

**Trolls on State Street?:
The Litigation of Financial Patents, 1976-2005**

Josh Lerner*

This paper examines the litigation of business method patents, contrasting suggestions from the theoretical law-and-economics literature with the suggestion that entrepreneurs are obtaining and then aggressively litigating awards of dubious validity. I focus on the subset of business method patents relating to financial products and services. I show that these awards are being litigated at a rate 27 times greater than that of patents as a whole. The awards being litigated are disproportionately those awarded to individuals and to smaller, private entities. The evidence regarding patent quality seems inconsistent—while more heavily cited patents are litigated more frequently in some analyses, better disclosed patents are also litigated more frequently, unlike in other technical areas. The results are consistent with suggestions that individuals are exploiting the patent system in this arena.

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Introduction

In recent years, business method patents have proven to be intensely controversial. Since they were judicially endorsed in the *State Street* case in the late 1990s, numerous critics have suggested that these awards have been distorting the patent system. For instance, Merges [2000] asserted that “the increased volume of patent applications stemming from this newly patentable subject matter has pushed the patent system into crisis,” and Lessig [2000] characterized these awards as “a new monster called forth from an old statute.” Reviewing this controversy, Allison and Hunter [2005] concluded:

Although patents in other areas of technology have brought forth complaints from various quarters, the magnitude of adverse commentary and reportage on business method patents was unprecedented.

While the discussions cited above focused on the United States, if anything, these awards have been more controversial in Europe.

Many discussions of the problems associated with business method patents have focused on “patent trolls,” individuals who obtain and then aggressively litigate patents of dubious validity (e.g., U.S. Federal Trade Commission [2003]; Jaffe and Lerner [2004]). These individuals are alleged to profitably exploit the weaknesses of the patent system: the rapid reviews given to patent applications in emerging areas such as business methods by underpaid, inexperienced patent examiners, and a litigation system that presumes that granted patents are valid and relies on juries that are frequently ill-suited for resolving these technical disputes. In many cases, their targets, facing the prospect of an injunction that will require them to shut down key operations, will choose to settle

rather than fight back. Observers have attributed the prevalence of individuals and small patent holding companies in this arena to the fact that they are “retaliation proof”: if a corporation with manufacturing and service operations were to aggressively pursue rivals, it might face counter-charges of patent infringement that would disrupt its own operations. Because these individuals have no activities other than litigation, they are much less vulnerable to such threats.

To cite one example, Vergil Daughtery, a Georgia Tech MBA, has received four patents for the pricing of “expirationless options,” despite the fact that perpetual options have been extensively studied in the finance literature since the 1960s. In June 2006, the holding company to which he had licensed the patents filed suit against the Philadelphia Stock Exchange, arguing (among other charges) that the Exchange’s proposed ten-year options infringed its patents (Schaafsma [2006]).

While a number of studies (Allison and Tiller [2003]; Hall [2003]; Lerner [2002]) have documented the increasing numbers of business method patent awards, the implications of the increase are unclear. It has long been understood that the bulk of patents have only very modest value (e.g., Pakes [1986]), so increasing numbers of these awards may or may not be economically significant. In this paper, I seek to address the limitations of earlier studies by focusing on arguably the most economically important manner in which patent awards are utilized: litigation. Because patent litigation typically entails several millions of dollars of expenditures (AIPLA [2005]), this step is unlikely to be undertaken lightly.

I focus on the subset of business method patents relating to financial products and services. Not only can these awards be readily identified—a condition that does not characterize all business method patents—but the importance of financial innovation is widely accepted: the economic importance of new products and services in the financial arena have been highlighted by, among others, Miller [1986] and Merton [1992], and empirically documented by Tufano [1989]. Yet the empirics of financial innovation have attracted remarkably little academic attention (Frame and White [2004]).

This paper seeks to document the extent to which financial patents are being litigated. If the theoretical models of suit and settlement (reviewed in Cooter and Rubinfeld [1989]) capture the drivers of litigation, we might expect that more valuable patents would be litigated more frequently. Similarly, we might expect more litigation when it is less costly relative to alternatives (e.g., settling disputes through arbitration or bilateral negotiations). Lerner [1995] and Lanjouw and Schankerman [2004] present a variety of evidence that larger firms, who are likely to have internal counsel and face lower capital costs, have a lower cost of litigating disputes. The informal “troll” hypothesis suggests, on the other hand, that entrepreneurs are obtaining patent awards of dubious merit and then using lawsuits to extract settlements. In this case, I anticipate that the importance of the patents should matter less in determining litigation, and that the awards of individuals and small firms would be disproportionately litigated.

To explore these hypotheses, I construct a data-set of all financial patents awarded between January 1976 and August 2003. I then analyze which awards were litigated through the end of 2005, and the determinants of this litigation. My key findings are as follows:

- Financial patents are being litigated at a rate 27 times greater than that of patents as a whole. Even relative to the most extensively litigated major category of patents (drugs and health), the rate is more than an order of magnitude higher.
- Inconsistent with the more general patterns, the finance patents being litigated are disproportionately those awarded to individuals. Inasmuch as those awarded to corporations are being adjudicated, it is overwhelmingly those awarded to smaller, private entities.
- The awardees of these patents are frequently not involved in the litigation themselves. Rather third parties—typically patent holding companies—are the most frequent plaintiffs.
- The defendants in these cases, on the other hand, are dominated by large financial institutions and exchanges.
- The representation of foreign patentees among those litigating financial patents is about one-half the level seen elsewhere.
- Unlike in other technical realms, cross-tabulations suggest that litigated patents are not being disproportionately cited by other patents, once the number of claims is adjusted for. In regression analyses, a greater number of citations is associated with more litigation. At least in part, this pattern seems due to a “publicity effect”: litigation leads patents to be more frequently cited.

- Better disclosed patents—*i.e.*, those with more backward citations—are litigated more frequently, unlike in other areas, where they are less often the subject of suits.

The interpretation of these findings must be cautious. I have not undertaken a detailed assessment of the originality of these patents, or analyzed the way in which they have been interpreted in the courts.¹ But collectively, the results seem consistent with the informal hypothesis that individuals are exploiting the system to obtain and litigate financial patents of questionable quality.

The plan of this paper is as follows. Section 1 briefly reviews the changes in patent law and practice in relation to business method patents. Section 2 describes the construction of the data-set. Section 3 presents the analysis. The final section concludes the paper.

1. Business Method Patents²

There has long been ambiguity about the patentability of business methods in the United States. At least since a 1908 court decision that established the “business methods exception,” many judges and lawyers have presumed that business methods were not patentable subject matter. While the U.S. Patent and Trademark Office (PTO) has issued patents on financial and other business methods for several decades, many observers

¹This would, of course, be a massive undertaking, since the cost of a detailed analysis of a single patent in the course of a lawsuit typically runs into the hundreds of thousands of dollars.

²This section is based on Lerner [2002] and Jaffe and Lerner [2004].

questioned their validity. Consequently, awardees were reluctant to incur the time and expense to litigate their awards.

Attitudes toward business method patents changed with the July 1998 appellate decision in *State Street Bank and Trust v. Signature Financial Group*. This case had originated with a software program used to determine the value of mutual funds, on which Signature had obtained a patent in 1993. State Street Bank sued to have the patent invalidated on the grounds that it covered a business method and was hence not patentable. While State Street's argument prevailed in the district court, the Court of Appeals for the Federal Circuit, the centralized appellate court for patent cases, reversed the finding. In its decision, the court explicitly rejected the notion of a "business method exception." The Supreme Court declined to hear State Street's appeal of the appellate decision in January 1999. In the numerous articles in the trade press that followed the two decisions, the case was interpreted as unambiguously establishing the patentability of business methods.

The decision appears to have led to a substantial increase in the filing and granting of business method patents, including financial patents. One of the major concerns expressed about these awards has been about their quality. For instance, Lerner [2002] shows that while academic research is highly relevant to many financial patents, these works are far less often cited than in patents in other academically related areas, such as biotechnology.

2. Constructing the Data-Set

This section describes how I constructed the data-set used in this analysis.

Patent awards. I identify awards using the online database of the U.S. Patent and Trademark Office, which summarizes all patents awarded since January 1976. Following the procedure in Lerner [2006], I identify all patents assigned to relevant US Patent Classification subclasses. Patents are classified at the time they issue to one or more classifications. There are over one hundred thousand such classes. The PTO takes such classifications very seriously, because they ensure that examiners will be able to identify the relevant earlier awards when they engage in subsequent patent searches. As in the earlier analysis, I employ all patents with a primary assignment to subclasses 705/4, 705/35 through 705/45, and 902/1 through 902/41. Because I wanted to be able to assess the quality of issued patents (which relies on being able to identify how frequently the awards are cited in subsequent documents), I only included patents in the sample if they were awarded through August 2003. In total, there are 2944 awards in the sample.

Litigation. I employ the Derwent LIT/ALERT patent litigation database to determine if, and how often, each patent in the sample has been litigated. This database is built using reports from the district courts where the patent litigation is initiated to the PTO. While these reports are required to be filed, as Lanjouw and Schankerman document [2001, 2003], in a considerable number of instances (about 35% in recent years and more earlier), no such report is made. (To address this deficiency, I adjust the computed patent litigation rates, as discussed below.) The data on litigation were

downloaded in May 2006. There appears, however, to be substantial reporting lags: no suits from 2006 and only one after August 2005 were found.³ From the database, we gather information on the key dates, parties, and location of the case, as well as the patents that were involved.⁴ Because data provided by Derwent was incomplete (it only assigned one patent to each lawsuit prior to 1990, even if there were multiple ones at issue), I obtained the docket filings for the earlier cases and augmented their records.

Characteristics of patentees. I also characterize the features of the parties to whom the patents were assigned in the year of the award. First, I classify the awardees into publicly traded corporations, privately held firms, individuals, and others (e.g., government and university entities). I define publicly traded entities as those for which financial and related information for the year prior to the award is available from Compustat, WorldScope, or filings with the U.S. Securities and Exchange Commission. I classify as private firms all other cases where there is an assignee other than the inventor.⁵ For private entities, I employ a variety of sources, including the *Moody's* manuals, the *Corporate Technology Directory*, national directories of firms (particularly of Japan), and directories of various segments of the financial services industry. In these cases, I simply seek to obtain information on the revenues and employment of the firm,

³I assume in the calculations below that the database contains all litigation involving these patents filed through the end of 2005. Thus, the estimates of the amount of litigation—and the disparities from other areas of patent litigation—are slightly understated.

⁴Because the considerable majority of patent cases ultimately settle, and these settlements are highly diverse and rarely disclosed to the public, it is impossible to characterize the outcomes of these cases in a systematic manner.

⁵Because it is difficult to determine whether non-U.S. foreign firms are publicly traded, some public firms may be misclassified as private. Given that the sample is dominated by U.S. and large Japanese firms, this problem should be limited.

as well as the nation in which its headquarters is based. If I am unable to identify the relevant information in the year of award, I use information from the year beforehand or, if this is not available, the year after the award. In many cases, however, I am unable to locate the sales and revenue information: many of the assignees are small patent holding companies that keep extremely low profiles. I am, however, able to characterize the location of all assignees: if information on firm location is not available from the above databases, I employ the location of the assignee as identified in the patent award. If there is no assignee, I use the location of the inventor.

Features of the patents. Over the past two decades, a variety of quantitative measures of patent quality have become widely adopted (Jaffe and Trajtenberg [2002]; Lanjouw, Pakes and Putnam [1998]). These methods rely on the citations either to or by the patent award to characterize the awards (forward and backward citations respectively), as well as the count of the claims in the awards. Patents with more forward citations and claims are frequently interpreted as being more important, while those with more backward citations are seen as more carefully describing the “prior art” of already-issued patents.

I compiled the number of forward and backward citations through July 2006 in order to have as full depiction of the patents as possible. I also identified those forward and backward citations that are self-citations. Finally, I computed two alternative measures of patent quality, such as generality and originality (see Jaffe and Trajtenberg [2002]).

3. An Analysis of Litigation

A. Summary Statistics

Table 1 provides an overview of the firms and patents included in the sample.

Several patterns stand out in Panel A:

- While the award date of the patents in the sample ranges from 1976 to 2003, they are concentrated in the second half, with the mean award in late 1994. This reflects the acceleration of financial patenting activity in recent years.
- These patents are heavily cited relative to the typical U.S. award. Jaffe and Trajtenberg [2001, p. 439] find that the typical twelve-year-old patent had received just fewer than seven citations, or one-quarter the level seen here.⁶
- Financial patenting activity is dominated by U.S. firms, which account for 74% of the awards. In recent years, approximately one-half of awards more generally have gone to non-U.S. entities. This disparity is particularly dramatic among individuals and private firms. The foreign assignees are dominated by Japanese firms to a much greater extent than in other technical fields, which reflects the fact that Japan is one of the few nations outside the U.S. that unambiguously allows business method patents.
- As noted in Lerner [2002], the representation of government and university assignees (about 0.4%) is considerably less than in patents as a whole, and certainly much less than in other academically-linked fields such as biotechnology and advanced materials.

⁶The predicted number of citations is slightly lower if one computes a weighted average based on the actual ages of the awards in the financial patents sample.

- While the bulk of patents are not litigated, a few awards are extensively so, with one patent being involved in fifteen lawsuits. (This is an award to an individual inventor, Lawrence B. Lockwood, which is being litigated through the patent holding company Pangea Intellectual Properties. The patent—number 6,289,319—covers an automated “financial transaction processing system,” and is cast in sufficiently broad terms that it probably covers all e-commerce transactions, as well as those employing automated teller machines. Pangea has been targeting small firms in its litigation, in a successful effort to obtain settlements of hundreds of thousands of dollars each from firms that are reluctant to bear the cost of litigation.⁷)

The second panel indicates a few characteristics of the lawsuits themselves. Most involve a single financial patent, but several encompass multiple awards. More interestingly, the role of third parties here is much greater than elsewhere. Only 46% of the disputes involve an assignee or an inventor as a plaintiff or a defendant. In other cases, the litigation is being conducted by third parties (who have typically purchased or licensed the patent) instead. This share of third parties is much greater than seen elsewhere. For instance, Lanjouw and Schankerman [2001, Table 1] find that in 68.5% of the cases, the assignee is either a plaintiff or defendant. (They do not examine cases where the inventor but not the assignee was a litigator, which would increase the share at least modestly.) While this finding is not in and of itself problematic, it does hint at the

⁷See, for instance, the discussion in <http://www.infoworld.com/articles/hn/xml/02/05/15/020515hnpangea.html> (accessed October 10, 2006).

importance of individuals, who are often unable to finance patent litigation themselves, in these disputes.

The divorce between innovation and litigation in this field is further underscored by Table 2. This presents the five most frequently represented firms in several categories, which prove to be dramatically different:

- The first column reports the most frequently represented financial innovators, as reported in Lerner [2006]. This compilation is based on stories in the *Wall Street Journal* on financial innovation between 1990 and 2002.⁸ This list is dominated by financial institutions and includes a major publisher.
- The second column presents the most frequent financial patentees between January 1976 and August 2003. While Citigroup appears here as well (and other financial institutions appear further down on the list), it is dominated by information technology companies. These firms—which routinely file for protection of hardware and software inventions—rapidly began filing for patents on innovations that were developed in the course of projects for financial service firms after the *State Street* decision (or even before).

⁸Mergers and acquisitions introduced complications to the tabulations. Citicorp appears in the first column because it was an active innovator until its acquisition by the Travelers Group in 1998. Subsequent innovations by this institution were attributed to Citigroup, its corporate parent in 2003 (which is credited with innovations developed by the new combined entity and the old Travelers Group). (Lerner [2006] provides a more detailed description of the procedure used.)

- The most frequent plaintiffs⁹ in financial patent litigation between 1976 and 2005 are reported in column 3. This list, in contrast to the others, is dominated by patent holding companies that have no lines of business other than licensing and litigating patent awards.
- The most frequent defendants in financial patent litigation between 1976 and 2005 are reported in the fourth column of Table 2. This list is more diverse, but in contrast to the plaintiffs, the compilation of the most frequently represented defendants is dominated by major investment banks, trading exchanges, and other established financial institutions.

B. Key Determinants of Litigation

I then examined the propensity for different classes of patents to be litigated. The basic distribution of patent awards over time is presented in Table 3. The first two columns make clear that the number of financial patents granted has increased in recent years and that the rate of litigation peaked among the patents awarded between 1990 and 1994.

The data in column 2, however, have two limitations. First, as alluded to above, not all cases are reported to the PTO. Lanjouw and Schankerman address this issue by

⁹In some cases, entities file for “declaratory relief,” or for a ruling that a patent they are being threatened with infringing is invalid. These cases appear relatively rare in the sample. Prior to making this and the subsequent tabulation in the fourth column of Table 2, I eliminate cases where the defendant is an assignee or an inventor of a patent in contention, but the plaintiff is not. I also eliminate from the list of defendants parties that appear twice or more as plaintiffs, as these cases are also likely to be suits for declaratory relief. In the third and fourth columns, when two firms are involved in the same number of suits, I rank them based on the number of patents over which they have litigated.

comparing the number of cases reported to the PTO with the number of case filings identified as patent related by the Federal Judicial Center.¹⁰ From this information, they are able to compute an adjustment factor, which scales up the number of reported cases to reflect non-reporting.

The second limitation has to do with the fact that all patents are not litigated immediately after issue. Rather, a considerable number of cases are initiated involving patents that are a few years old (the probability of litigation drops considerably for older patents). Because many of the patents in our sample are quite young (having been awarded as recently as mid-2003), this truncation bias may be significant. Based on patents awarded between 1982 and 1986, Lanjouw and Schankerman [2003] report adjustment factors: i.e., factors that allow one to compute the total expected amount of litigation over a patent's lifetime based on activity in the initial years.¹¹

Column 3 presents the adjusted amount of litigation. Once these corrections are made, there is no clear time trend in the amount of litigation: the upward adjustments are greatest for the oldest patents (due to the severe non-reporting biases in early years) and

¹⁰This administrative office compiles a database of all litigation, but does not indicate which patents were involved in individual cases.

¹¹There are two subtle differences between my procedure and Lanjouw and Schankerman's. First, the earlier authors assumed that there was only one patent per lawsuit due to the limitations in the early Derwent data noted above, while I researched the cases to determine missing patents. Because there are on average 1.3 patents per case in my sample, this will slightly inflate the reported rate. Second, approximately twenty percent of the entries in the Derwent database are duplicate records, referring to different actions in the same suit. I deleted these entries (which apparently was not done by Lanjouw and Schankerman). Thus, collectively these two adjustments should have a very modest effect on the comparisons.

the most recent ones (because of their greater truncation). Comparing the litigation rates to the similarly adjusted data of Lanjouw and Schankerman [2001, Table 1], the overall rate of litigation is some *twenty-seven times greater* than in their overall sample of awards. Even the technology group with the greatest litigation rate in the Lanjouw-Schankerman sample, “drugs and health,” has a litigation rate that is less than 7% that seen in financial patents.

Table 4 considers the litigation rate for patents with different classes of owners. Here again, there are dramatic differences between the litigation of these patents and that of patents more generally. There are substantial differences along three dimensions:

- Lanjouw and Schankerman [2001, page 145] found that corporate owners were far more likely to become involved in a patent suit than individual owners. Here, precisely the opposite result holds: patents assigned to individuals are five times more likely to be litigated than those held by public corporations, and 50% more likely to be so than those held by private firms (which include both smaller operating firms and patent holding companies).
- Overall (Lanjouw and Schankerman [2001, Table 1]), patents by individuals and institutions in the United States are 4.7 times more likely to be litigated than foreign-owned ones. Among financial patents, the ratio of the probabilities is almost twice as large (8.9 times).
- No clear patterns appear overall in the litigation rate of firms of different sizes (Lanjouw and Schankerman [2004, Table 3]). Here, by way of contrast, a dramatic effect appears. Among patents awarded to firms with fewer than 200

employees at the time, there is more than one lawsuit per patent. Among the patents awarded to the largest firms (those with over 200,000 employees), there is no litigation at all in this sample. When firms are segmented by revenues, a similarly dramatic pattern appears.

Thus, the characteristics of the patentee—type, nationality, and size—appear to drive the decision to litigate financial patents to a considerably greater extent than in other fields. Moreover, the prevalence in litigation of small firms and individual inventors seen here is quite anomalous.

I compare the characteristics of the patents themselves in Table 5. Following Lanjouw and Schankerman [2001], I examine domestic and foreign patentees separately, as their citation practices may differ. I contrast patents that are and are not litigated. Like litigated patents overall, litigated financial patents have more forward citations and claims. The difference in the number of forward citations, however, is much smaller and no longer statistically significant at the five-percent confidence level when I compute citations per claim. Thus, while litigated financial awards may be more expansive in their claims, they are not disproportionately cited once the number of claims are controlled for (unlike litigated patents more generally).

Moreover, among patents generally, patents with more backwards citations—which economists have interpreted as ones that more carefully reveal their intellectual predecessors—are less likely to be litigated. Among financial patents, the opposite pattern holds: litigated patents actually reveal more prior art. Together, these cross-

tabulations suggest that the decision to litigate financial patents may be driven less by the merits of the cases, and more by other considerations.

In the tabulations above, we have assumed that forward citations proxy for importance, which drives litigation. There might be another relationship between citations and innovation, however: patents that are litigated might be more frequently cited, not because they are more important, but rather because the publicity generated by the lawsuit calls attention to the award. This might lead to false inferences.

Following the procedure of Lanjouw and Schankerman [2001, Table 4], I test for the presence of a publicity effect. In particular, for all litigated patents, I look at the mean number of citations obtained in the years after the patent was applied for. In the first column, I look at the citations per year for patents that had not yet been (but eventually will be) litigated, separating the awards by the time since the patent has issued. I then compute in subsequent columns the number of citations that all patents received in the year after the filing of the lawsuit, the second year after such a suit, and so forth.

The results in Table 6 show that at least part of the difference in citations between litigated and non-litigated patents is driven by the “publicity effect.” In the three years after the dispute, the litigated patents garner 5.2 more forward citations relative to the baseline before the inception of litigation. (By the fourth year, the citation rate has returned to the baseline.) For the mean patent in the sample, which is twelve years old, this translates into a little under one-half of a citation per year. This accounts for roughly

23% of the difference in annual forward citation rates for litigated and non-litigated financial patents (4.0 and 2.1).

I then turn in Table 7 to a regression analysis to explain the prevalence of litigation. The unit of observation is each patent award in the sample. I employ two dependent variables in the reported regressions. The first (following the analyses in Table 5 of Lanjouw and Schankerman [2001]) is an indicator denoting as one instances where the patent was litigated before the end of 2005, and zero otherwise. The second is the count of lawsuits in which the patent was involved. (I do not adjust here for truncation or reporting biases, instead employing the year of the award as a control variable.)

In the first three regressions (which include a Poisson and more robust negative binomial regression when using the count of lawsuits), I employ a set of control variables modeled after those used by Lanjouw and Schankerman [2001]. These include the number of claims, the number of forward and backward citations per claims and their squares, and the share of citations that are self-citations (which may be less informative about quality or the thoroughness of the disclosure in the patent application).¹²

In Table 8, I explore the magnitude of the coefficients. I analyze the first, third, fourth and fifth regressions reported in Table 7. In the first column, I report the predicted

¹²I omit a number of independent variables less appropriate to a single industry sample, such as a measure of the similarity of each patent to the patents citing the award. Because so many of the awards are litigated by third parties, I do not run separate equations estimating the prevalence of litigation initiated by patentees and alleged infringers.

dependent variable at the means of the continuous variables and with the binary variables coded as zero. In the subsequent rows, I change one independent variable at a time, e.g., increasing the number of claims by one standard deviation or shifting the binary variables denoting a U.S. assignee from zero to one. In each case, I show the change in predicted dependent variable as the independent variable is shifted.

The basic patterns in the three regressions are that firms with more claims are more frequently litigated: a one standard deviation increase in the third regression increases the predicted number of suits per thousand from 72 to 160. Those with more forward citations experience an even more dramatic increase—a one standard deviation boost in the third regression raises the litigation rate per thousand to 244—though this effect weakens among firms with the highest citation rates. Firms with more backwards citations similarly are more frequently litigated: counter to the pattern seen in the overall population of awards, patents with better disclosure of the prior art do not experience less litigation.

Regression 4 adds a variety of firm characteristics to the specification. Consistent with the cross-tabulations in Table 4, patents awarded to public corporations are far less likely to be litigated: the predicted litigation rate falls by nearly two-thirds. Those patents awarded to individuals and particularly U.S. residents are more likely to be so. When I add employment and sales in the year of the award to the specification in regressions 5 and 6, the sample size shrinks (both due to the exclusion of individuals and the absence of data for many private entities), but the basic patterns remain. For instance, a one

standard deviation increase in employment in the fifth regression reduces the expected amount of litigation by 78%. Geographic location is no longer statistically significant in this case: the results in regard to nationality seem entirely driven by U.S. individuals and private firms for which no financial data are available.

While more important patents do appear to be more frequently litigated, as the economic models of suit and settlement would suggest, other results seem more problematic to reconcile with this view. In particular, the fact that better disclosed patents—*i.e.*, those with more backward citations—attract more rather than less litigation suggests that something else is going on. Similarly, the tendency of public corporations and larger firms, whose cost of litigation should be considerably lower, to litigate their patents less frequently seems puzzling. Rather, the latter results seem more consistent with the informal troll hypothesis delineated in the introduction.

C. Robustness Checks

I undertake a variety of robustness checks to examine whether the results are sensitive to the specification used. Most of these changes appear to have little impact.

The first concern is whether the results are sensitive to the particular specification used. One natural concern relates to our assumption that there is a linear trend over time in the propensity to litigate patents of different vintages, as would be the case if older patents were more frequently litigated simply because they had more time to generate conflicts. It may instead be that the patent office granted particularly problematic patents

in certain years or the cost of litigation varied over time. To address this concern, I repeat the specification reported in column 3 of Table 7 in column 7 of the same table, now employing dummy variables for the award year. The key results are little changed.

Another possibility is that the specification is problematic because it fails to account for the large number of zero observations in the sample. One way to address this problem is to estimate a zero-inflated negative binomial specification, in which a first stage estimates the probability that the patent is litigated at all, and the second focuses on the number of suits filed conditional on there being litigation. I report the second stage in column 8 of Table 7, again using a second-stage specification akin to that in column 3. (The first stage, which includes controls for the year of the award, the employment and sales of the firm, and the status of the assignee, is not reported.) While the sample is considerably smaller—reflecting the data limitations in the first-stage equation—the basic results go through as before: not only are patents with more claims more likely to be litigated, but so are those with more citations. (The positive impact of backward citations is no longer significant in this specification.) In unreported regressions, I repeated the other analyses using zero-inflated equations, and found that the key results were qualitatively unchanged, though sometimes at lower levels of statistical significance.

I also undertook a variety of other robustness checks in unreported analyses. Among the changes were:

- Using the adjusted counts of lawsuits, as in Tables 3 and 4, rather than the actual counts as the dependent variable in the regressions. (In the reported regression, by controlling for the year of the award, I at least partially addressed the differing vintages of the awards.) In ordinary least squares regressions, the results were similar in both the magnitude of marginal effects and statistical significance.
- Repeating the analysis using alternative measures of patent importance, such as originality and generality (Jaffe and Trajtenberg [2002]) in lieu of the citation counts. These alternative measures proved to have limited explanatory power.
- Employing the additional financial data available on public firms. The basic patterns continued to hold when these controls were added.
- Adding fixed effects for the firms awarded the patents. In regressions akin to that reported in column 3 of Table 7, the results were little changed: patents with more forward citations and claims were significantly more likely to be litigated. When measures of firm characteristics were added, however, these coefficients' significance dropped sharply from the reported regressions, which reflected the fact that the features of the firms only changed slowly (if at all).

4. Conclusions

This paper examines the controversial topic of business method patents. Many critics suggested that “patent trolls,” individuals who obtain and then aggressively litigate

patents of dubious validity, have exploited the weaknesses of the patent system in ways that are socially detrimental.

I focus on the subset of business method patents relating to financial products and services. I show that financial patents are being litigated two dozen times more frequently than patents as a whole. The awards being litigated are disproportionately those awarded to individuals and to smaller, private entities. The evidence regarding patent quality seems inconsistent—while more heavily cited patents are litigated more frequently in some analyses, better disclosed patents are also litigated more frequently, unlike in other technical areas. As argued above, taken together, the results are consistent with suggestions that individuals are exploiting the system to obtain and litigate financial patents of questionable quality.

This paper leaves open numerous questions. One of the most interesting is whether there have been benefits from financial patents that at least partially offset some of the costs associated with the apparent abuse of these awards. For instance, some practitioners suggest that the prospect of obtaining patent protection has encouraged financial institutions to pursue projects that they might not have otherwise, as well as to enter into strategic relationships that might have been difficult to negotiate without patents. I hope to explore these impacts in future research.

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Table 1: Characteristics of Patents and Lawsuits

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The table presents the key features of the patents and the 246 lawsuits involving these patents through the end of 2005.

<u>Panel A: Patent Awards</u>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max.</i>
Award year	1994.7	7.3	1976	2003
Application year	1992.1	7.1	1969	2002
Citations made	13.3	17.6	0	243
Citations received through July 2006	24.0	33.2	0	407
Self-citations made	0.6	2.1	0	60
Self-citations received through July 2006	0.4	1.0	0	15
Claims	20.9	20.9	1	375
Generality	0.44	0.25	0.07	1
Originality	0.53	0.27	0.06	1
Sales of assignee in award year (billions of 2003\$s)	24.9	37.8	0	467
Employment of assignee in award year (000s)	86.0	113.3	0.005	891
Assignee is a U.S.-based individual	16.0%			
Assignee is a non-U.S.-based individual	2.3%			
Assignee is a U.S.-based public corporation	32.5%			
Assignee is a non-U.S.-based public corporation	16.2%			
Assignee is a U.S.-based private firm	24.9%			
Assignee is a non-U.S.-based private firm	7.7%			
Nationality of assignee (if non-U.S.):				
Japanese	57.6%			
British	8.5%			
French	6.5%			
German	6.3%			
Lawsuits involving patent through end of 2005	0.08	0.59	0	15
<u>Panel B: Lawsuits</u>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max.</i>
Number of financial patents in suit	1.32	1	1	7
Patents awarded to plaintiff?	5.90%			
Patents assigned to plaintiff?	32.60%			
Patents awarded to defendant?	1.10%			
Patents assigned to defendant?	6.40%			

Table 2: Most Frequently Represented Firms

The table summarizes the firms most frequently represented in the tabulations of financial innovators between 1990 and 2002, financial patentees between 1976 and 2003, and litigators of financial patents between 1975 and 2005. The tabulations of plaintiffs and defendants exclude cases where an alleged infringer sues for declaratory relief; the compilation of defendants, actions against frequent patent plaintiffs..

<i>Innovators</i>	<i>Patentees</i>	<i>Plaintiffs</i>	<i>Defendants</i>
Merrill Lynch	Hitachi	Pangea Intellectual Properties, LLC	American Express
Citigroup	International Business Machines	Divine Technology Ventures	Citigroup
American Express	NCR	Source, Inc.	Chicago Board of Trade
Citicorp	Citigroup	Meridian Enterprises Corp.	New York Mercantile Exchange
McGraw-Hill	Fujitsu	Travelers Express Co.	JP Morgan Chase

Note:

The source of the first column is Lerner [2006].

Table 3: Distribution of Adjusted and Unadjusted Lawsuits, by Year

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The table presents for each time period the number of financial patents awarded and the adjusted and unadjusted rate of lawsuits involving these patents. See text for discussion of the adjustment process.

<i>Patent award year</i>	<i>Patents</i>	<i>Unadjusted lawsuits/ 1000 patents</i>	<i>Adjusted lawsuits/ 1000 patents</i>
1976-1979	110	45.5	285.9
1980-1984	258	19.4	62.4
1985-1989	443	101.6	235.4
1990-1994	294	210.9	411.9
1995-1999	762	86.6	299.2
2000-2003	1075	58.6	337.1
All patents	2942	83.6	293.5

Table 4: Adjusted Lawsuits by Firm Type

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The table presents for various sub-classes of assignees the adjusted rate of lawsuits involving these patents. See text for discussion of the adjustment process.

<i>Firm type in award year</i>	<i>Adjusted lawsuits/ 1000 patents</i>
<u>By Assignee Status</u>	
Publicly Traded Firm	114.5
Privately Held Firm	396.6
Individual	591.7
p-Value, test of no difference	0.000
<u>By Nation of Assignee</u>	
United States	382.8
Japan	29.9
Other	61.0
p-Value, test of no difference	0.000
<u>By Employees in Award Year</u>	
0-200	1153.0
201-1000	313.1
1001-50,000	80.3
50,001-200,000	47.1
>200,000	0.0
p-Value, test of no difference	0.000
<u>By Revenues in Award Year (millions of 2003\$s)</u>	
0-10	790.9
10.1-100	681.5
100.1-1000	74.7
1000.1- 10,000	84.5
10,000.1-50,000	45.1
>50,000	0.0
p-Value, test of no difference	0.000

Table 5: Comparison of Means for Litigated and Non-Litigated Patents

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The table presents for patents assigned to domestic and foreign assignees several characteristics of the patents.

	<u>Domestic</u>		<u>Foreign</u>	
	<i>Litigated</i>	<i>Not Litigated</i>	<i>Litigated</i>	<i>Not Litigated</i>
Claims	31.00	22.73 ***	24.83	14.40 *
Forward citations/year	4.04	2.40 ***	4.07	1.40 ***
Backward citations	19.39	14.78 **	9.83	8.24
Forward cites/year/claim	0.28	0.20 *	0.21	0.16
Backward cites/claim	1.77	1.18 *	0.61	0.96

Note:

*, **, and *** denote significance at the 10%, 5% and 1% significance level

Table 6: "Publicity Effect" on Patent Citation Rates

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The table reports mean annual forward citations for 6- to 15-year lags after the patent application filing date for the subset of awards that were eventually litigated, relative to the litigation date.

Citation Lag (years after patent application filing date)	Annual Citations Among Eventually- Litigated Patents <i>Not Yet Litigated</i>	Annual Citations Among Patents Litigated:			
		<i>1-year Previously</i>	<i>2-years Previously</i>	<i>3-years Previously</i>	<i>4-years Previously</i>
6	5.00	2.09	3.09	5.55	3.43
7	4.09	4.64	3.20	3.89	5.82
8	7.50	3.00	7.77	5.25	7.09
9	6.00	5.36	4.40	7.58	2.00
10	7.20	9.20	7.75	4.13	13.75
11	5.33	3.25	10.20	6.22	3.33
12	2.33	11.50	8.50	9.50	4.33
13	6.67	4.67	7.67	3.33	8.33
14	3.00	11.75	7.75	5.67	1.00
15	1.20	16.00	6.00	8.50	0.00
Overall Mean*	4.83	7.15	6.63	5.96	4.91

*Overall mean numbers of annual citations taken over citation lags of 6 through 15 years.

Table 7: Regression Estimates for Litigation

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The dependent variable in the first regression is a dummy variable indicating whether the patent was ever litigated; in the remaining regressions, it is the count of lawsuits involving the patent. The first regression employs a probit specification; the second is a Poisson estimation; and the remainder use negative binomial specifications.

	<i>Dependent variable: Was patent litigated?</i>			<i>Dependent variable: Number of lawsuits involving firm</i>				
	<u>Probit</u>	<u>Poisson</u>	<u>Negative Binomial</u>					
Logarithm of number of claims in patent	0.506 [0.069]***	0.918 [0.094]***	0.927 [0.168]***	0.866 [0.171]***	0.863 [0.330]***	1.334 [0.374]***	1.021 [0.181]***	0.806 [0.355]**
Forward citations per claim	0.083 [0.021]***	0.165 [0.031]***	0.249 [0.073]***	0.220 [0.068]***	0.261 [0.093]***	0.328 [0.110]***	0.160 [0.071]**	0.252 [0.096]***
Forward citations per claim squared	-0.001 [0.001]**	-0.003 [0.001]***	-0.004 [0.002]***	-0.004 [0.002]**	-0.004 [0.002]**	-0.005 [0.002]**	-0.002 [0.002]	-0.003 [0.002]
Backward citations per claim	0.157 [0.042]***	0.244 [0.053]***	0.320 [0.132]**	0.295 [0.128]**	0.381 [0.175]**	0.144 [0.118]	0.400 [0.135]***	-0.187 [0.293]
Backward citations per claim squared	-0.003 [0.002]**	-0.005 [0.002]**	-0.009 [0.006]	-0.008 [0.005]	-0.012 [0.007]*	-0.002 [0.003]	-0.011 [0.006]**	0.017 [0.014]
Share of forward citations that are self-citations	-0.836 [0.446]*	-1.929 [0.855]**	-2.343 [1.222]*	-1.135 [1.083]	-0.639 [1.101]	-1.342 [1.360]	-2.829 [1.358]**	-1.113 [1.448]
Share of backward citations that are self-citations	-0.049 [0.109]	-0.469 [0.275]*	-0.420 [0.370]	-0.036 [0.279]	0.174 [0.314]	-0.045 [0.402]	-0.256 [0.344]	-0.329 [0.441]
Year of award	0.001 [0.007]	-0.016 [0.011]	0.014 [0.021]	0.008 [0.020]	0.001 [0.033]	0.082 [0.045]*		-0.001 [0.035]
Was assignee a public corporation?				-0.981 [0.261]***	-1.322 [0.417]***	0.204 [0.543]		
Was assignee an individual?				0.520 [0.275]*				
Was assignee based in the United States?				1.189 [0.374]***	-0.485 [0.524]	-0.723 [0.572]		
Employment in year of award (000s)					-0.013 [0.005]***			
Sales in year of award (billions of 2003 \$s)						-0.066 [0.020]***		
Constant	-5.373 [14.842]	25.793 [21.168]	-33.809 [41.287]	-23.004 [40.635]	-7.753 [65.229]	-169.758 [90.580]*		-4.022 [68.542]
Year of award dummy variables	N	N	N	N	N	N	Y	N
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019
Observations	2786	2786	2786	2786	1510	1463	2786	1443

Notes:

Robust standard errors in brackets.

*, **, and *** denote significance at the 10%, 5% and 1% significance level.

The eighth regression is the second stage of a set of equations that controls for probability of no litigation occurring at all.

Table 8: Estimated Litigation Probabilities

The sample consists of 2942 financial patents awarded between January 1976 and August 2003. The dependent variable in the regression in the first row is a dummy variable indicating whether the patent was ever litigated; in the remaining regressions, it is the count of lawsuits involving the patent. The regression in the first row employs a probit specification and the remainder use negative binomial specifications. The first column presents the predicted dependent variable at the means of the continuous variables and with the binary variables coded as zero; the other columns show the change in predicted dependent variable as one variable at a time is shifted.

	At means	+1 Standard Deviation in Log Claims	+2 Standard Deviations in Log Claims	+1 Standard Deviation in Forward Citations per Claim	+2 Standard Deviations in Forward Citations per Claim	+1 Standard Deviation in Backward Citations per Claim	+2 Standard Deviations in Backward Citations per Claim	Patent Holder is a Public Corporation	Patent Holder is an Individual	Patent Holder is from the United States	+1 Standard Deviation in Employment	+2 Standard Deviations in Employment
Probability of Litigation (regression #1 in Table 7)	3.84%	9.18%	18.66%	8.97%	15.96%	8.95%	16.39%	-	-	-	-	-
Count of Lawsuits (#3)	0.072	0.160	0.358	0.244	0.613	0.165	0.325	-	-	-	-	-
Count of Lawsuits (#4)	0.032	0.068	0.144	0.095	0.217	0.069	0.129	0.012	0.054	0.105	-	-
Count of Lawsuits (#5)	0.073	0.154	0.325	0.270	0.749	0.192	0.410	0.019	-	0.045	0.016	0.003