Verizon's challenge to the Federal Communications Commission's *Open Internet Order* voided the core substance of those rules. But in losing the authority to enforce those rules, the Commission gained substantial new authority. By accepting the FCC's interpretation of section 706 as affirmatively delegating the regulatory authority to promote the deployment of broadband,[215] the D.C. Circuit affirmed a significant breadth of FCC regulatory authority.[216]

This was no "minor victory."[217] Rather, the Commission has already relied on its revised interpretation of the statute to support a complete overhaul of the Connect America Fund, a nearly $5 billion per year subsidy for broadband and telecommunications deployment,[218] to preempt state statutes that restrict municipally-provided broadband service, and to support, in conjunction with its authority under Title II of the Communications Act, new network neutrality rules.

Furthermore, the reach of section 706 extends beyond the Commission and into the states. The statute explicitly vests authority with "each State commission" to encourage the deployment of broadband to all Americans.[219] The statute's concurrent grant of jurisdiction to the FCC and to state commissions has important implications for the model of cooperative federalism that has dominated telecommunications regulation for nearly two decades. The grant of federal power might be seen as giving authority to preempt decisions traditionally vested with the states. The grant of authority to state commissions allows local regulators to act where the FCC has declined to do so.

In a twist, the grant of power to state commissions might be used to promulgate network neutrality-like regulations at the state level. Under the economic theory advanced by the Commission and accepted by the D.C. Circuit, network neutrality rules are designed to spur investment in broadband infrastructure through increased demand for broadband-based services. States, then, might exercise their own section 706 authority to promote "infrastructure

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impose on a locality.

215. *2010 Open Internet Order*, *supra* note 7, at 121.

216. Verizon Commc'ns Inc. v. FCC, 740 F.3d 623, 628 (D.C. Cir. 2014).

217. Paul Barbagallo, *In a Case Hinging on Regulatory Authority, a Minor Victory for the FCC*, BNA TELECOMM. L. RESOURCE CTR. (Jan. 15, 2014), http://www.bna.com/case-hinging-regulatory-n17179881366.

218. Connect America Fund, 26 FCC Rcd. 17,663, 17,672 (2011) (setting the budget at $4.5 billion for each of the six years following 2011).

219. 47 U.S.C. § 1302(a) (2014).

investment" through regulations that prevent broadband providers from blocking and throttling access to legal content and from discriminating among network applications on the basis of affiliation.[220] Some complaints about the practices of broadband providers have already been brought to the attention of state authorities. Until now, states have referred those matters to the Federal Communications Commission.[221] Section 706 gives those states the opportunity to directly address their citizen's concerns, and allows for parallel enforcement of network neutrality violations.

To be sure, broadband carriers may encounter difficulties when faced with multiple regulators. Indeed, the Commission has used its own authority under section 706 to preempt state regulation and prevent the proliferation of "50 or more additional sets of different economic regulations."[222] Recently, however, the Commission has been more tolerant of state regulation, and it has even taken tentative steps to encourage telecommunications experimentalism. In early 2014, the Commission began accepting proposals for a series of policy experiments to guide its ongoing regulatory approach. By "central[izing] coordination of the evaluation of the results" of these varied policy approaches, some features of the Commission's new process are classically experimentalist.[223] But other aspects of the Commission's approach adhere to a more rigid command-and-control model of regulation: The Commission "encourage[s] geographic diversity" in proposals for policy experiments,[224] but involves state regulators only to the extent that it must "notify and consult" them.[225]

That need not be so. Section 706's concurrent grant of jurisdiction to federal and state regulators embraces an experimentalist approach to telecommunications regulation. In some ways, the exercise of these overlapping grants of authority may be in competition. But more importantly, section 706 allows a state to "serve as a laboratory; and try novel social and economic experiments" with broadband policy.[226] The Commission's interpretation of section 706 gives states the freedom to experiment with varied approaches to telecommunications regulation, while empowering the Commission to generalize their successes.

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220. *Id.*

221. Letter *from* Derek Schmidt, Att'y Gen., Kan., to FCC (Nov. 2, 2012) (forwarding complaint filed by Douglas McClendon with the Kansas Attorney General alleging that Google Fiber's Terms of Service violate network neutrality principles).

222. Vonage Holdings Corp., 19 FCC Rcd. 22,404 at 22,427 (2004).

223. Charles F. Sabel & William H. Simon, *Minimalism and Experimentalism in the Administrative State*, 100 GEO. L.J. 53, 79 (2011).

224. Technology Transitions; Connect America Fund, 79 Fed. Reg. 11,327 (Feb. 28, 2014) (to be codified at 42 C.F.R. pt. 54).

225. *Id.* at 13.

226. New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting).

REDEFINING "VALUABLE PATENTS": ANALYSIS OF THE ENFORCEMENT VALUE OF U.S. PATENTS

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ABSTRACT

This study analyzes the factors that make patents valuable in enforcement awards. Leading scholarship predominantly relies on proxies for value (e.g., whether a patent has been asserted or maintained), to designate which patents are "valuable" and which are not. Here, we study value directly and precisely, identifying the specific characteristics that are associated with higher or lower monetary enforcement values. In so doing, we identify previously unobserved characteristics of "valuable patents" and their values in litigation.

Specifically, we mine a vast array of data relating to each patent that has been held valid and infringed and for which damages have been awarded in U.S. District Court cases from 2006 to 2011. The dataset comprises nearly 400 patents from over 200 cases awarding infringement damages during this six-year timeframe. We use the damages awarded for infringement as an exact quantitative measure of value, which we analyze with reference to over 70 unique data points for each patent, including variables regarding prosecution history, inventors, specification and claim structure, family tree, forward citations and recorded transfers and liens.

Based on our analysis, we categorize "valuable patents" from the perspective of enforcement awards as follows: (1) commercialized patents, (2) upstream patents, and (3) forward-cited patents, with certain caveats. We further investigate each of these categories to provide new insights into patent enforcement value and articulate relevant distinctions between enforcement and other types of patent value, such as licensing or transfer value.

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* Associate, Skadden, Arps, Slate, Meagher & Flom LLP. The views expressed herein are solely those of the author and do not reflect the views of others, including PricewaterhouseCoopers LLP, Skadden, Arps, Slate, Meagher & Flom LLP (or its attorneys or clients), or any of their respective affiliates.

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for the proprietary database on which this study was built. Thanks are also due to the organizers of the 14th Annual Intellectual Property Scholars Conference at Boalt Hall in Berkeley, Calif. on Aug. 7-8, 2014, where preliminary results of this study were presented. Additionally, this work has benefited from the helpful comments and contributions of many, including Michael Mazzeo, David Schwartz and Samantha Zyontz. Finally, the author thanks the tremendous research work and feedback provided by Rebecca Cress, Scott Flanz, Jordan Joachim, Megan Manfred, Joanie Piasta, Josh Podolnick, Tina Praprotnik, Hoda Rifai-Bashjawish, Aliya Sanders, and Katie Webb, as well as the entire Patent Analytics Team at Skadden.

INTRODUCTION

"Valuable patents" as the term is defined in leading scholarship are generally understood to be those patents that have been asserted in litigation or maintained to full term. However, these proxies for value are over-inclusive, and they further fail to specify *how much* value a particular patent has. Moreover, proxy analysis often lacks the precision to determine what factors make one patent more or less valuable than another. In light of the tremendous importance of patents as an asset class and the modern economy of patent enforcement, licensing and other monetization activities, it is imperative that we develop an accurate understanding of patent value and its principal characteristics.

This study analyzes patent enforcement value directly, focusing on the amount of damages awarded in court for infringement of individual U.S. patents. Our dataset comprises U.S. District Court patent infringement awards from 2006 to 2011, including nearly 400 patents that were held valid and infringed in over 200 cases decided during this period. Moreover, we compile one of the most comprehensive arrays of intrinsic and acquired patent attributes to date, including over 70 variables coding the features of each patent, characteristics of the litigants, and case factors. By applying regression analysis and other statistical techniques to this dataset, we parse out three distinct facets of patent enforcement value and further identify distinguishing characteristics that are associated with each.

Specifically, we find that the patents most valuable in enforcement proceedings are (1) commercialized patents, (2) upstream patents, and (3) with certain caveats, forward-cited patents. First, our analysis reveals that one of the most important measures of patent enforcement value is whether the claimed invention is being commercialized by its owner, and in turn we find evidence that the amount of damages likely to be awarded is strongly dependent on the market economics in which such commercialization occurs. Second, we observe a significant value premium for upstream patents and differentiation

between upstream and downstream patents, whereby "upstream" patents that give rise to follow-on inventions and improvements have significantly higher value than other patents on average and, in particular, relative to patents for those "downstream" derivatives. Furthermore, we find that forward citations strongly correlate with patent enforcement value; however this signal is somewhat less clear, and the presence of strong relationships between forward citations and many other patent characteristics, as well as certain deviations at the high value range, suggest a more complicated relationship between forward citations and value.[2] Additionally, we find that proprietary patents that have been held and enforced by their original applicants are significantly more valuable in court awards than patents acquired from third parties prior to enforcement, which further reinforces the significance of the commercialization and development functions we observe.

Importantly, we note at the outset that our findings regarding patent enforcement value may not be generalizable to other types of patent value, particularly given the selection of our dataset. We are exclusively studying fully litigated cases that have not settled. Moreover, we do not address licensing or other monetization activities that are undertaken without litigation. There are many reasons to think that different factors may drive patent value in different settings depending on how the patent is being used, and therefore it is important to be mindful of the particular context of any study of patent value.

Nonetheless, we attempt here to provide a detailed picture of patent enforcement value in court awards and explore its various dimensions. In the analysis below, we investigate patents enforced by non-practicing entities, patents involved in large-entity litigations, patents in different industry sectors and patents that have been traded, in each case controlling for a wide range of patent characteristics. We also pose for future study certain key questions about forward citations, which despite being the most prominent metric for estimating patent value have certain key limitations and complicating factors.

This study is organized as follows. In Part II below, we outline relevant theoretical background and prior scholarship. Next, Part III describes our dataset and empirical methodology, including detailed descriptions of the variables we code and summary statistics and trends pertaining to our data of patent awards. Part IV details our correlation analysis, large-scale regression modeling and specific investigation of key parameters, and provides our results. Finally, our interpretations and conclusions follow in Part V.

I. THEORETICAL BACKGROUND

Most prevailing theories of patent value define "valuable patents" as those

2. *See infra* Part IV.C. We also compare our results with other work that has found complexities and a non-monotonic citation to value relationship. *See* Abrams et al., *infra* note 33.

likely to be asserted in infringement litigation.[3] However, assertion is an imprecise proxy for value—for instance, most completed patent litigations result in non-infringement or invalidity findings (*i.e.*, no value), and most of those that find infringement result in relatively low damages awards (low value). Also, the vast majority of patent lawsuits are settled before trial, and these may similarly result in very low value or, in cases where the patent holder drops the suit, no value. Yet, assertion-based proxies will label any asserted patent as "valuable" irrespective of the actual amount of value, if any, eventually awarded. Other widely-used proxies focus on whether a patent has been maintained or abandoned, but these similarly do not reflect the fact that most patents maintained as active are never licensed or asserted or even practiced, nor do these proxies reflect the vast disparity in values of those few maintained patents that have any net worth.

Moreover, different sources of patent value are likely to vary widely depending on how the patent is used, whereas the general term "patent value" overlooks such distinctions. Value from licensing revenues versus firm market capitalization, and intangible asset worth versus enforcement value, are not necessarily directly comparable to each other, and different factors may have different influences on each type. For example, a patent that has been widely licensed may generate low damages in an individual litigation against an accused infringer,[4] and a patent held for defensive purposes may have high value to its owner precisely because it is not licensed to third parties. Even specifically focusing on value in litigations, some patents may be more valuable in voluntary settlements relative to fully-litigated enforcement awards (*e.g.*, NPE patents versus practiced patents, where the latter may be more likely to garner higher awards of lost profits).[5]

Here, we focus on patent enforcement value via the amounts awarded for infringement of an individual patent in fully litigated cases, which allows us to precisely examine the features of this type of patent value and distinguish it from other types. The sections below describe the leading prior scholarship, focusing on the predominant proxy-based studies in Part A, and addressing in Part B on the few direct studies of value that have been conducted. This section concludes by describing patent enforcement value as a specific type of patent value and identifying prior work relevant to the study thereof.

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3. *See*, *e.g.*, John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 449 (2004).

4. In particular, prior license royalties are typically taken into account when computing reasonable royalties. *See generally ResQNet.com, Inc. v. Lansa, Inc.*, 594 F.3d 860 (Fed. Cir. 2010).

5. *See* Michael J. Mazzeo et al., *Do NPEs Matter? Non-Practicing Entities and Patent Litigation Outcomes*, 9 J. COMPETITION L. & ECON. 879 (2013) [hereinafter Mazzeo et al., *Do NPEs Matter?*] (analyzing the characteristics of NPE patents and finding that NPEs are likely to receive lower award amounts relative to other patent holders).

A. *Proxies for Value*

The leading studies of patent value use proxies for economic value and seek to empirically determine the factors that influence the proxy in question. A prime example is *Valuable Patents* by Allison, Lemley et al.,[6] which focuses on whether a particular patent will be asserted in court. The authors argue that the connection between assertion and core asset value is strong, but they also acknowledge the limitations of their proxy: "While not every valuable patent is necessarily litigated, we believe that the relationship is strong enough to justify the conclusion that litigated patents are a good proxy for valuable patents. . . . We acknowledge that the litigation/value connection is an important and controversial assumption."[7]

The authors conclude that, relative to non-litigated patents, "valuable patents" according to their definition are more likely to: (1) be younger, (2) be owned by domestic rather than foreign companies, (3) issue to individuals or small companies, (4) have more forward and backward citations, (5) spend longer in prosecution, (6) contain more claims and (7) predominantly come from the mechanical, computer, medical device, and other select industries.[8] Notably, the authors also observe that "valuable patents" tend to have more continuations and other child applications than non-litigated patents[9] or otherwise come from large patent families (*i.e.*, clusters of domestic patents deriving from the same ultimate parent).[10] However, the authors do not expressly distinguish between upstream and downstream patents or find significant differences in value between them.[11]

The *Valuable Patents* article spawned a number of follow-on and responsive studies and commentaries by both the original authors and other academics. For example, Allison, Lemley, and Walker also studied "extreme value" patents, which they define as those patents asserted in multiple litigations, and further focusing on the role of non-practicing entities in launching multi-assertion campaigns.[12] Also, Miller analyzed the connection between these most-litigated patents and validity.[13] And Chien has further

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6. Allison et al., *supra* note 3.

7. *Id*. at 443.

8. *Id*. at 438.

9. *Id*. at 456-8.

10. *Id*. at 457 n.93.

11. Rather, both patents that give rise to more children and patents with larger overall families are found to be "valuable" based on likelihood of assertion. *Id*. at 457-58 ("Litigated patents were part of a family of 1.85 patents on average, while non-litigated patents had a family size of only 1.22.").

12. *See generally* John R. Allison et al., *Extreme Value or Trolls on Top? The Characteristics of the Most Litigated Patents*, 158 U. PA. L. REV. 1 (studying litigation rates of patents in specific industries).

13. *See generally* Shawn P. Miller, *What's the Connection Between Repeat Litigation and Patent Quality? A (Partial) Defense of the Most Litigated Patents*, 16 STAN. TECH. L. REV. 313 (2013).

extended the methodology of predicting patent litigation, including by introducing new "intrinsic" and "acquired" patent attributes, such as recorded transfers and liens.[14]

Valuable Patents and its progeny draw upon a formative set of articles by Lanjouw and Schankerman, which study the predictors of patent infringement suits in a broader economic context including market and industry factors, litigant characteristics, sector-specific patent densities and technology class.[15] These studies identify certain characteristics of parties and their patent assets that increase the likelihood of a suit being filed in a particular market/industry context. They find in part that the probability of patent litigation increases with respect to patents that are central to follow-on innovations of a company, particularly between companies that are close rivals or where the patent holder needs to maintain a reputation for aggressive enforcement.[16] By contrast, companies in concentrated industries or with particularly large patent portfolios relative to others are less likely to engage in litigation as they often have other means of avoiding disputes or cross-licensing.[17] These studies further identify certain specific patent characteristics that increase the probability of assertion, most notably patents having a higher number of claims and more forward citations per claim.[18] Notably, the authors do not study these attributes in isolation, instead analyzing them relative to the distributions of similarly-situated patents based on industry classification and other groupings.[19]

Finally, another common proxy for value focuses on patent "mortality" rates, namely the likelihood that an entity will abandon its patent rather than pay scheduled maintenance fees to the USPTO at statutory intervals. Like assertion, maintenance is a reasonable proxy for value in many respects—if a patent holder pays to maintain a patent then it is likely to be more valuable to that entity than an abandoned patent. However, payment of maintenance fees is

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14. Colleen V. Chien, *Predicting Patent Litigation*, 90 TEX. L. REV. 283, 298-99 (2011).

15. *See, e.g.*, Jean O. Lanjouw and Mark Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. ECON. 129 (2001); Jean O. Lanjouw and Mark Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?*, 47 J.L. & ECON. 45 (2004); Jean O. Lanjouw and Mark Schankerman, *Research Productivity and Patent Quality: Measuring Innovation with Multiple Indicators*, 114 ECON. J. 223, 441-65 (2004).

16. Lanjouw and Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, *supra* note 15, at 129-30.

17. Lanjouw and Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?*, *supra* note 15, at 48.

18. Lanjouw and Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, *supra* note 15, at 131.

19. *Id.* Implicitly this approach acknowledges that forward citations are influenced by contextual factors—*e.g.*, patents in more densely-patented fields are more likely to have a higher number of forward citations arising during ordinary prosecution of subsequent patents by other applicants. Although this supports the connection between forward citations and assertion (since patent density is a strong predictor of assertion), the connection to economic value is less direct.

a very broad brush for tracing the outlines of patent value, given that renewal fees are quite low and companies have a variety of reasons for maintaining their portfolios independent of specific value assessments (including common contractual requirements to maintain assets that are subject to blanket financing or license agreements).

One study in this tradition, authored by Barney in 2002,[20] identified several statistical markers for patent "value" as represented by the survival-mortality relationship. Specifically, that study found that maintained patents are more likely to come from certain IPC classes, including that "patents relating to genetic engineering and computers appear to be statistically more valuable."[21] It also analyzed structural features, finding that patents having more independent claims, shorter claims, and longer specifications are more valuable.[22] Interestingly, it also found that patents claiming priority to early applications are likely to be *more* valuable, explaining that: "Intuitively, more priority claims probably means a patent is entitled to an earlier filing date, which can be beneficial in fending off art-based validity attacks. It could also indicate a greater level of overall interest and investment by the patentee."[23] The study does not appear to examine continuity data or child applications, or make the distinction between upstream and downstream patents. Finally, it finds a strong correlation between forward citations and patent value, echoing prior studies that reached similar conclusions.[24]

B. *Direct Studies of Value*

Certain studies have taken a different approach than the value-proxy corpus and analyzed economic value directly. These studies often use market capitalization of the patent holders as their measure of value, although some more recent studies have focused on royalties from certain types of licensing relationships,[25] although none focus on enforcement value from infringement awards.

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20. Jonathan A. Barney, *A Study of Patent Mortality Rates: Using Statistical Survival Analysis to Rate and Value Patent Assets*, 30 AIPLA Q.J. 317, 329 (2002). Another study examining patent renewal rates was authored by Bessen in 2006. James Bessen, *The Value of U.S. Patents by Owner and Patent Characteristics* (Boston Univ. Sch. of Law, Working Paper No. 06-46, 2006), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=949778. These studies also draw on foundational scholarship by Mark Schankerman and Ariel Pakes. *See, e.g.*, Ariel Pakes & Mark Schankerman, *The Rate of Obsolescence of Patents, Research Gestation Lags, and the Private Return to Research Resources*, *in* R&D, PATENTS, AND PRODUCTIVITY 73-88 (Zvi Griliches ed., 1984); Mark Schankerman & Ariel Pakes, *Estimates of the Value of Patent Rights in European Countries During the Post-1950 Period*, *in* 96-384 THE ECONOMIC JOURNAL, 1052-1076 (1986).

21. Barney, *supra* note 20, at 331.

22. *Id.* at 332-33.

23. *Id.* at 333. *Cf. infra* Part IV.C (finding that priority claims are significantly *negatively* correlated with award value).

24. *Id.* at 333 n.43.

25. *See* Abrams et al., *infra* note 33.

One of the leading studies that analyzes market capitalization value was published in 2005 by Hall, Jaffe, and Trajtenberg, titled *Market Value and Patent Citations*.[26] This work provides conceptual and practical foundations for studying forward citations generally, and it specifically investigates the extent to which citations of a firm's patents collectively are associated with that firm's market valuation, as measured by Tobin's Q component ratios of R&D to assets, patents to R&D and forward citations to patents. Their work further developed statistical techniques to correct forward citation counts for age truncation effects (*e.g.*, the fact that forward citations accrue over time and are therefore dependent on the measurement date and likely to be highly truncated for young patents).[27] This study also accounts for the distributional significance of different technology classes—as with Lanjouw and Schankerman's methodology described above, they adjust for expected lifetime citation counts relative to the patenting density of the particular industry sector.[28] The authors further study specific details of forward citations that are associated with higher market value, finding that high citation concentrations correspond to significant market premiums and further observing significant differences between self-citations (by subsequent applications of the same patent holder) versus citations by third party applications.[29]

Notably, market capitalization based on portfolio value is still a proxy for individual patent value (although arguably a more precise one than assertion or mortality). Furthermore, one might expect forward citations to be more strongly correlated with the market value of a firm's knowledge stock than with patent-specific enforcement award value, since market value and forward citations operate to a certain extent by similar mechanisms. That is, both function as independent estimations of the worth or importance of an underlying asset, rather than solely as private owner-informed valuations of the asset itself.[30]

Importantly, our results herein are consistent with certain key findings of Hall et al., which lends credibility to our analysis. Specifically, they find that self-citations from "down-the-line patents owned by the same firm" generally indicate higher value than third party citations.[31] This is consistent with our

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26. Bronwyn H. Hall, Adam Jaffe & Manuel Trajtenberg, *Market Value and Patent Citations*, 36 RAND J. ECON. 16 (2005).

27. *Id.* at 21-22.

28. *Id.*

29. *Id.* at 31-33. *See also* Bronwyn H. Hall, Adam Jaffe & Manuel Trajtenberg, *The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools* (Nat'l Bureau of Econ. Research, Working Paper No. 8498, 2001), http://www.nber.org/papers/w8498.pdf.

30. One might also expect certain network effects in forward citations, whereby patents that are highly cited may be more likely to register or be taken seriously in prior art searches and therefore be cited again by subsequent applications. Moreover, there may be feedback effects for market value in that forward citations are publicly reported and therefore may influence market value directly to the extent they are used in analysts' assessments and investment algorithms.

31. Hall et al., *supra* note 26, at 31-33.

finding that upstream patents are significantly more valuable than downstream patents—although defined in terms of continuation applications rather than "down-the-line patents" which generate self-citations, both upstream patents and self-cited patents are defined by their impact on follow-on inventions by their owners.[32]

Transitioning from market value to licensing value, a recent study of the connection between licensing value and forward citations was conducted by Abrams, Akcigit, and Popadak, titled *Patent Value and Citations: Creative Destruction or Strategic Disruption?*.[33] The authors utilize a proprietary dataset of licensing revenues derived from patents owned by a large non-practicing entity and analyze the relationship between forward citations and lifetime licensing value. Although their dataset is somewhat selective, their results are striking. In particular, they model the citation-licensing value relationship as an inverted U-curve, finding that citations tend to increase with value for "productive" innovation efforts aimed at developing and patenting new technologies, whereas forward citations decrease with value for "strategic" patents aimed at protecting established market share and preventing entry by subsequent firms.[34]

Their findings also provide support for the upstream-downstream distinction observed herein: in particular, they find evidence that continuation and divisional patents (*i.e.*, downstream patents) are more likely to be associated with "strategic" patenting which individually may have lower value, whereas the earlier upstream patents that are protected by such efforts may have higher value and sustain their market prominence longer as a result.[35] Yet, they also predict that strategic upstream patents are likely to have a lower citations-to-value relationship, and they observe strong negative quadratic terms in their citation-to-value regressions that give rise to the inverted-U curve they report. We conduct specific analyses below to investigate the extent to which their findings from NPE licensing value are consistent with enforcement value in court awards.

Importantly, there are many conceptual reasons why licensing value may not be directly comparable to enforcement value. Rather, voluntary transactions differ from court enforcements in several respects. Even to the extent licenses are negotiated in the "shadow of litigation," voluntary transactions often involve sources of value apart from the patents themselves (including associated services, information exchange, etc.).[36] Also, other considerations

32. *See infra* Part IV.C.

33. Abrams et al., *Patent Value and Citations: Creative Destruction or Strategic Disruption?* 1 (Nat'l Bureau of Econ. Research, Working Paper No. 19647, 2013), http://www.nber.org/papers/w19647.

34. *Id.* at 2.

35. *Id.* at 7.

36. Indeed, courts recognize the difficulty in using licensing royalties as a benchmark for litigation outcomes, and the selection of comparable licenses and extent to which their economics impact reasonable royalty awards are often heavily litigated.

often influence negotiations, such as relative bargaining power, the reputations of the parties, and the desire to avoid the high costs of patent litigation. More fundamentally, voluntary transactions including settlements reflect the "meeting-of-the-minds" between parties as to whether and on what terms on which to license a given patent, whereas enforcement awards represent the special case where parties do not agree to any license.

In this light, enforcement awards provide a unique measure of patent asset value relative to other measures. By minimizing transactional incentives and stock market influences that may affect market-based measures, and by avoiding the imprecision of proxies, court awards offer a specific monetary valuation of the patent rights held to be infringed. We refer to this measure as *patent enforcement value*,[37] which arises from litigating a claim to judgment and obtaining a non-negotiated remedy.[38]

Prior work by the author and two coauthors provides a framework for analyzing patent enforcement value.[39] Those studies conducted large-scale empirical analyses of patent infringement awards, focusing on the factors that are associated with the aggregate value awarded in each case. The results identified key predictors of patent case value, including certain characteristics of the parties (such as enterprise size and whether the plaintiff is an NPE), type of award (such as lost profits versus reasonable royalties) and relevant patent attributes. However, those studies do not address patent-specific value (as opposed to case value) or focus in depth on the individual patent attributes that are associated with such value. The present study builds from that framework to analyze patent-specific enforcement value and the attributes associated therewith, using the methodology described below.

II. DATASET AND METHODOLOGY

This Part describes our empirical methodology. Specifically, Part A describes the dataset and data collection procedure used to code it. Part B details the preprocessing methodology for refining the dataset and preparing the variables for statistical analysis. Finally, Part C provides summary statistics and distribution analyses of the final data.

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37. More specifically, patent enforcement value as measured by lost profits or reasonable royalties represents the amount of compensatory damages for infringement proven to and awarded by a court within the market and legal framework existing at the time.

38. We do not claim that enforcement value is independent of market factors or transaction value. To the contrary, we argue that enforcement value provides a clear quantitative measure from which to study the influence of various patent characteristics, and from which to derive models of value for further study.

39. Michael J. Mazzeo et al., *Explaining the "Unpredictable": An Empirical Analysis of U.S. Patent Infringement Awards*, 35 INT'L REV. L. & ECON.58 (2013) [hereinafter Mazzeo et al., *Explaining the "Unpredictable"*]; *see also* Jonathan H. Ashtor et al., *Patents at Issue: The Data Behind the Patent Troll Debate*, 21 GEO. MASON L. REV. 957 (2014); Mazzeo et al., *Do NPEs Matter?*, *supra* note 5.

A. *Dataset*

Our dataset comprises U.S. District Court cases decided from 2006 through 2011 in which a monetary award was granted for patent infringement. We start from a database of all patent cases reported in Westlaw from 1995-2011, which is maintained and was licensed to us by PricewaterhouseCoopers ("PwC").[40] Specifically, our final dataset comprises a total of 221 cases and 385 patents, with over seventy unique variables for each patent. The following paragraphs provide additional detail regarding the cases, patents, and variables studied herein.

1. *Cases and Patents*

The complete PwC dataset from 1995 through 2011 contains 1,751 patent cases in Westlaw in which a decision was made on patent validity and infringement, either at summary judgment or following trial. Of those 1,751 cases, 421 included holdings of validity and infringement for at least one patent and either had available award amounts or were cases related to Abbreviated New Drug Application (ANDA) litigation. There were 45 ANDA cases with $0 awards (since ANDA cases do not result in damages) and 376 cases with reported awards greater than $0.

In the target period of 2006-2011, the PwC dataset contains a total of 335 patent cases in which at least one patent was held valid and infringed. Of these cases, forty were ANDA cases and seventy-four did not have a reported award (likely due to post-trial settlement before damages were assessed). The awards in the remaining 221 cases comprise the dataset used herein.[41]

After selecting the relevant years from the PwC dataset, our research team retrieved from Westlaw the complaints, dockets, opinions and verdict forms of each case. Using these materials, we verified the award amount and identified the patent(s) on which the award was based. To ensure reproducibility of our results and avoid selection bias, we did not add or exclude any cases from the dataset during this phase of coding; unlike proprietary datasets based on unpublished or limited data, our dataset should reflect the majority of reported decisions during the relevant time period.[42]

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40. *See 2014 Patent Litigation Study*, PRICEWATERHOUSECOOPERS (July 2014), http://www.pwc.com/en_US/us/forensic-services/publications/assets/2014-patent-litigation-study.pdf [hereinafter 2014 PwC Study]. PwC uses this data in its annual reports and statistics on patent litigation, which are widely cited and used by academics, practitioners and government policy-makers.

41. The breakdown of cases per year are as follows:

2006	2007	2008	2009	2010	2011
33	39	45	42	36	26

42. We note that other sources report higher case counts for this time period, such as PatStats.org. Certain discrepancies may be due to different categorizations of infringement awards (*e.g.*, we do not include contractual disputes), awards for particular types of claims

2. *Intrinsic Attributes*

To analyze the impact of structural and other inherent patent characteristics on award value, we coded approximately forty-five "intrinsic attributes" for each patent in the dataset.[43] Intrinsic attributes are useful in the analysis because they exist at the time the patent is granted and, with certain exceptions,[44] remain unchanged through the life of the patent. Accordingly, they generally are unaffected by *ex post* events such as patent transfers, collateralizations, enforcement, and licensing and are not influenced by product-specific and market-driven effects, such as the ultimate commercialization value of the patented technology.

The intrinsic attributes studied herein can be loosely grouped into the following four categories: priority attributes, structural features, prosecution history and backward citations, and inventor characteristics. Each category is further described below, and the complete list of intrinsic patent attributes included in our dataset is provided in Appendix A.

a. *Priority Attributes:*

The variables in this category relate to priority claims made by the applications from which the asserted patents issue, including whether the application was published prior to issuance, whether the application claimed priority to an earlier provisional or non-provisional application, whether the application was a direct child of another application (*e.g.*, a continuation, continuation-in-part or divisional), and the number of parent applications identified on the face of the patent. We also coded various dates associated with these factors, such as the original priority date and the filing date, from which we calculated the duration that elapsed between them. These variables were coded from USPTO records and the patents themselves together with information from Public PAIR and Google Patents.

(*e.g.*, we exclude all ANDA cases) and damages awarded (*e.g.*, we do not count fees or other monetary awards that are not directed to compensation for infringement). Nonetheless, there are likely some reporting gaps, although we expect that these are likely to be small and generally unbiased. We are grateful to David Schwartz for pointing out the discrepancy with the PatStats counts.

43. The "intrinsic" versus "acquired" attributes terminology is commonly used in prior scholarship. *See*, *e.g.*, Chien, *supra* note 14, at 287.

44. Notably, intrinsic characteristics are not entirely uninfluenced by *ex post* events. For example, structural features, such as the number of dependent and independent claims, may be changed through reexamination proceedings during the life of the patent, which are more likely to be initiated when a patent is asserted. We coded the intrinsic attributes existing as of the time of assertion, accounting for changes due to reexaminations, and we included a flag indicating whether the patent was reexamined.

b. *Structural Features*

These variables relate to the type and structure of the patents asserted, such as the application type (utility, design, or plant), first industry classification (IPC category),[45] number of dependent and independent claims, respective lengths of the written description and claims (measured as number of patent columns of each), number of figures, and boolean flags for whether the patent contains formulas or data tables. These variables were coded from the patent files.[46]

c. *Prosecution History and Backward Citations*

We gathered extensive information relating to the prosecution history of the patents prior to issuance and citations to prior art made by the applicant and examiner. These variables include the duration of prosecution, number of Office Action rejections, and boolean flags for terminal disclaimers, term adjustments, and certificates of correction. Also, we counted the numbers of backward citations made by the applicant and the examiner, respectively, as well as the type of prior art cited (patents versus non-patent references). These variables were largely coded from Public PAIR records and the patent documents.

d. *Inventor Characteristics*

We also coded several variables to investigate the relationship between the inventors of a patent and its expected enforcement value. Specifically, we counted the number of total inventors and specific numbers of domestic and foreign inventors named on each patent (based on their reported country of residence). Additionally, using Public PAIR we also coded whether the applicant filed with small entity or undiscounted status.[47]

3. *Acquired Attributes:*

As discussed above, prior scholarship has recognized the importance of acquired attributes,[48] and we included several acquired attributes in our dataset to investigate the relationship with enforcement value. Specifically, our dataset

45. *See infra* Appendix D.

46. Other studies have included structural features in analyzing proxies for value. *See*, *e.g.*, Barney, *supra* note 20, at 332-33. Also, recent work has used sophisticated computational analysis of structural features to analyze validity. *See*, *e.g.*, Yan Liu et al., *Latent Graphical Models for Quantifying and Predicting Patent Quality*, 17 ACM SIGKDD INT'L CONF. ON KNOWLEDGE DISCOVERY AND DATA MINING 1145 (2011).

47. Micro-entity status was not relevant for the patents in our dataset given the date range.

48. *See generally* Hall et al., *supra* note 26 (studying forward citations).

includes forward citations, recorded transfers and liens, and the number of child applications claiming priority to the patent at issue, as further described below. The complete list of acquired attributes and corresponding data sources is provided in Appendix B.

a. *Forward Citations*

Using the "Referenced By" feature in the USPTO database,[49] we counted the number of citations received from other patents that were applied for as of the date of the complaint in which the patent at issue was asserted. To mitigate age-truncation bias, we then computed an age-adjusted number of forward citations for each patent by dividing by the fraction of the patent's twenty-year life elapsed as of the complaint date. This provides a first-order correction to the truncation bias, which approximates a uniform citation distribution over time (and therefore likely overstates the number of lifetime forward citations, particularly for young patents). However, employing a distribution-specific approach, such as the widely used adjustment developed by Hall, Jaffe and Trajtenberg in their NBER work,[50] would also entail significant noise given the relatively young age of the patents in our dataset relative to the population at large. In particular, we queried the 2012 updated NBER dataset, which includes all patents issued through 2006,[51] and found that 358 of the 385 total patents in our sample were included therein. Yet, many of these 358 patents had issued within a few years of 2006, meaning that the future patents citing to them are not reflected in the NBER dataset, leading to serious truncation. Accordingly, NBER's age-adjustment factors and generality measures are not necessarily reliable for the patents we study here. After employing our first-order adjustment, significance testing reveals that the strong negative correlation between forward citations actually received and age is eliminated.

Also, we note that most of the patents in our dataset lie towards the end of the 3-7 year age range (the median patent age of our sample is 7.3 years and the average is 8.3 years) when the bulk of lifetime citations are expected to be received,[52] and therefore we expect that even the unadjusted citation data is likely to capture the major proportion of lifetime citations expected to be received. Additionally, to further mitigate age truncation effects, we re-coded the forward citation counts by relaxing the limitation to only citing patents that had been applied for as of the relevant complaint date and instead including all citing patents issued through December 2014. This expands the citations

49. *USPTO Patent Full-Text and Image Database*, U.S. PATENT & TRADEMARK OFFICE (last visited May 7, 2015), http://patft.uspto.gov/netahtml/PTO/search-bool.html.

50. Hall et al., *supra* note 26, at 21-22 (providing a more complex adjustment technique).

51. NATIONAL BUREAU OF ECONOMIC RESEARCH, PATENT DATA PROJECT, https://sites.google.com/site/patentdataproject/Home (last visited on Oct. 24, 2015).

52. *See* Alan C. Marco, *The Dynamics of Patent Citations* 5-6 (Vassar College Economics, Working Paper No. 84, 2006).

window to encompass the major portion of the lifespan of most patents in our sample, if not the entire term in many cases. Our results are largely invariant to the different measures we employ.[53]

b. *Recorded Transfers*

We also code recorded patent assignment and transfer data,[54] in order to examine the relationship between patent transfers and value. Theoretically, one might expect a positive correlation between transfers and enforcement value, in that a patent that has been sold is one that was perceived as valuable by the transacting parties and for which the buyer's price quantifies the amount of value exchanged.[55] However, one might also expect a negative relationship on the theory that a patent holder is less likely to sell a patent with high enforcement value, particularly if it covers important products or technologies. Additionally, non-practicing entities complicate the relationship, in that they typically acquire their patents from other entities prior to enforcement and typically will record this transfer in order to demonstrate standing to enforce the patent (thereby increasing the number of recorded assignments of their patents). NPEs have been found to receive lower compensatory damages awards on average,[56] which could tend towards a negative correlation with the number of transfers. Our transfer data was coded from the USPTO Assignments database, filtering for records that pertain to third-party transfers and excluding name changes or other transactions involving the same patent holder.

c. *Recorded Liens*

We also study data on recorded liens, which have received less attention in

53. We also intend to further examine correlations using more specific citation measures, such as self-citations versus third party citations and within-field versus external citations, in follow-on studies.

54. Previous studies have also used these acquired characteristics. *See*, *e.g.*, Chien, *supra* note 14, at 287. Although USPTO records only reflect transfers that have been recorded, whereas some transfers may remain private, recordation is inexpensive and the patent recording statutes protect those who promptly record against subsequent title claims. *See* 35 U.S.C. § 261 ("An assignment, grant or conveyance shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless it is recorded in the Patent and Trademark Office within three months from its date or prior to the date of such subsequent purchase or mortgage.").

55. Notably, Serrano has empirically studied the relationship between patent assignments and value (as proxied by forward citations) and found that citations significantly correlate with assignments. *See* Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents*, 41 RAND J. ECON. 686 (2010). We observe significant correlations between forward citations and assignments, but we find that assignments are significantly negatively related to the actual enforcement value awarded in court. This further highlights the distinctions between types of patent value.

56. *See* Mazzeo et al., *Do NPEs Matter?*, *supra* note 5, at 899-900.

prior scholarship. Liens or security interests may be recorded for a variety of reasons, most frequently where the patent is being used as collateral for a bank loan or other financing. Theoretically one might expect a positive relationship between recorded liens and enforcement value because most financial lenders require borrowers to seek prior approval before enforcing the patents that are granted as collateral; accordingly, the patent holder may expect higher enforcement value for encumbered patents because they have taken the extra step of obtaining lender approval prior to enforcement.[57] We coded the number of security interests recorded in the USPTO Assignments database, filtering for recordations of relevant security interests and excluding releases of previously granted liens. Next we converted this data to a boolean flag of whether any liens were recorded, given that the counts were highly skewed (*i.e.*, most patents in the dataset had zero recorded liens, and only approximately 13% had a one or more liens recorded).[58]

d. *Child Applications*

Finally, we also investigated each patent's progeny of subsequent U.S. continuations and divisionals based on continuity data from Public PAIR.[59] One might expect child continuity data to be an important indicator of enforcement value, whereby patents with more children may be more likely to be early-stage inventions and thereby possibly have greater value. Also, subsequent child applications may reflect ongoing investment and R&D by the patent holder in that particular technology, which could both generate more value and also reflect that the underlying technological resource is inherently more valuable. Furthermore, prior research has linked continuation practice with strategic efforts by the patent holder to shield the invention from subsequent disruptive market entry, which may enable the technology owner to maintain market power longer and thereby accrue more enforcement value.[60]

Given the high skew of this variable (most patents had zero children, and several with children had multiple children),[61] we used a boolean flag

57. One might also expect a negative relationship if the patent holder is less likely to pledge as collateral patents that it perceives as valuable, in order to avoid encumbering them. However, given that many financing agreements require blanket liens on all patents owned by the patent holder, the patent holder is unlikely to be able to select which patents to pledge as collateral.

58. Notably, this data likely includes some reporting bias in that liens are not required to be recorded prior to enforcement; however, given that financial lenders have incentives to perfect their interests and recording against U.S. patents is a relatively cheap and routine practice for many lenders, we expect this effect to be minimal.

59. This analysis could be extended to include foreign child patents based on WIPO data, and one could expect that this would further reinforce the effects observed by domestic data alone.

60. Abrams et al., *supra* note 33, at 7.

61. Specifically, 121 patents had zero children, 78 had one child, 47 had two children, 70 had three or four children, and 69 had five or more children.

indicating whether or not subsequent U.S. child applications had been filed from each patent.

4. *Case and Party Characteristics:*

In addition to intrinsic and acquired patent attributes, our dataset includes approximately twenty variables relating to each case and the litigants. Case variables include the Circuit in which the U.S. District Court was located, flags indicating the type of damages awarded (*e.g.*, lost profits or reasonable royalties, and whether enhanced damages were awarded), whether a judge or jury decided the case, and the length of the litigation. Litigant variables include the size, industry SIC code, Fortune 500 status, and foreign versus domestic domicile of the plaintiff and defendant.[62] We principally used the complaint and final court opinion or order to code the case-related variables, and we used Mergent records and the Forbes Fortune 500 list for the applicable year of decision to code the party characteristics. The complete list of case and party characteristics included in our dataset is provided in Appendix C.

5. *Award Allocation Variables:*

Finally, in cases where multiple patents were asserted, we coded variables to describe the allocation of the ultimate damages award among the patents that were held valid and infringed in order to obtain the patent-specific award amount. This process entailed close examination of the final disposition of each such case, principally relying on verdict forms in jury trials and the order memoranda in bench trials. First, starting from the full set of 221 cases, we separated out those cases in which only a single patent was held valid and infringed. This subset contained 136 cases, and for these we allocated the total award amount to the asserted patent.[63] Of the remaining eighty-five cases in which multiple patents were held infringed, we investigated the opinions and verdicts to identify those cases that explicitly allocated a distinct award amount to each of the infringed patents. There were thirteen such cases, and we assigned the case-specified award to the applicable patents.

For the remaining 72 cases in which multiple patents formed the basis of the award and the court or jury made no explicit, we reviewed the case and docket materials to determine the number of claims that were held infringed for each of the infringed patents. Using these claims counts, we allocated the lump-sum award amount on a *pro rata* basis according to the number of infringed claims in each such patent.[64] Notably, where a verdict or order specified that a

62. Our dataset also includes a flag indicating whether the patent holder is a non-practicing entity, but this study does not analyze that characteristic. A separate study will analyze NPE patents and their characteristics and value.

63. These included both cases in which only a single patent was asserted and cases in which multiple patents were asserted but only a single patent was held valid and infringed.

64. For example, if a case awarded $300,000 for infringement of two patents, *A* and *B*,

particular claim was infringed multiple times, such as by multiple infringing products of the defendant, we counted that claim multiple times for the corresponding patent.[65] Also, sixteen of these cases were directed verdicts for which the case materials did not specify which claims were infringed. For these cases, we allocated the awards *pro rata* based on the number of independent claims of each infringed patent.

B. *Pre-Processing Methodology:*

Following the coding phase, we conducted a number of standard preprocessing steps to facilitate statistical analysis and ensure robustness of the results.[66] We used both Microsoft Excel and R for the preprocessing steps, which included the following:

- Certain of the raw data variables were converted into boolean flags to avoid highly skewed and discontinuous data, such as the numbers of foreign inventors, U.S. child applications, non-patent backward citations and recorded liens, respectively.

- Certain categorical variables were created to represent non-numerical data. For example, IPC codes were categorized into eight groupings based on the first letter industry marker, as shown in Appendix D. Also, SIC codes were grouped into ten categories based on NAICS classification ranges according to the first two digits thereof, as shown in Appendix E.

- After computing patent age and other relevant time durations from the dates we coded (*e.g.*, patent prosecution time was computed as the number of days elapsed between the filing date and issue date), many of these variables were log-transformed to produce normally distributed regressors. For example, prosecution time, litigation length, and the time elapsed prior to assertion (age of patent as of the complaint date) were log-transformed, as were certain count variables where this produced clearer results.

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and the verdict found 2 claims of patent *A* infringed and 1 claim of patent *B* infringed, then the allocation would be $200,000 for patent *A* and $100,000 for patent *B*. We also note that other allocation methods may be appropriate.

65. One advantage of this approach is internal consistency with cases in which a single patent was infringed—that is, a *pro rata* allocation with a single infringed patent would allocate the entire award to that patent.

66. For example, several preprocessing steps were undertaken to generate normally distributed regressors and eliminate heteroscedasticity thereof in order to avoid unreliable or inflated regression coefficients. These steps, for instance, included log transformations of time and count variables to eliminate over-dispersion, as well as converting certain discontinuous and highly skewed integer variables into categorical factors or boolean flags.

- Finally, the patent-allocated award amount was adjusted for inflation and log-transformed to obtain the dependent regressor for analysis. Specifically, we first applied CPI adjustment to convert each award amount to 2011 dollars. Next, we log-transformed the inflation-adjusted amounts. Such transformation resulted in normally distributed values that allowed us to apply a linear regression model.[67]

C. *Summary Statistics:*

Prior to regression analysis of the full dataset, we generated several key statistics of the distribution of inflation-adjusted patent-specific award amounts. First, Table 1 below shows the mean, median, and standard deviation of the awards distribution, together with skew measures:

Table 1 – Patent Awards Summary Statistics

Statistic	2011 Dollars ($)	2011 Dollars (log)
N	385	385
Mean	$26,172,000	14.58
Median	$2,143,000	14.30
Max	$1,937,849,000	21.38
Variance	1.44e+16	7.46
Std. Deviation	1.20e+8	2.73
Skewness	11.61	-0.34
Kurtosis	172.14	2.80

Next, Figure 1 below plots a histogram of the non-transformed inflation-adjusted distribution, and Table 2 shows the decile amounts:

Figure 1 – Patent Awards Distribution (Histogram)

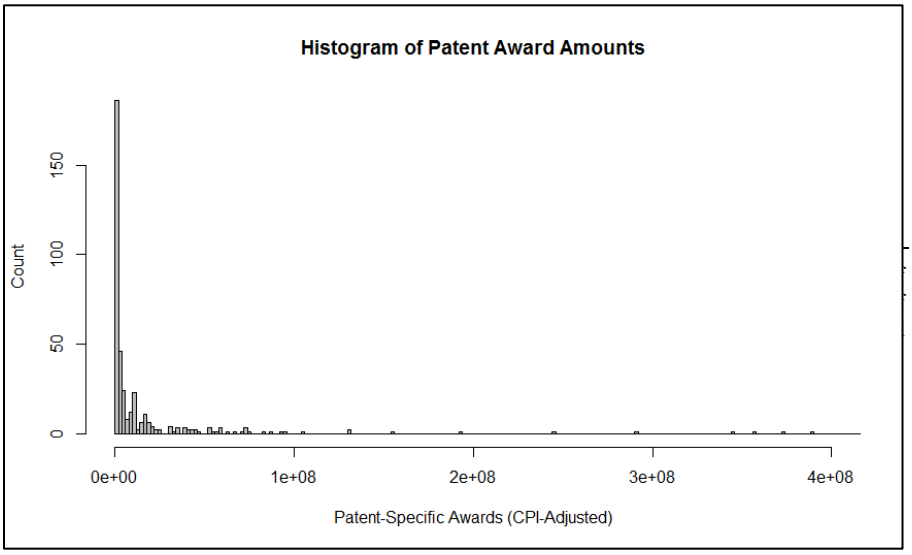


Table 2 – Patent Awards Distribution (Deciles)

Decile	Max. Award (2011 Dollars)	Count
0%	$644	38
10%	$40,561	38
20%	$137,070	39
30%	$508,010	38
40%	$1,042,990	39
50%	$2,142,857	38
60%	$3,808,688	38
70%	$8,867,199	39
80%	$16,034,170	38
90%	$43,340,160	39
100%	$1,937,849,000	1

We also analyzed the time-dependence of the award values over the six-year period by conducting a targeted regression with the year-of-decision variable and also plotting the respective means and standard deviations of the inflation-adjusted awards in each year. This analysis revealed no significant time trend over the period studied. Table 3 below shows the regression results and Figure 2 shows a box-plot of the awards data by year:[68]

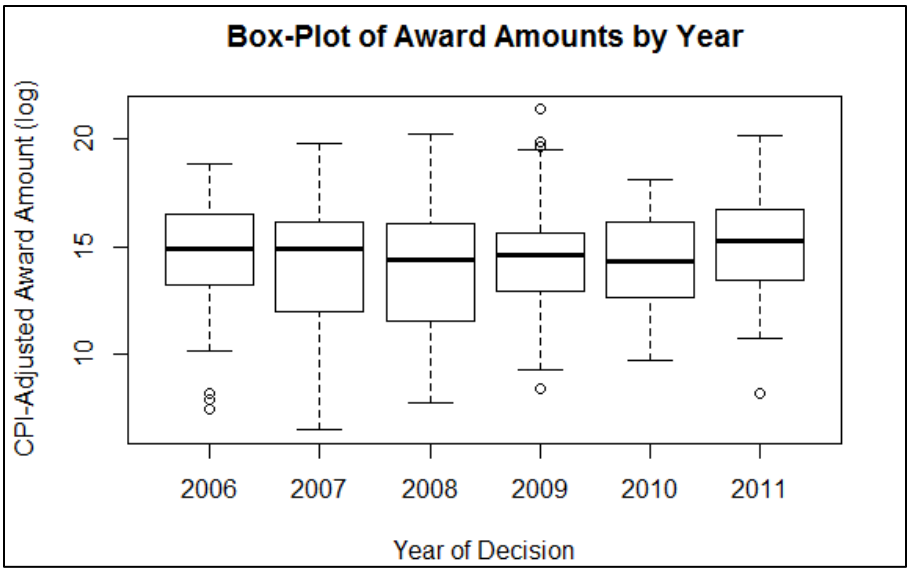
Table 3 – Time Regressions of Award Amounts

Variable	R^2	Adj. R^2	Std. Error (df)	F Statistic (df1, df2)	p-value
Year of Decision (Integer)	0.0010	-0.0016	2.733 (383)	0.3717 (1, 383)	0.542
Year of Decision (Factor)	-0.0166	-0.0036	2.726 (379)	1.278 (5, 379)	0.272

68. The breakdown of patent-specific award amounts per year are as follows:

2006	2007	2008	2009	2010	2011
52	65	84	76	65	43

Figure 2 – Award Amounts by Year



Finally, we conducted statistical tests to ensure that the log-transformed awards variable was normally distributed, thereby facilitating linear regression modeling. A Kolmogorov-Smirnov test was conducted to compare the log-transformed distribution against a randomly generated normal distribution having the same mean and standard deviation,[69] which found the transformed award amounts to be normally distributed within 5% and 1% degrees of statistical significance.[70]

III. ANALYSIS AND RESULTS:

This section presents the results from our statistical analyses of the complete preprocessed dataset described above. We conducted these analyses using R and its standard functions. Specifically, we ran linear regressions using the normally distributed numerical and boolean or categorical variables described above.[71] We also conducted correlation tests and tested for significant correlations among various patent attributes,[72] using the standard 95% confidence interval unless otherwise noted.

69. Specifically, 10 random normal distribution samples were generated using the mean and standard deviation of the log-transformed awards distribution, and the K-S test results were averaged over these 10 iterations.

70. Specifically, K-S testing over 10 iterations yielded a p-value of 0.481 (not significant) and D-value of 0.0644.

71. Specifically, the `lm` function in R was used for the linear regressions, with the default settings.

72. Specifically, the `cor.test` function in R was used for the correlation tables, with the default Pearson's moment method.

A. *Correlation Analysis*

Our first set of analyses focuses on investigating the characteristics of all patents in the dataset and the relationships between these attributes. Specifically, our dataset contains each of the 385 U.S. patents for which infringement damages were awarded during the relevant time period. Setting aside the question of *how much* value each of these patents has and what drives the differential amounts, we know that each of these patents has *some* enforcement value. That is, each of these patents is a "valuable patent" according to our definition. Accordingly, we first seek to study the characteristics of these patents and learn new insights about the features of "valuable patents" generally.

To do so, we construct a correlation table showing the pairwise correlations among relevant intrinsic and acquired attributes from the dataset. The table is an upper-triangular matrix (only showing values in the upper right-hand diagonal) to eliminate duplication in the transpose cells, and omits identity values along the diagonal.[73] Each cell shows the correlation between the patent attribute in the corresponding row with the attribute in the corresponding column, and we have included an indicator of the degree of significance thereof (*** for significance at the 0.1% level, ** at the 1% level, * for 5% and "." for 10%).

This analysis reveals several important correlations and trends, and the following presents our principal observations grouped according to the categories of intrinsic and acquired attributes described above. The full correlation table for these attributes is provided in Appendix F.

1. *Priority Attributes*

One striking result is the fact that the number of parents from which each patent claims priority is independent of the age-adjusted forward citations of that patent, whereas the number of children applications claiming priority to a patent correlates very significantly with age-adjusted forward citations. Taken together, these results may reflect an important difference between upstream and downstream inventions, whereby upstream inventions that give rise to more follow-on inventions (and therefore more child applications) have a greater technological impact, as represented by the higher number of forward citations received. By contrast, downstream inventions that derive from a longer lineage of parents may have lesser technological impact and fewer forward-citations, or they may be independently important and receive their own citations, leading to no overall correlation between number of parents and citation count.[74] We will further analyze the upstream-downstream distinction

73. To read the pairwise correlations from the upper triangular matrix, choose an attribute from the header row and read vertically down to the diagonal, then read right along the corresponding row to the edge.

74. The upstream-downstream distinction has received little attention in scholarship,

in the regression analysis below to determine the differences in enforcement value associated with each type of patent.

We also included in the correlation table the patent filing year, which exhibits several correlations one would expect and therefore provides a sanity check for the data.[75] For example, the time to assert (age at complaint) and numbers of assignments and liens are significantly negatively correlated with filing year, due to time truncation effects for younger patents.

The number of parent applications is significantly correlated with the number of inventors,[76] length of the written description, and number of figures, each of which would be expected for continuation and other child applications that are likely to claim additional subject matter and have greater specificity than more primary upstream applications.

Interestingly, the number of parents is also significantly positively correlated with the number of Office Action rejections received during prosecution. This could reflect the process of refining claims of the child applications to distinguish it from their parents. Alternatively, child applications with a greater number of parents could be facing a greater number of rejections because applicants are trying to test the limits of their priority and claim scope with new claims that arguably incorporate new matter or are not fully enabled by the earlier-filed specifications.[77]

2. *Inventor Characteristics*

There are also several other interesting correlations involving the number of inventors. For instance, patents with more inventors tend to have more claims, longer written descriptions, and more figures. These correlations likely reflect the added subject matter contributed by each inventor.[78] Also, patents with more inventors tend to have more child applications, which could also reflect additional subject matter contained in the original specification that can be claimed by future child applications.[79] Finally, patents with more inventors

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although there are some notable exceptions. *See*, *e.g.*, Dmitry Karshtedt, *The Completeness Requirement in Patent Law*, 56 B.C. L. REV. (*forthcoming* 2015) (defining "upstream inventions" as patents on research tools that could block subsequent inventive activity).

75. The priority year and publication status of each patent are omitted from the correlation table as they are strongly correlated with filing year and number of parents, respectively, and therefore exhibit similar pairwise results.

76. Similarly, for child applications with more parents, given that all or a subset of the child's named inventors will also be named inventors of the parent applications (and therefore have more hits on average).

77. Alternatively, applicants may file continuation claims that are not substantively different than the parent applications, which should also generate more rejections.

78. Inventorship requires contribution to the conception of the claimed invention, not merely reduction to practice, and therefore more inventors are likely to correspond to more claimed subject matter. *See Fiers v. Revel*, 984 F.2d 1164, 1169 (Fed. Cir. 1993).

79. Also, as noted above, the number of inventors is significantly positively correlated with the number of parents (i.e., later-stage child applications are more likely to have more inventors), which is expected based on the rules of inventorship and continuation practice.

tend to receive more forward citations, which may indicate greater technological impact (although this may also in part reflect citations by future patents of these inventors, which collectively may be greater in number than patents produced by fewer inventors).

3. *Recorded Transfers and Liens*

Another interesting result is the independence of recorded assignments and liens from many intrinsic patent attributes. Specifically, the numbers of recorded assignments and liens are not significantly correlated with priority attributes, structural features, or inventor characteristics.[80] Notably, to a certain extent one would expect a degree of independence of recorded transfers and liens from intrinsic patent characteristics, given the blanket approach typically taken to recordation practices. That is, where a business is being sold or bank financing is being provided, the buyer/lender will typically record against all acquired/pledged assets given the low costs associated with doing so (at least for domestic intellectual property), rather than select only the most valuable assets for recordation.

Yet, we do find that forward citations are significantly correlated with recorded assignments. This is consistent with recent findings of Serrano, who conducted a large-scale empirical study of transferred patents and found evidence that patents that have higher private valuable to their owners (as proxied by forward citations) are more likely to be transferred.[81] Yet, it also suggests some ambiguity in the types of value indicated by forward citations—specifically, as we find below, transfer value is often inverse to enforcement value and therefore if forward citation counts indicate both types of value then a higher number of forward citation alone does not necessarily suggest a high expected infringement award.

4. *Forward Citations*

Forward citations are one of the most strongly correlated patent attributes in the dataset, and they exhibit significant correlations with nearly every other variable. For example, age-adjusted forward citations are significantly positively correlated with the number of inventors, prosecution time and backward citations (both applicant and examiner citations), structural features (number of claims, length of written description and number of figures), as well as number of children (but not number of parents).

As noted above, these results further suggest that forward citations in bulk

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80. Although the number of assignments is significantly correlated with the number of children, and significantly negatively correlated with the filing year (or positively correlated with the age at trial/time-to-assertion), these results are likely driven by age truncation effects.

81. Serrano, Characteristics of Patent Litigation: A Window on Competition, *supra* note 55, at 686-708.

may be somewhat imprecise identifiers of particularly valuable patents. By contrast, more refined citation metrics could yield greater clarity. For example, in measuring relationships with stock market value, Hall, Jaffe and Trajtenberg distinguish between self-citations (from subsequent patents owned by the same applicant as the cited patent) and citations from third party patents.[82] Also, Lanjouw and Schankerman use the number of citations per claim and sophisticated measures of technology diffusion and technology area concentration to study the determinants of patent litigation.[83] More recently, Galasso and Schankerman also employ refined citation metrics to study the impact of patent invalidation on subsequent technology development (*e.g.*, new third party citations received after invalidation).[84] In future research we intend to parse citation data in closer detail to investigate which specific types of citations are most strongly associated with enforcement value.

B. *Regression Models:*

Next, we conducted regression analysis to study the relationship between various patent attributes and enforcement value. We first attempted to maximize the degree of fit of the model by incrementally adding variables and measuring the increased explanatory power they provide versus reductions in degrees of freedom. Table 4 below shows the degree of fit of various iterations of this process as well as the final resulting model:

82. Hall et al., *supra* note 26.

83. Lanjouw and Schankerman, *supra* note 15.

84. Alberto Galasso, & Mark Schankerman, *Patents and Cumulative Innovation: Causal Evidence from the Courts*, 130 Q.J. Econ. 317 (2014).

Table 4 – Fitting the Regression Model

Model	R^2	Adj. R^2	Std. Error (df)	F Statistic (df1, df2)	p-val	Sig. of Change (ANOVA)
(1) Baseline Model	0.5954	0.5470	1.838 (343)	12.31 (41, 343)	$< 2.2^{-16}$	N/A
(2) w/ Upstream & Downstream	0.6236	0.5723	1.786 (338)	12.17 (46, 338)	$< 2.2^{-16}$	***
(3) w/ Forward Citations	0.6315	0.5802	1.769 (337)	12.29 (47, 337)	$< 2.2^{-16}$	**
(4) w/ Assign. & Liens	0.6459	0.5941	1.740 (335)	12.47 (49, 335)	$< 2.2^{-16}$	**
(5) w/ Prosec. History	0.6729	0.6182	1.687 (329)	12.31 (55, 329)	$< 2.2^{-16}$	***
(6) w/ Inventor Characteristics	0.6807	0.6262	1.670 (328)	12.49 (56, 328)	$< 2.2^{-16}$	**
(7) w/ Structural Features	0.6931	0.6374	1.644 (325)	12.44 (59, 325)	$< 2.2^{-16}$	**
(8) All variables	0.6972	0.6411	1.636 (324)	12.43 (60, 324)	$< 2.2^{-16}$	*

Full regression results on file with the author.

Specifically, we started with a small baseline subset of independent variables and iteratively added new variables to measure their impact on the model. The significance testing shown in the last column of Table 4 are analysis of variance (ANOVA) measures based on the immediately preceding model, showing (loosely speaking) the extent to which each new model has significantly better fit than the preceding one.

The final regression reveals a considerably high degree of fit. Specifically, Model (8) includes all categories of pre-processed variables in the regression and yields an R^2 value of approximately 0.70. Loosely speaking, this means that approximately 70% of the variation in award value is explained by the variables, which is quite high for this type of statistical analysis.[85] This degree of fit further suggests that the majority of systematic factors influencing award value are represented by the modeled variables, particularly since one would expect a fairly high amount of idiosyncratic variation in award value that would limit the theoretical maximum degree of fit of even a perfect model. For example, specific features of the individual litigations, infringing products and parties in each case are also likely to influence award value, and jury or judge

85. This result is also consistent with previous analyses of patent infringement awards (including studies by the author), which provide further support. *See* Mazzeo et al., *Explaining the "Unpredictable"*, *supra* note 5, at 66-67.

idiosyncrasies may also in higher or lower award amounts than expected. Such factors are not susceptible to modeling and limit the best possible fit.

Finally, we provide in Appendix G plots of the residuals of the final model, showing that the errors are generally normally distributed. This suggests that there are no strong systematic trends missing from the model.

C. *Specific Variable Analyses*

Our final set of analyses focuses on the specific relationships between enforcement value and certain key patent, case and party variables, based on significance testing of their specific regression coefficients. We used the regression coefficients from Model (8), shown in Appendix H, as well as certain targeted analyses described below.

1. *Case and Party Characteristics*

Some of the most significant factors influencing patent enforcement value are the characteristics of the parties and features of the litigations in each case, independent of attributes of the asserted patents themselves. This is not surprising. For example, whether a case is decided by judge or jury is expected to significantly influence award amount, in large part because high-stakes litigations are most commonly tried by juries (due to litigant selection effects). Similarly, defendants in the Fortune 500 are more likely to face larger infringement verdicts because their revenue base for measuring damages is likely to be larger than that of a smaller infringer.[86] Also, parties have greater incentives to litigate more aggressively and spend more on their claims and defenses when the stakes are higher, as reflected by the significant correlation between litigation length and award value.

However, one key result is the significant positive coefficient for lost profit awards,[87] whereas reasonable royalty awards are not significant.[88] The fact that

86. These results are consistent with previous published analyses by the author. *See* Mazzeo et al., *Do NPEs Matter?*, *supra* note 5, at 3. However, more recent data indicates that the median NPE award is significantly higher than the median practicing entity award. 2014 PwC Study, *supra* note 40, at 19.

87. This is consistent with previous findings. *See* Mazzeo et al., *Explaining the "Unpredictable"*, *supra* note 39, at 68. However, the majority of awards (209 in total) are reasonable royalty awards, which is consistent with PwC's reports. *See* 2014 PwC Study, *supra* note 40, at 9.

88. We note that previous work found jury awards of reasonable royalties to be significantly positively correlated with case-aggregated (as opposed to patent-specific) award amounts. There are several possible explanations for the difference here. For example, plaintiffs who claim reasonable royalties may be more likely to assert multiple patents (and therefore be more likely to obtain a smaller award for each patent) than plaintiffs who claim lost profits, particularly if plaintiffs seeking reasonable royalties are not suing their direct competitors where it may be more likely that a single core patent covers the plaintiff's technology and is infringed by the defendant's accused product. The data provide some support for this hypothesis, specifically that reasonable royalties were the basis of damages

lost profits tend to be higher indicates that patent holders who practice their inventions are likely to receive larger infringement verdicts. Importantly, lost profits are available only where the patent holder is practicing the invention in competition with the accused infringer.[89] Thus, this result suggests that *commercialized patents* tend to have higher enforcement values.[90]

It should also be noted that the patent holder's Fortune 500 status is significantly positively related with award amount, whereas the patent holder's small entity status is significantly negatively related. These factors indicate that the size of the patent holder strongly influences award value. To the extent patent holder size corresponds to the extent of commercialization value derived from the technology at issue (which is a reasonable assumption, particularly for lost profit awards which are based on the profit the patent holder would have earned from its own commercialization activities but for the infringement), this further points to the link between commercialization and enforcement value.

2. *Priority Claims and Child Applications*

Based on our observations from the correlation analysis above, we further seek to identify whether upstream patents (with fewer parents and more children applications) have significantly higher or lower enforcement value than downstream patents (with more parents and fewer children). We find strong evidence that upstream technology patents tend to have higher enforcement values than downstream patents. Patents that give rise to child applications tend to have significantly higher enforcement award values overall, and patents that are children of other patent applications (i.e., continuations, divisionals or continuations-in-part) tend to have significantly lower enforcement values.

These results emphasize the distinction between upstream and downstream patents and the strong impact this has on expected enforcement value. Importantly, each category is significantly distinguishable from the population of other patents on the whole based on the significance of their respective

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in 56% of cases in which multiple patents were held infringed, whereas they were the basis of damages in only 46% of cases in which a single patent was held infringed.

89. The lost profits calculus generally requires such competition. *See* Panduit Corp. v. Stahlin Bros. FibreWorks, 575 F.2d 1152, 1157 (6th Cir. 1978).

90. Furthermore, this result is contrary to many widespread concerns about non-practicing entities. Rather, the highest enforcement values are recovered by parties who enforce their patents as a means of protecting their own product-driven revenues, whereas parties who do not practice the inventions claimed by their asserted patents are likely to receive lower awards. In an economy of high enforcement costs, this result also implies that the return on investment earned from enforcing patents tends to be lower for non-practicing entities, except to the extent they are able to reduce their own enforcement costs relative to other patent holders. Common NPE practices reflect this need to streamline enforcement: e.g., some of the most successful NPEs often utilize contingent-fee legal services and gravitate to "rocket-docket" jurisdictions that may help to lower their costs and secure payment more efficiently.

coefficients.[91] Furthermore, the significant differences between the intrinsic characteristics of upstream versus downstream patents identified in our correlation analysis above provides additional support to the categorical distinction we observe here.[92]

Notably, child applications are filed by the applicant with respect to their own prior parent applications,[93] and therefore they are most properly viewed as indicators of upstream or downstream inventions relative to the applicant's *own* technology.[94] This is consistent with the findings of Hall et al. that self-citations are significant indicators of value, as self-citations similarly arise from future patents of the same applicant.[95] Additionally, this also comports with the findings of Abrams et al. that patent holders may protect their market share by strategically filing downstream child patents to crowd out competitors. One might expect greater enforcement value to accrue to upstream patents as a result of such strategic activities.[96]

However, it is also reasonable to expect more continuations to be filed for upstream inventions that are more valuable to begin with, as the original applicant mines this novel technological resource and further refines and improves the original technology. For example, theories of cumulative innovation by Kitch and others suggest that one main social benefits of patent protection is to facilitate subsequent development of early-stage inventions and

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91. Also, as a robustness test we checked that there were reasonable populations of patents that were not clearly upstream or downstream. Specifically, 42% of patents had *both* at least one parent and child application, and 13% of patents had *no* parent or child applications.

92. Notably, the upstream-downstream distinction should not be confused with the difference between platform versus end-user technologies. For example, the foundational architecture of mobile technologies or other standard-essential inventions may be considered platform technologies, which give rise to improvement technologies created by *third parties*. As a result, platform technologies are likely to be widely licensed, such as via FRAND or other non-exclusive cross-licensing terms, which would suggest that their *enforcement* value may be lower than their aggregate *transaction* value. Further distinction between these various categories is a topic for future research.

93. One semantic exception is when an examiner issues a restriction requirement during prosecution, which requires the applicant to move certain claims to a divisional application (thereby creating another child application) or cancel them. Yet, even in this circumstance the applicant has the option to elect whether to continue prosecuting the divided claims.

94. The applicant-specific definition makes sense, particularly when innovation is viewed as an iterative process of intra-firm improvement with limited cross-pollination between competing technologies. *See*, *e.g.*, Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & Econ. 265 (1977). Also, these results are consistent with the commercialization-effect observed in the lost profits variable and other regressors—a patent holder that improves upon its own technology is more likely to practice it as well, and the data indicates that these types of patent holders receive the highest enforcement value in infringement suits.

95. Hall et al., *supra* note 26 at 4.

96. Abrams et al., *supra* note 33 at 7.

promote downstream technological advancement.[97]

3. *Structural Features*

Notably, structural features of the patents studied are generally not significant. For example, we tested the number of figures (as well as a flag indicating whether a particular patent is in the top quartile with respect to number of figures), presence of formulas or data tables, claim length and number of dependent claims per independent claim, and we found that these are not individually significant. Also, adding or omitting them in the aggregate does not significantly affect the fit of the overall model.

However, one notable exception is the length of the written description, which is positive and significant at the 1% level. We further tested whether this result was influenced by variations in typical written description lengths in different technology sectors—for example, if high-tech patents in IPC G or H are likely to have longer written descriptions, then the significance we observe here could simply be driven by technology effect (as noted below). Notably, we do find substantial variation between average WD-length in each IPC category, with an inter-quartile increase of nearly 100% (*i.e.*, nearly double) from the first quartile to the third quartile, and IPC A and H registering as having the highest average WD lengths. However, excluding only the WD length variable significantly reduces the model's fit, which suggests that its explanatory effect is not entirely related to IPC category. Also, when we replace the raw WD length with IPC-adjusted metrics, such as mean-removed WD length (where the IPC-specific mean WD length is removed) and WD length percentile measures (where the IPC-specific WD length distribution is used to determine the percentile), we still find these metrics to be positive and significant.

Optimistically, the positive relationship between written description length and enforcement value could indicate that patents with greater disclosure yield larger rewards to their owners. If true, this could support the disclosure function policy justification for granting patent rights. However, we do not have sufficient evidence in this study to infer such a result, and we leave this topic for future research.

4. *Prosecution History and Backward Citations*

We also find certain significance of the prosecution duration and number of Office Action rejections, but these results are ambiguous. In particular, extremely high prosecution lengths are negative and significant, as measured by a boolean flag indicating whether the prosecution was in the top 75 percent of all patents in the sample. The number of Office Action rejections is positive and significant only when this prosecution length flag is added, which could suggest that these effects are cancelling each other out to a certain extent.

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97. Kitch, *supra* note 94.

Also, the total number of backward citations is not significant individually. Although it is positive and significant in certain models that also include a citations per claim variable, the latter has a negative coefficient which suggests the effects may be cancelling each other.

5. *Inventor Characteristics*

Inventor characteristics generally do not exhibit strong correlations with enforcement value, including the total number of inventors and the number of U.S. inventors, as well as a flag indicating whether there are many inventors relative to the average. However, the presence of a foreign inventor is positive and significant at the 1% level. We expect this relates to the size of the patent holder, whereby larger firms are more likely to have foreign R&D facilities and also foreign firms that are selling and enforcing patented products in the U.S. market are more likely to have larger scale.

6. *Forward Citations*

As expected based on prior studies, forward citations are significantly positively correlated with enforcement value. We use the natural logarithm of citations received from later patents that had been filed as of the complaint date, and we find this measure to be strongly positively and significantly associated with patent enforcement value (at the 0.1% level). We also find significance of base 10 (not log-transformed) forward citation counts, although these results are somewhat weaker and only apparent in certain model specifications.

As discussed above, we expect some degree of age dependency and truncation effects given that several of the patents in our sample were still relatively young at the time they were asserted. Accordingly, we also measured the citations received from all patents issued as of Dec. 2014, which allows us to capture a much longer portion (if not all) of the expected high citation window of these patents. Replacing this variable in the analysis does not significantly change the fit of the model or overall results, and we find this measure of citations to similarly be positive and significant at the 0.1% level.

Notably, we also observe that when we use the Dec. 2014 citation counts, the coefficient of patent age becomes significant (at the 10% level), which suggests that, although weak, patent age has a positive relationship with enforcement value. This result makes sense given the longer timeframe during which damages may accrue for older patents. However, the effect is weak, and age interactions with forward citations may mask it in certain specifications.

Notably, as mentioned above, our correlation analysis reveals that forward citations are also significantly positively correlated with many other intrinsic and acquired attributes, which themselves are not significant indicators of patent value based on our regression results. Accordingly, forward citations may face Type I errors (false positives) as predictors of patent enforcement

value, in that a high number of forward citations may be associated with other characteristics that do not necessarily translate into greater enforcement value. Nonetheless, particularly when viewed in conjunction with other factors in the context of a robust model, forward citations do exhibit strong associations with enforcement value and thus have utility in prediction and analytics applications.

7. *Forward Citation-to-Value Relationship*

Motivated by the recent findings of Abrams et al. that forward citation counts do not monotonically increase with patent value, we further investigate the citation-to-value relationship in the context of enforcement awards. Specifically, Abrams et al. find that citations follow an inverted U-shaped curve relative to value, whereby higher-value "strategic" patents exhibit a decreasing citation-to-value relationship.[98] First, we test whether the citation-to-value relationship for our dataset exhibits an inverted-U shape similar to that reported by Abrams et al. We bucketed patent value into percentiles and calculated the average number of forward citations (using the December 2014 counts) received by patents in each bucket. We also plot citations received on the y-axis versus non-bucketed values on a log scale on the x-axis. Appendix I shows each graph. Interestingly, we do not observe an inverted-U curve or decreasing citation-to-value relationship at the high-value range, although we do observe a tapering off for the most valuable patents that suggests a non-monotonically increasing relationship.

To investigate further, we regress forward citations against absolute (base 10) enforcement value and the square of enforcement value to see if we can detect a significant negative quadratic term consistent with their findings. As reported in Appendix J, the coefficient of value squared is negative and significant, although it is much weaker in magnitude than the positive linear value term.[99] This is consistent with Abrams et al.'s observation of a negative quadratic influence, although they observe a much stronger effect that dominates at the high-value range.[100] By contrast, when we add trend lines to the figures in Appendix I to show both a purely linear relationship (shown in red) versus a linear-plus-negative quadratic relationship (shown in blue) using our regression coefficients, we find that the negative quadratic effect is quite minor even at the high end. Overall, the relationship between citations and value we observe is always increasing, and the values required for the quadratic term to dominate and the trend to begin to slope downwards would be extremely high.[101]

These results provide some perspective on the differences between

98. Abrams et al., *supra* note 33, at 7.

99. These results are consistent when we add certain party and patent characteristics, such as patent holder size, technology sector and patent age, consistent with Abrams et al.'s analysis. *Id*.

100. *Id*. at 28.

101. The local maximum implies a patent award value of $2 billion in 2008 dollars.

licensing value and enforcement value. Particularly given the selection differences between Abrams et al.'s dataset and ours. They use values of voluntary licensing revenues received by a large NPE in the high-tech sector, whereby revenues are generated by widely licensing the patents on a non-exclusive basis to multiple companies simultaneously. By contrast, our data is derived from individual enforcements in which the patent holder and infringer do not agree to a license, and the more valuable patents are likely to be those that were not previously licensed but were practiced exclusively by their owners. Furthermore, whereas commercialization value and ongoing technological development (upstream patent value) are principal drivers of our data, neither of these effects is present for NPE-owned patents that in large part have been acquired (directly or indirectly) from the original applicants.

Nonetheless, consistent with their results, we also observe a negative quadratic influence, which suggests that citations do not monotonically increase with value. This provides additional impetus to investigate the citation-to-value relationship more closely, which we plan to study in future work.

8. *Technology Field*

We also analyzed the IPC technology classifications to determine if certain technology fields are significantly associated with higher or lower enforcement value. We find that specific IPC categories exhibit significant relationships, with the high-tech sector (IPC G for Physics and H for Electricity) in particular showing a strong positive association. The bio-pharma sector (IPC category A for Human Necessities) is also positive and significant, although to a lesser extent. These results reflect the fact that patents are highly important assets in the high-tech and bio-pharma sectors. However, the selection of the data may also influence these results, in that widespread licensing practices and patent densities in the high-tech sector suggests that the cases that go to trial (rather than settle) may be more likely to be extremely contentious and have even higher stakes than litigated cases in other industries.

9. *Recorded Transfers and Liens*

Another striking result is the strong negative coefficient for the number of recorded assignments. As posited above, entities that practice and derive commercialization value from their patents may be less likely to transfer them, which is further supported by our finding that commercialization value is a strong contributor to enforcement value.[102] Moreover, we find that patents that are transferred more often (and therefore presumably have higher transaction

102. Also, non-practicing entity litigation may contribute, in that NPEs typically acquire their patents from other entities (and therefore increase the number of assignments), and NPEs tend to receive lower awards on average. *See* Mazzeo et al., *Do NPEs Matter?*, *supra* note 5, at 3.

value) tend to have even lower enforcement value, as measured by the specific boolean flag indicating whether the patent has been assigned many times (*i.e.*, the number of recorded assignments is in top 75% quartile).

By contrast, the boolean flag for recorded liens is not significant in either regression model. As mentioned above, this could reflect the blanket approach taken to collateralization and perfection in many financing arrangements. Also, the small number of recorded liens in the dataset overall could reflect lender restrictions on enforcing patents that have been pledged as collateral.[103]

IV. INTERPRETATIONS AND CONCLUSIONS:

The analysis above reveals three distinct categories of "valuable patents" and the characteristics of each; additionally we observe fundamental distinctions between patent enforcement value and transaction value. The following summarizes our principal findings:

A. *Commercialization Value*

We find that one of the most significant indicators of patent enforcement value is the extent to which a patent is practiced by its owner. Lost profit damages, which are only available to practicing patent holders, are strong predictors of award amount, and the size of the plaintiff, which one would expect to reasonably correspond to the size of the revenue base associated with the technology at issue, is also significantly associated with award value. Also, lower enforcement awards are associated with patents that have been transferred, which further highlights the impact of commercialization by the patent holder. Specifically, a non-commercialized patent may yield greater value as an asset to be traded than as exclusive rights to be enforced, whereas a patent covering valuable commercialized technology is more likely to be retained to protect its owner's competitive domain.

B. *Upstream Technology Value*

We also observe clear evidence of upstream technology value as another category of patent enforcement value. Specifically, patents that give rise to follow-on child applications are likely to result in higher awards, both on average and in particular relative to downstream patents that claim priority from parent applications.

C. *Citation Value*

We also find that forward citations are an important indicator of patent enforcement value. This is consistent with many other studies, and common

103. Only 49 (approx. 13%) of patents in the dataset had recorded liens.

analytics practices, that treat forward citations as a general proxy for patent value. Yet, we further find that forward citations are highly correlated with a host of other patent attributes, some of which are associated with high enforcement value and others with low enforcement value, which suggest that forward citations may simultaneously code for multiple different types of patents and sources of value. Moreover, we find that the citation-to-value relationship is not strictly linearly increasing, and particularly in the high-value range there are negative influences that reduce the observed association. We plan to investigate the value predicting capacity of more refined citation-based metrics in future research.

D. *Transfer Value*

Finally, we find evidence of key distinctions between patent enforcement value and transaction value. Specifically, patents that have been assigned tend to have lower enforcement values, and patents with many recorded assignments are further associated with lower awards. Furthermore, the number of recorded assignments and liens are independent of most intrinsic patent characteristics. By contrast, we find that assignments and liens are significantly correlated with forward citations, which suggests that citations may be associated with both enforcement value and transaction value.

Accordingly, based on our analysis of patent enforcement value, we find that "valuable patents" are (1) commercialized patents, (2) upstream patents, and (3) with certain caveats, forward-cited patents. Current theory and practice use a definition of "valuable patents" that is derived from proxy-based studies of patent value, but there are substantial limitations to this approach. Instead, by studying value directly, we derive new findings about factors that define, and in turn may be used to predict, the enforcement value of U.S. patents.

APPENDICES:

APPENDIX A - INTRINSIC PATENT ATTRIBUTES:

Variable	Description	Coding Source
us_patent_no	Patent number	Page 1 of Patent
us_pub_no	Publication number	Page 1 of Patent
file_date	Filing date	Page 1 of Patent
published?	TRUE if the application was published (has a publication number), FALSE if not.	Page 1 of Patent/PAIR
pub_date	Publication date	Page 1 of Patent
priority_date	The priority date shown in Google Patents	Google Patents
issue_date	Issue date	Page 1 of Patent
IPC	IPC Code (e.g., G04FFalse)	Page 1 of Patent
utility?	TRUE if this is a utility patent (TRUE *unless* patent number starts with "D" or "PP")	Page 1 of Patent
design?	TRUE if this is a design patent (patent number starts with "D")	Page 1 of Patent
plant?	TRUE if this is a design patent (patent number starts with "PP")	Page 1 of Patent
cont?	TRUE if this is a continuation of another patent or patent application	Page 1 of Patent
div?	TRUE if this is a divisional of another patent or patent application	Page 1 of Patent
cont_in_part?	TRUE if this is a continuation-in-part of another patent or patent application	Page 1 of Patent
num_parents	Number of parent patents or patent applications referenced on page 1 / PAIR	Page 1 of Patent / PAIR > Continuity Data
PCT?	TRUE if this is a PCT patent	Page 1 of Patent (PCT number)
PCT_number	PCT number assigned	Page 1 of Patent
term_disclaimer?	TRUE if there is a terminal disclaimer	Page 1 of Patent (asterisk next to patent number / notice)
term_adjustment?	TRUE if there is a patent term adjustment	Page 1 of Patent (notice)
num_US_inventors	Number of inventors with US domiciles	Page 1 of Patent

Variable	Description	Coding Source
num_foreign_inventors	Number of inventors with foreign domiciles	Page 1 of Patent
num_inventors	Sum of num_US_inventors and num_foreign_inventors	Calculated
entity_status	Entity status as shown in PAIR (e.g., "Small", "Undiscounted")	PAIR (http://portal.uspto.gov/pair/PublicPair)
named_applicant?	TRUE if there is a named applicant in PAIR; FALSE otherwise.	PAIR (http://portal.uspto.gov/pair/PublicPair)
bkd_cit_applicant	Number of citations to other patents/apps that were made by the applicant.	Page 1 of Patent
bkd_cit_examiner	Number of citations to other patents/apps that were made by the examiner (*).	Page 1 of Patent
bkd_cit_tot	Sum of bkd_cit_applicant and bkd_cit_examiner	Calculated
non_pat_cites?	TRUE if the patent cites non-patent documents.	Page 1 of Patent
non_pat_cites_num	Number of non-patent documents cited in the patent.	Page 1 of Patent
US_children?	TRUE if patent has any patents or applications claiming priority to it	PAIR > Continuity Data (http://portal.uspto.gov/pair/PublicPair)
num_US_children	Number of patents or patent applications claiming priority to this patent	PAIR > Continuity Data (http://portal.uspto.gov/pair/PublicPair)
num_OA_rejections	Number of Office Action Rejections (Final or Non-Final) during prosecution.	PAIR > Transaction History
reexam_reissue?	TRUE if this is a reexamination patent (number starts with RE OR reexam cert)	Patent / Patent Number
re_number?	TRUE if the patent number starts with RE	Patent Number
reexam_cert?	TRUE if there is a Reexamination Certificate appended to the patent	Patent
cert_correction?	TRUE if there is a Correction Certificate appended to the patent	Patent
num_claims_tot	Total number of claims (adjusted for re-exam/correction, if applicable)	Patent (count)
num_indep_cl	Number of independent claims (adjusted for re-exam/correction, if applicable)	Patent (count)
num_dep_cl	Number of dependent claims (adjusted for re-exam/correction, if applicable)	Patent (count)
num_cols_WD	Number of columns in the written description portion of the patent (whole cols)	Patent (count)
num_cols_cl	Number of columns in the claims portion of the patent (whole cols, at least 1)	Patent (count)
num_figures	Number of figures in the patent	Patent (count)

Variable	Description	Coding Source
formulas?	TRUE if the patent contains mathematical or scientific formulas; FALSE otherwise.	Patent
num_formulas	Number of mathematical or scientific formulas in the patent.	Patent (count)
data_tables?	TRUE if the patent contains tables of data; FALSE otherwise.	Patent
num_data_tables	Number of tables of data in the patent.	Patent (count)

APPENDIX B – ACQUIRED PATENT ATTRIBUTES:

Variable	Description	Coding Source
fwd_cites_prev	Total number of forward citations prior *to* the complaint date.	USPTO "Referenced By"
num_assignments	Number of assignments prior to the complaint date.	Goog Pats / PAIR
num_liens	Number of liens prior to the complaint date.	Goog Pats / PAIR

APPENDIX C – CASE AND PARTY CHARACTERISTICS:

Variable	Description	Coding Source
num_P	Number of plaintiffs in the final decision awarding damages.	Complaint/Docket
num_P	Number of defendants in the final decision awarding damages.	Complaint/Docket
p_ind_sic_4	Industry SIC Code (4-digit) of the Plaintiff.	Mergent: mergentonline.com
d_ind_sic_4	Industry SIC Code (4-digit) of the Defendant	Mergent: mergentonline.com
p_US_F500_csyr_B	TRUE/FALSE if Plaintiff was listed on the US Fortune 500 *for the year of decision (2006-2011)*.	US Fortune 500: http://fortune.com/fortune500/
p_US_F500_csyr_rank	Rank of Plaintiff on the US Fortune 500 *for the year of decision (2006-2011)*, if p_F500_caseyr_B is TRUE.	US Fortune 500: http://fortune.com/fortune500/
d_US_F500_csyr_B	TRUE/FALSE if Defendant was listed on the US Fortune 500 *for the year of decision (2006-2011)*.	US Fortune 500: http://fortune.com/fortune500/
d_US_F500_csyr_rank	Rank of Defendant on the US Fortune 500 *for the year of decision (2006-2011)*, if p_F500_caseyr_B is TRUE.	US Fortune 500: http://fortune.com/fortune500/

APPENDIX D – IPC CODE CATEGORIES:

A: Human Necessities
B: Performing Operations, Transporting
C: Chemistry, Metallurgy
D: Textiles, Paper
E: Fixed Constructions
F: Mechanical Engineering, Lighting, Heating, Weapons
G: Physics
H: Electricity

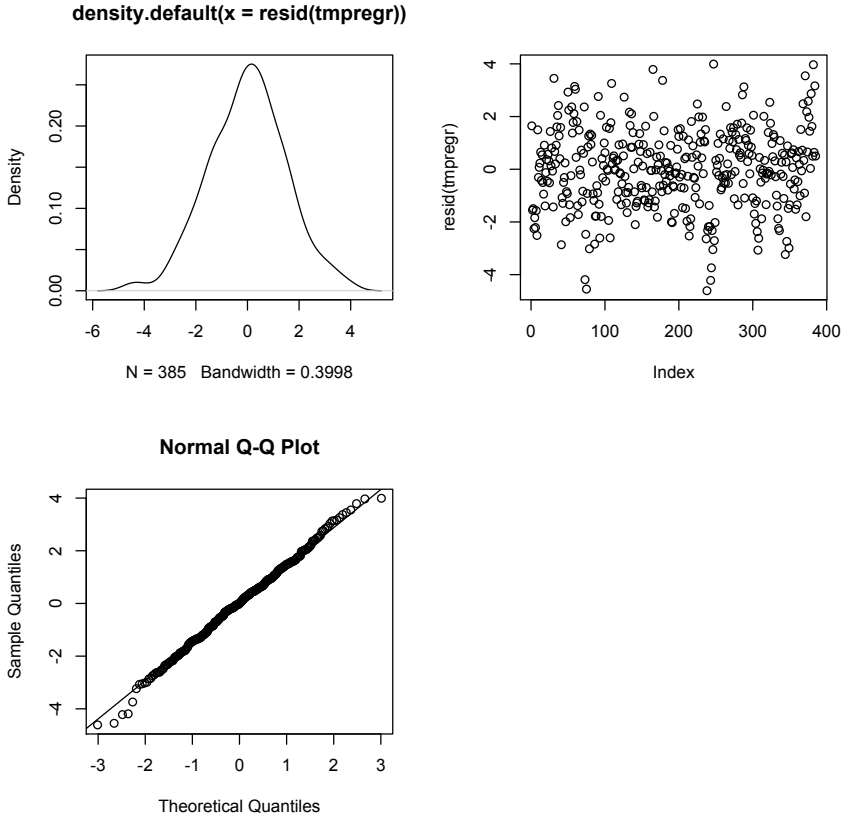
APPENDIX E – SIC CODE GROUPINGS:

01-09: Agriculture, Forestry & Fishing
10-14: Mining
15-17: Construction
20-39: Manufacturing
40-49: Transportation, Communications, Electric, Gas & Sanitary Services
50-51: Wholesale Trade
52-59: Retail Trade
60-67: Finance, Insurance & Real Estate
70-89: Services
91-99: Public Administration

APPENDIX F – CORRELATION TABLE:

	prosec. time	# OA rej.	# par.	# inv.	bkd. cit. app.	bkd. cit. ex.	# child.	# claims	WD length	# figs.	time to assert	fwd. cit.	# assg.	# liens
file year	0.03	-0.03	0.26 ***	-0.03	0.31 ***	-0.04	0.07	0.12 *	0.08	0.08	-0.56 ***	-0.06	-0.33 ***	-0.11 *
prosec. time		0.44 ***	0.07	0.14 **	0.04	0.05	0.12 *	0.13 **	0.17 ***	0.11 *	-0.18 ***	0.11 *	0.07	0.07
# OA rej.			0.14 **	0.19 ***	0.04	0.16 **	0.1 *	0.03	0.07	0.07	-0.09 .	-0.01	0.05	0.11 *
# par.				0.15 **	0.36 ***	0.03	0.1 .	0.23 ***	0.29 ***	0.27 ***	-0.27 ***	-0.01	-0.11 *	-0.07
# inv.					0.09 .	0.05	0.2 ***	0.16 **	0.31 ***	0.34 ***	-0.07	0.22 ***	-0.01	0.01
bkd. cit. app.						-0.12 *	0.13 **	0.22 ***	0.12 *	0.18 ***	-0.23 ***	0.13 *	-0.11 *	-0.04
bkd. cit. ex.							0.01	-0.04	-0.05	-0.04	0.08	0.12 *	0.06	-0.03
# child.								0.18 ***	0.24 ***	0.2 ***	-0.01	0.34 ***	0.14 **	0.01
# claim.									0.33 ***	0.26 ***	-0.05	0.28 ***	0.07	0.11 *
WD length										0.71 ***	-0.04	0.1 *	-0.05	-0.04
# figs.											-0.05	0.12 *	-0.05	0.04
time to assert												0.34 ***	0.26 ***	0.11 *
fwd. cit.													0.33 ***	0.16 **
# assg.														0.18 ***

APPENDIX G – MODEL RESIDUALS:



APPENDIX H – REGRESSION RESULTS:

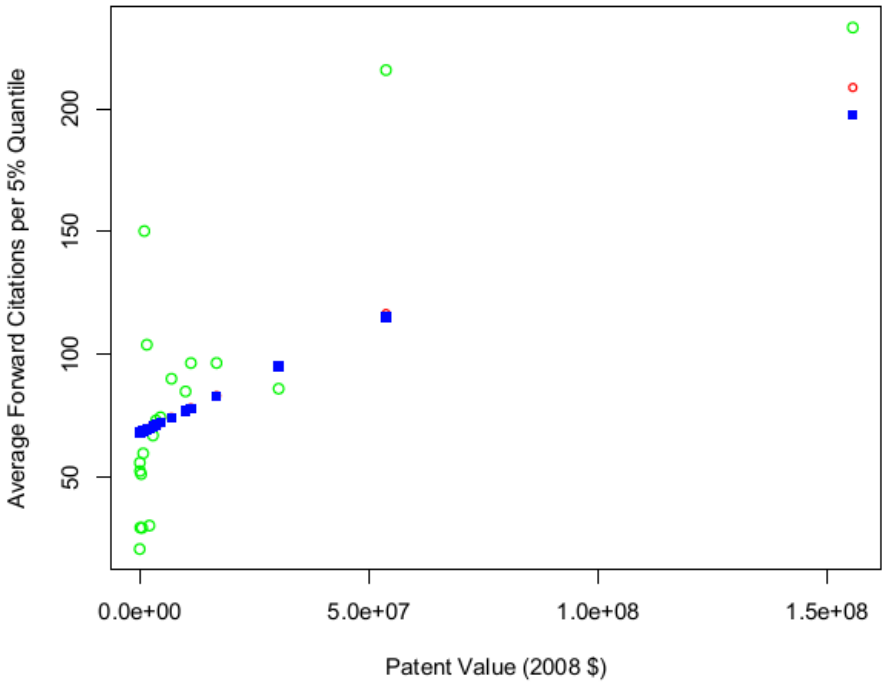
Variable	Coeff.	Std.Err.	t-val	Pr(>|t|)	Signif.
Jury Trial	1.52	0.29	5.19	0.00	***
F500 Patent Holder	0.84	0.31	2.71	0.01	**
F500 Defendant	1.13	0.29	3.90	0.00	***
Lost Profits	1.15	0.27	4.30	0.00	***
Reasonable Royalties	0.20	0.21	0.96	0.34	
NPE (individual)	0.54	0.44	1.22	0.22	
NPE (company)	0.50	0.33	1.51	0.13	
NPE (university)	3.45	1.40	2.47	0.01	*
Small Entity	-0.92	0.25	-3.70	0.00	***
IPC A	1.27	0.71	1.77	0.08	.
IPC G	1.66	0.67	2.49	0.01	*
IPC H	1.84	0.69	2.66	0.01	**
Patent Age	0.00	0.00	0.93	0.35	
Parent?	0.87	0.27	3.26	0.00	**
Child?	-0.74	0.25	-2.96	0.00	**
Forward Citations	0.38	0.10	4.01	0.00	***
Assigned?	-0.61	0.25	-2.41	0.02	*
Many Assignments?	-0.62	0.27	-2.32	0.02	*
Foreign Inventor?	0.94	0.29	3.27	0.00	**
Long Prosecution?	-0.68	0.26	-2.59	0.01	*
# Office Actions	0.18	0.09	2.02	0.04	*
WD Length	0.01	0.00	3.11	0.00	**

Full regression results on file with the author.

R^2:0.698
Adj. R^2:0.642
Std.Err.:1.635
$F_{(60,324)}$:12.46
p-val:0.000
N: 385

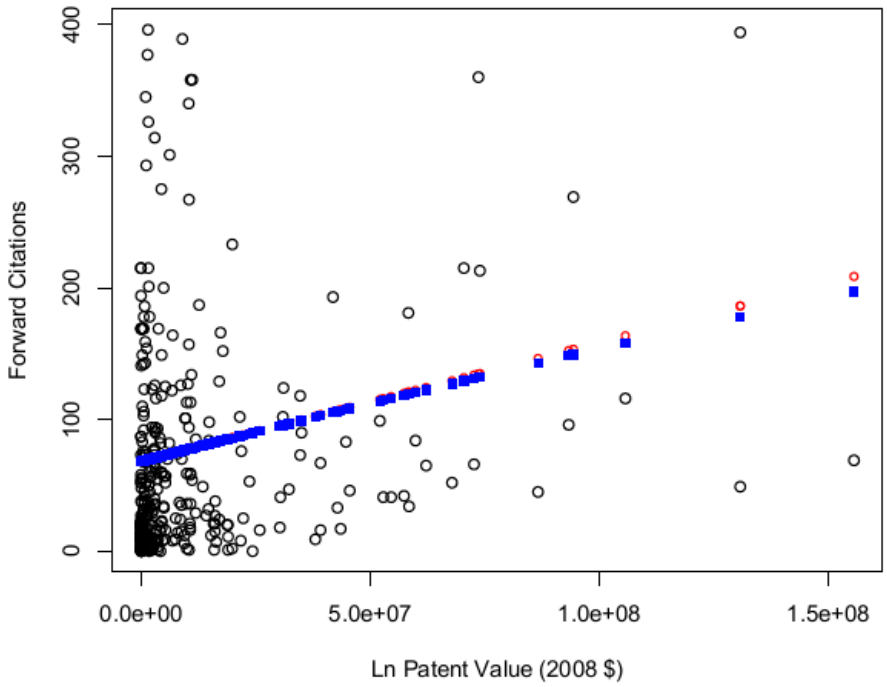
APPENDIX I – CITATION-TO-VALUE PLOTS:

Citations to Value (bucketed values)



(Avg. FC in green)
(linear trend in red)
(linear+quadratic in blue)

Citations to Value (log value scale)



(FC in black)
(linear trend in red)
(linear+quadratic in blue)

APPENDIX J – CITATION-TO-VALUE REGRESSION:

Variable	Coeff.	Std.Err.	t-val	Pr(>|t|)	Signif.
Patent Value	2.34e-8	4.42e-9	5.31	1.96e-7	***
Patent Value Squared	4.77e-17	1.29e-17	3.67	2.60e-4	***

Dependent variable is the log of Dec. 2014 citation counts.

R^2:0.105
Adj. R^2:0.0998
Std.Err.:1.492
$F_{(2,366)}$:21.4
p-val:0.000
N: 369