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THE LITIGATION OF FINANCIAL INNOVATIONS

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ABSTRACT

This paper examines the litigation of patents relating to financial products and services. I show that these grants are being litigated at a rate 27 to 39 times greater than that of patents as a whole. The patents being litigated are disproportionately those issued to individuals and to smaller, private entities, as well as those whose features may proxy for higher quality. Larger entities are disproportionately targeted in litigation. I discuss how the findings are in large part consistent with the theoretical literature on the economics of litigation.

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Introduction

The impact of financial innovation is widely accepted. For instance, the economic importance of new products and services in the financial arena has been heralded by Miller [1986] and Merton [1992], questioned by Van Horne [1985], and empirically documented by Tufano [1989]. Yet the empirics of financial innovation have attracted remarkably little academic attention, as highlighted in a review article by Frame and White [2004].

Moreover, in the past decade, there has been a profound change in the conditions under which financial innovations are pursued. The *State Street* case in the late 1990s unambiguously established the patentability of financial inventions. (The history of financial patenting is summarized in Appendix A.) Because patents fundamentally alter the way in which innovations can be used—for instance, they make the type of rapid diffusion documented by Tufano [1989] less feasible—assessing the impact of patenting is critical to understanding the future of financial innovation. In particular, we know almost nothing about the way in which these financial patents, having been granted, are utilized by firms.

This paper seeks to understand the litigation of financial patents. Litigation is crucial to delineating the boundaries of patent awards. Moreover, since patent litigation typically entails several millions of dollars of expenditures for each party in a suit (AIPLA [2005]), the lawsuits in this sample represent a significant expenditure of resources in their own right.

After framing the paper through a discussion of the economics literature on suit and settlement, I empirically examine the litigation of all financial patents awarded between January 1976 and August 2003 through the end of 2005. I find that financial patents are being litigated at a rate 27 to 39 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. The rates are also far greater than that in the early years of an emerging industry where the extent and breadth of patent protection was initially ambiguous, biotechnology.

The bulk of this paper seeks to understand the litigation of financial patents in greater depth. I show that:

- The finance patents being litigated are disproportionately those issued to individuals. Inasmuch as those granted to corporations are being adjudicated, it is overwhelmingly those issued to smaller, private entities. This seems inconsistent with suggestions that larger firms will be able to detect infringements more accurately.
- Litigated patents appear to be more important than other financial patents: they have more claims, and disproportionately cite and are cited by other patents. This result appears consistent with standard economic models of suit and settlement.
- Litigation does not appear to have increased for patents awarded after the *State Street* decision, despite the likely increase of uncertainty about these awards. If

these years also saw an increase in the awarding of lower-quality patents, however, the lack of a temporal pattern may be consistent with theory.

- The defendants in these cases are dominated by larger firms. I suggest that well-off firms' greater propensity to be the target of lawsuits—and individuals' and smaller firms' tendency to initiate litigation—may reflect differences in the cost of litigation.

The plan of this paper is as follows. Section 1 briefly reviews the relevant literature on the economics of litigation. Section 2 describes the construction of the data-set. Section 3 analyzes which patents are litigated. Section 4 examines which firms are defendants in lawsuits. The final section concludes the paper.

1. Modeling and Analyzing Suit and Settlement

Since the pioneering work of Priest and Klein [1984], economists have understood that the decision to litigate rather than to settle disputes is a function of the expected payoffs. To summarize a well-developed literature (see the survey by Cooter and Rubinfeld [1989]), conditional on a legal harm being done, four considerations can be seen as increasing the probability of a trial being held:

- The likelihood that the offence is detected by the potential plaintiff.
- The size of the stakes under dispute.
- The uncertainty about the outcome of the controversy between the two parties.
- The costs of settlement relative to that of trial.

In the context of financial patent litigation, these hypotheses have a number of implications:

- The extent to which infringements are identified may be a function of the characteristics of the patentees. It is likely that larger, more established firms will have better information about the state of the market and the activities of their rivals, so they might be more likely to initiate litigation. Typically, patent litigation is initiated by the patent-holders themselves.[1] Among the ways we can characterize an entity are whether the patent-holder is a corporation, whether it is publicly traded, and its size and sales.
- While we cannot directly measure the value of patents, several indirect measures can be employed. The literature (e.g., Jaffe and Trajtenberg [2002], Lanjouw, Pakes, and Putnam [1998]) has suggested that patent value can be captured through a number of proxies, including the number of claims made in the issued patent, the number of citations in other patents that the patent subsequently received (an indication that subsequent inventions have built on this discovery), and the number of citations made by the patent (which has been interpreted as reflecting the care with which the patent drafters have searched the prior patents). Theory suggests that these more valuable patents should be more frequently litigated.
- The extent of uncertainty surrounding financial patents increased substantially after the *State Street* decision. Prior to this period, there was a general consensus

[1]While potential infringers can sue for "declaratory judgment" that they do not infringe a patent, these actions are only permitted when the alleged infringer has already been threatened with litigation. Other parties are not allowed to sue to have a patent declared invalid.

that financial innovations were unlikely to be patentable. After the decision, questions about the future of business method patent awards, the scope of these grants, and the size of the monetary damages associated with the infringement of financial patents have proliferated. But it should also be noted that the acceleration in the number of filings after the decision (documented in Lerner [2002]) suggests that more marginal discoveries may have been patented post-*State Street*. These less important discoveries may be less frequently litigated for the reasons delineated in the previous bullet.

- Assessing the relative costs of settlement rather than trial is challenging. An overall time trend may be difficult to discern. For instance, lawyers have been increasingly willing to work for plaintiffs on a contingency basis in patent cases, which reduces the cost of litigation sharply. Danzon [1983] shows how such contingency arrangements can lead to a greater willingness of plaintiffs to file suit in some cases, but not others.

One complication is introduced by the fact that most theoretical depictions are of the decision to proceed to trial once a suit has been filed. The empirical analysis here will focus on the initial decision to file litigation. In part, this is due to necessity: it is the exceptional patent case that proceeds to the end of a trial.[2] It can thus be argued that the decision to initiate litigation is the critical one in this setting. But more importantly, basic models of suit and settlement (e.g., Cooter and Rubinfeld, [1989, Section II.C]) suggest that factors affecting the decision to settle a dispute prior to trial should also drive the

[2]For instance, in Lanjouw and Lerner's [2001] sample, only in 11% of the patent suits was a verdict rendered in the case.

decision to settle prior to the inception of litigation. The same considerations—the probabilities of success, the extent of uncertainty, and the rewards if successful—should largely shape the decision to file a lawsuit and to proceed to trial.[3]

It should be noted, however, that models of nuisance litigation suggest that the decision to file a suit may be different in some instances from the decision to proceed to trial. In particular, a plaintiff may be willing to file a suit that would have a negative expected value were it to go to trial if certain conditions are met, such as if the defendant has greater costs in litigating disputes or if the defendant's costs are more "front-end loaded" (see, for instance, Bebchuk [1988], Cooter and Rubinfeld [1989], and Rosenberg and Shavell [1985]). In these instances, a plaintiff may rationally initiate a losing suit.

Earlier literature (e.g., Lerner [1995]) has suggested that firms as opposed to individuals, and larger firms in particular, should have more litigation experience and consequently lower litigation costs due to "learning curve" effects. This might lead us to conclude that nuisance litigation against large firms should be rare. Recent developments, however, raise questions about this interpretation. For instance, the reliance on injunctions both prior to (preliminary injunctions) and after (injunctive relief) a finding of patent infringement mean that the cost of an adverse judgment to a larger firm—where a shut-down and the associated reputational damage may affect a wide variety of product lines—may be greater than to a small firm or to an individual with a single product (or no

[3]A similar assumption has been made in other empirical research on litigation, such as Browne and Puelz [1999] and Lanjouw and Schankerman [2003].

product at all). If this suggestion holds, we may see disproportionate numbers of lawsuits directed against large firms by individuals or smaller concerns.

2. Constructing the Data-Set

This section summarizes how I constructed the data-set used in this analysis. More details are in Appendix B.

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. 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 (which gives me three years to observe citations). 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 through the end of 2005. I do not observe cases where litigation was threatened but no lawsuit was filed. Ideally, I could address this concern through a Heckman-style regression. But in the classic Heckman analysis, we typically have strong priors about what considerations lead to non-responses (e.g., that young children or a wealthy spouse may deter a woman's labor force participation). In this analysis, it was much more difficult to identify observable variables that could plausibly explain settlement prior to the filing of a lawsuit.

Characteristics of patentees. I also characterize the features of the parties to whom the patents were assigned in the year of the award. I classify the awardees into publicly traded corporations, privately held firms, individuals, and others (e.g., government and university entities), as well as obtaining information on the headquarters location, revenues, and employees of the patentee.

Features of the 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. The interpretation of self-citations is ambiguous: in part, it may indicate awards that are more valuable to the patentees. Earlier work, however, suggests that large firms disproportionately cite themselves. Finally, I computed two alternative measures of patent quality: generality and originality (see Hall, Jaffe, and Trajtenberg [2002]).

Potential defendants. In the final analysis in Section 4, I examine which firms are sued for infringement. In order to identify potential infringers, I analyze all firms in the "Finance, Insurance and Real Estate" industry category (except for Standard Industrial Classification class 65, which contains real estate operators) listed in Compustat in any year between 1990 and 2002. I download a variety of measures characterizing the firm's financial health and its propensity to innovate on an annual basis.

3. An Analysis of the Litigation of Patents

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 [2002, p. 439] find that the typical twelve-year-old patent had received just fewer than seven citations, or one-quarter the level seen here.[4]
- Financial patenting activity is dominated by U.S. firms, which account for 74% of the awards. In recent years, approximately one-half of all patent awards 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.
- 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

[4]The 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.

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.[5])

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.)

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

This point is 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.[6] 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).
- The most frequent plaintiffs[7] in financial patent litigation between 1976 and 2005 are reported in column 3. This list, in contrast to the others, is dominated by

[6]Mergers 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.)

[7]In some cases, entities file for "declaratory relief," or for a ruling that a patent they are being threatened with litigation about 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.

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. 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. The Overall Level of Litigation

I then examined the propensity for these patents to be litigated. The basic distribution of patent awards and suits 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 (which is expressed as suits per thousand patents issued) peaked among the patents issued between 1990 and 1994.

The data in column 2, however, have two limitations. First, not all cases are reported to the PTO. Lanjouw and Schankerman address this issue by comparing the number of cases reported to the PTO with the number of case filings identified as patent related by the Federal Judicial Center. This administrative office compiles a comprehensive database of all litigation. It does not, however, indicate which patents were involved in individual cases, so cannot be used as the basis for the analysis here. From this information, Lanjouw and Schankerman are able to compute an adjustment factor (reported in Appendix I of their 2003 paper), 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 the sample are quite young (having been awarded as recently as mid-2003), this truncation bias may be significant. I report two adjustments to the number of lawsuits:

- First, based on the actual distribution of litigation over time of all patents awarded between 1982 and 1986, Lanjouw and Schankerman [2003, Appendix I] report adjustment factors: i.e., factors that allow one to compute the total expected amount of litigation over a patent's lifetime based on the extent of such activity in the initial years after award.[8]
- Second, I look at the propensity to litigate financial patents specifically. Using the number of lawsuits in each year after each patent award in the sample as the dependent variable, I estimate the propensity of patents in different age groups and technology classes and with different grant dates to be litigated. I then use these coefficients to predict the amount of litigation over the patent's lifespan.

[8]There 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, my reported litigation rate will be slightly higher. 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.

Because the litigation of financial patents tends to be more concentrated in the later years after the award, this generates larger estimates than the first approach.

Columns 3 and 4 present 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 the most recent ones (because of their greater truncation). Comparing the litigation rates in the third column to the similarly adjusted data of Lanjouw and Schankerman [2001, Table 1], the overall rate of litigation is 27 times greater than in their overall sample of awards; using the fourth, it is 39 times greater.

The rate of patent litigation is far greater than that in other fields. In 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. Nor do other emerging technologies—where uncertainty is presumably greater—appear to have rates approaching financial patents. For instance, Lerner [1995] examines the litigation of the first 2048 biotechnology awards. He finds that the rate of litigation was less than one-fifth the rate seen here.

C. The Distribution of Litigation

Table 4 considers the litigation rate for patents with different classes of owners. Here again, there are dramatic differences across the various sub-samples:

- Patents assigned to individuals are five times more likely to be litigated than those held by public corporations, and about 50% more likely to be so than those held by private firms (which include both smaller operating firms and patent holding companies).
- Patents by individuals and institutions in the United States are 8 to 10 times more likely to be litigated than foreign-owned ones.
- The litigation rate of firms of different sizes differs dramatically. Among patents awarded to firms with fewer than 200 employees at the time, for instance, 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.

The prevalence in litigation of patents by small firms and individual inventors is quite striking.

I compare the characteristics of the patents themselves in Table 5. 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 is controlled for. Litigated patents do, however, cite more prior art.[9]

I then turn in Table 6 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 is an indicator denoting as one instances where the patent was litigated before the end of 2005, and zero otherwise. This is in the first column, which features a probit analysis. The second (in the remaining columns) is the count of lawsuits in which the patent was involved. In these cases, I estimate Poisson and negative binomial specifications. (I do not adjust the dependent variable here for truncation or reporting biases, instead employing dummy variables for each patent award year.)

In the first three regressions (which include a probit analysis as noted above, as well as a Poisson and more robust negative binomial regression when using the count of

[9]In the discussion above, I have argued 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. In an unreported table, 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 before and after the patent was litigated. Part of the difference in citations between litigated and non-litigated patents appears to be driven by a "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).

lawsuits), I employ a set of independent variables suggested by the theoretical discussion above.[10] These include the number of claims, the logarithm of one plus the number of forward and backward citations per claim, dummy variables denoting cases where there were no forward or backward citations, and the share of citations that are self-citations (which may be informative about the importance of the patent to the firm or just citation practices).[11]

Each of these regressions paints a consistent story. Patents ranking higher on the proxies for importance—those with more claims and with more forward and backward citations—are more likely to be litigated. The controls for self-citations are consistently insignificant.

In Table 7, I explore the magnitude of the coefficients. I analyze the first, third, fourth and fifth regressions reported in Table 6. In the first column, I report the predicted 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 variable 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.

[10]The sample size is smaller in the first regression. Some observations are dropped from the probit regression because a zero or one outcome is perfectly predicted.

[11]In cases where there are no citations, I code the share of self-citations as zero.

These provide an illustration of the magnitude of the effects delineated above. For instance, regarding the finding that patents with more claims are more frequently litigated, a one standard deviation increase in the third regression increases the predicted number of suits per thousand patents from 24 to 64. Those with more forward citations also experience an increase—a one standard deviation boost in the third regression raises the litigation rate per thousand to 49. Patents with more backwards citations, which again may suggest more important awards, similarly experience an increase in the litigation rate (to 40 per thousand).

Regression 4 adds a variety of characteristics of the patentee to the specification. (Once again, each patent is a separate observation, so some patentees are represented multiple times in the regression). 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 two-thirds. Those patents awarded to U.S. residents are more likely to be so. (The patterns concerning individuals are statistically insignificant.) When I add the logarithm of employment (in thousands) and sales (in millions of 2003 dollars) in the year of the award to the specification in regressions 5 and 6, larger firms' patents are associated with less litigation, as before. (In each case, I add one to the count of employees or sales before taking the logarithm.) For instance, a one standard deviation increase in employment in the fifth regression reduces the expected amount of litigation by 70%. We will defer discussing the implications of these results until we explore the distribution of defendants in these cases in Section 4.

Another natural question is whether there is a time trend in the pattern of litigation. On the one hand, the uncertainty around patent value is likely to have increased markedly after the *State Street* decision. On the other hand, the increase in financial patent filings after this decision may mean that more marginal discoveries were being patented post-decision. Chart 1 shows the coefficient on each annual dummy variable in the first negative binomial regression in Table 6 (the third regression). Not only are there no consistent patterns over time, but the year dummies are collectively and individually insignificant. A similar pattern emerges from year dummies in the other regressions. Perhaps reflecting the countervailing pressures, no pattern in the propensity to litigate appears around the time of the decision.

D. 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 my assumption that the appropriate time control was the date of award. It is reasonable to control for award date, as older patents may be more frequently litigated simply because they had more time to generate conflicts and the propensity to litigate will vary over time (patents can typically not be litigated until they are awarded). But it may be that there are systematic patterns in the patents applied for over time. To address this concern, I repeat in unreported regressions the specifications reported in Table 6, now also employing dummy variables for the application 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 7 of Table 6, 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.) The basic results go through as before. In unreported regressions, I repeated the other analyses using zero-inflated equations, and found that the key results were qualitatively unchanged. Similarly, I re-estimate the equations in Table 6 using a Tobit specification, and find that the results are qualitatively unchanged.

Another concern is that lawsuits may vary in intensity. In some cases, suits may be dropped or settled soon after being filed; in others, litigation may progress for years. (Of course, a suit that is quickly settled for a large amount may also be very disruptive to a defendant.) In order to measure the intensity of litigation, I total the number of docket filings in each case, using the records of the PACER system.[12]

[12]In approximately five percent of the cases, I am unable to obtain the index of the docket file, either through PACER or an examination of the physical docket. In these instances, I assume that the case had zero docket entries. I also repeat the analysis, assuming that these missing cases have the mean number of docket entries, and find that the results are essentially unchanged.

I then estimate Tobit regressions, employing the cumulative number of docket entries in the lawsuits associated with each patent as the dependent variable. Table 8 reports the regressions corresponding to the negative binomial analyses in columns 3 through 6 of Table 6. The primary results that appeared in the earlier regressions continue to go through as before.

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 using dummies for the year of issue, I addressed the differing vintages of the patents.) 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 (Hall, 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 about publicly traded 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 6, 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).

- Dividing the patentees by those above and below the median employment (and in a separate analysis, sales). Among both large and small patentees, the basic patterns held: patents with more claims and citations are more frequently litigated. The relationship between firm size and probability of litigation, however, is only statistically significant among the smaller firms.

4. Analysis of Defendants

In the analysis in Section 3, I analyze which patents are litigated. I now turn to examining which firms are especially likely to be named as defendants in these actions. Because it is difficult to observe the entire pool of potential defendants, I focus on publicly traded firms, which I can identify and characterize.

Theoretical work on the propensity to file litigation suggests that the costs of litigation should matter. But, as discussed in Section 1, the predicted effects are not obvious: larger firms should have lower litigation costs due to "learning curve" effects, but are also more vulnerable to damage to other product lines and their reputation from an adverse judgment. I employ several proxies for potential litigation costs:

- the firm's experience (measured, admittedly imperfectly, as the logarithm of its age as a public entity)[13]

[13]I compute the age and other measures using the Compustat identifier associated with the firm at the time of the innovation. I map in the count of innovations using the appropriate identifier. These assignments are not always apparent, but can be determined by

- its financial scale (as measured through the logarithm of assets)
- its financial condition (measured via its profitability, calculated as pre-tax operating income over sales)
- its leverage, measured as the ratio of the book value of the firm's long-term debt to total capitalization (the book value of its long-term debt and preferred stock plus the market value of its common stock).
- the location of its headquarters (foreign firms might face greater litigation costs), and
- the extent to which it engages in innovative activities (measured by the number of innovations associated with that firm reported in the *Wall Street Journal*, the extent of the firm's interconnections to academia, and the financial innovations occurring in the firm's zip code, all computed in the year of the observation).

I confine the analysis to all firms with a primary assignment to Standard Industrial Classification (SIC) codes 60–69 or else who developed a financial innovation that was reported in the *Wall Street Journal* during these years. (See Lerner [2006] for a discussion of the identification of these innovations; the results are robust to just using financial firms.) I report the analysis for the entire sample, and then for U.S.-only firms, and just for the period after the *State Street* decision. In each case, I add (but do not report) fixed effects that control for the major three-digit Standard Industrial Classification classes in the sample.

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reviewing the corporation's history using the Hoover's directory, Lexis-Nexis, the SDC Mergers and Acquisitions database, and online sources. Thus, for instance, an innovation by Wachovia Bank in 1999 would be assigned to Compustat GVKEY 11247 (denoted ''Wachovia Corp-Old''), while one by First Union Bank in that year would be assigned to GVKEY 4739 (denoted ''Wachovia Corp,'' reflecting the fact that First Union acquired Wachovia in 2001 and assumed its name).

The analysis, reported in Table 9, suggests that the strongest determinant of a firm being a defendant in financial patent litigation is its scale: the coefficient measuring the firm's assets is consistently positively and significant. The measures of innovation are consistently insignificant, and the firm headquarters dummies are inconsistent in sign.

One interpretation of these patterns—as well as the earlier finding that patents owned by individuals and smaller firms are much more likely to be litigated—harkens back to the discussion of the costs of litigation delineated in Section 1. If large firms find litigation substantially more costly than do other parties—presumably due to the risk of damage to their reputation or to other lines of business from a possible injunction—they may disproportionately be the subject of nuisance litigation, in which entities with lower litigation costs rationally target them with dubious claims, confident that the defendants will find it in their interest to settle the cases.

5. Conclusions

This paper examines the litigation of financial patents. I find that financial patents are being litigated two to three dozen times more frequently than patents as a whole. The awards being litigated are disproportionately those awarded to individuals and to smaller, private entities. Patents with more claims and more citations are also more frequently litigated. Larger firms are disproportionately targeted in litigation.

I argue that many of the patterns here are consistent with theoretical models of suit and settlement. In particular, the selection of more important patents for litigation follows directly from theoretical suggestions that high-stakes disputes should lead more frequently to litigation. If we accept the suggestion that larger firms have significantly greater costs of litigation, the patterns regarding the initiation of lawsuits and the targets in litigation would be consistent with theories of nuisance litigation.

It is less clear why we see the extraordinary high level of litigation in this area, even when compared to other emerging technology classes. It may be that given the substantial uncertainty and high potential rewards associated with these patents, the pressures to proceed to litigation are particularly great. Alternatively, the differences in the litigation costs between the various innovating parties may drive large numbers of nuisance suits, which may explain the prevalence of litigation.

This paper suggests a number of questions. Foremost among these are the consequences of these patterns of litigation for innovation in financial services. For instance, has the high level of intellectual property litigation deterred or encouraged the introduction of new products and services in this area? How have firms' innovative choices been affected by this new intellectual property regime? What has been the impact on social welfare? Understanding the consequences of these shifts are important, given the economic impact of financial innovation.

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Appendix A: Background on Business Method Patents[14]

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 questioned their validity. Consequently, patent-holders 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 the expansion of awards in this area has been about their quality. These concerns are at least partially supported by Lerner [2002], who 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.

[14]This appendix is based on Lerner [2002].

Appendix B: Details About Sample Construction

Patents: 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.

Litigation: The Derwent database is built using reports to the PTO from the district courts where the patent litigation is initiated. 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 in detail in Section 3.B.) 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.[15] From the database, I gather information on the key dates, parties, and location of the case, as well as the patents that were involved.[16] Because the lists of litigating parties provided by Derwent are 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. I count the number of lawsuits involving each patent, regarding each case as one suit even if there are multiple defendants named.

Patentees: 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 a non-governmental, non-academic assignee other than the inventor.[17] 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,

[15]I assume in the calculations below that the database contains all records involving patent litigation 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.

[16]Because 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.

[17]Because 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 corporate financial patentees are 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 issued patent. If there is no assignee, I use the location of the inventor.

Potential defendants: Information on financial health and headquarters location are taken from Compustat. I count innovations by a given firm by totaling the stories about innovative financial products or services introduced by that firm in the *Wall Street Journal* in a given year. I characterize the potential for knowledge spillovers by totaling the number of innovations by firms headquartered in the same zip code in the same year. I characterize the extent to which each firm is close to the academic frontier by employing the firm's representation on the editorial boards of four leading academic-practitioner journals, normalized by the firm's assets. I calculate each firm's editorial board seats at the beginning of each year. I count a firm that is a sponsor of a journal as having the equivalent of two editorial board seats. Lerner [2006] provides more details on these measures.

Table 1: Characteristics of Patents and Lawsuits

The sample consists of 2942 financial patents issued 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.

Panel A: Patent Awards	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Year patent issued	1994.7	7.3	1976	2003
Application year	1992.1	7.1	1969	2002
Claims made	20.9	20.9	1	375
Citations made	13.3	17.6	0	243
Citations made per claim	1.2	3.1	0	121.5
Citations received through July 2006	24.0	33.2	0	407
Citations received through July 2006 per claim	2.3	6.0	0	129
Self-citations made	0.6	2.1	0	60
Self-citations received through July 2006	0.4	1.0	0	15
Generality	0.44	0.25	0.07	1
Originality	0.53	0.27	0.06	1
Sales of assignee in issue year (billions of 2003$s)	24.9	37.8	0	467
Employment of assignee in issue 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

Panel B: Lawsuits	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Number of financial patents in suit	1.32	1	1	7
Patent invented by plaintiff?	5.90%			
Patent assigned to plaintiff?	32.60%			
Patent invented by defendant?	1.10%			
Patent 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.

Innovators	*Patentees*	*Plaintiffs*	*Defendants*
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 issued between January 1976 and August 2003. The table presents for each time period the number of financial patents issued and the adjusted and unadjusted rate of lawsuits involving these patents. See text for discussion of the adjustment procesess.

Patent award year	*No. of Patents*	*Unadjusted lawsuits/ 1000 patents*	*Rate, Adjusted Using All Patents*	*Rate, Adjusted Using Finance Patents*
1976-1979	110	45.5	285.9	285.9
1980-1984	258	19.4	62.4	62.4
1985-1989	443	101.6	235.4	266.4
1990-1994	294	210.9	411.9	607.1
1995-1999	762	86.6	299.2	491.4
2000-2003	1075	58.6	337.1	506.6
All patents	2942	83.6	293.5	429.3

Table 4: Adjusted Lawsuits by Firm Type

The sample consists of 2942 financial patents issued 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 processes.

Firm type in award year	*Adjusted lawsuits/ 1000 patents Using All Patents*	*Adjusted lawsuits/ 1000 patents Using Finance Patents*
By Assignee Status		
Publicly Traded Firm	114.5	175.4
Privately Held Firm	396.6	579.1
Individual	591.7	846.5
p-Value, test of no difference	0.000	0.000
By Nation of Assignee		
United States	382.8	560.9
Japan	29.9	34.8
Other	61.0	95.8
p-Value, test of no difference	0.000	0.000
By Employees in Award Year		
0-200	1153.0	1581.9
201-1000	313.1	488.0
1001-50,000	80.3	115.7
50,001-200,000	47.1	70.8
>200,000	0.0	0.0
p-Value, test of no difference	0.000	0.000
By Revenues in Award Year (millions of 2003$s)		
0-10	790.9	1238.0
10.1-100	681.5	1096.9
100.1-1000	74.7	119.9
1000.1- 10,000	84.5	113.9
10,000.1-50,000	45.1	72.8
>50,000	0.0	0.0
p-Value, test of no difference	0.000	0.000

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

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

	Domestic		Foreign	
	Litigated	*Not Litigated*	*Litigated*	*Not Litigated*
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: Regression Estimates of Number of Lawsuits

The sample consists of 2942 financial patents issued 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.

	Dependent variable: Was patent litigated?	*Dependent variable: Number of lawsuits involving patent*					
	Probit	Poisson	Negative Binomial				
Logarithm of number of claims in patent	1.062	1.125	0.976	0.806	0.854	0.621	0.705
	[0.101]***	[0.183]***	[0.184]***	[0.182]***	[0.184]***	[0.198]***	[0.206]***
Log of forward citations per claim	0.668	0.962	0.844	0.704	0.785	0.715	0.824
	[0.118]***	[0.246]***	[0.241]***	[0.237]***	[0.239]***	[0.272]***	[0.289]***
Zero forward citations?	-0.711	-0.177	-0.118	-0.160	-0.138	-0.278	
	[0.731]	[0.912]	[0.891]	[0.885]	[0.889]	[0.889]	
Log of backward citations per claim	0.887	1.047	0.922	0.700	0.709	0.770	0.796
	[0.149]***	[0.295]***	[0.287]***	[0.285]**	[0.287]**	[0.303]**	[0.306]***
Zero backward citations?	-14.189	-14.276	-15.444	-14.675	-16.062	-14.919	
	[863.717]	[1,020.750]	[1,508.425]	[959.875]	[1,936.375]	[1,161.905]	
Share of forward citations that are self-citations	-1.791	-1.420	-0.171	0.076	-0.016	-0.655	-1.278
	[1.616]	[1.413]	[1.004]	[0.947]	[0.963]	[1.257]	[1.219]
Share of backward citations that are self-citations	-0.311	-0.178	0.093	0.162	0.139	0.088	0.085
	[0.404]	[0.416]	[0.286]	[0.281]	[0.278]	[0.510]	[0.426]
Was assignee a public corporation?			-1.092	-0.016	0.094		
			[0.268]***	[0.359]	[0.441]		
Was assignee an individual?			0.428	0.335	0.283		
			[0.282]	[0.284]	[0.280]		
Was assignee based in the United States?			1.309	1.390	1.248		
			[0.387]***	[0.399]***	[0.391]***		
Log of employment in year of issue (000s)				-0.573			
				[0.124]***			
Misssing employment data?				-0.186			
				[0.341]			
Log of sales in year of issue (millions of 2003 $s)					-0.250		
					[0.073]***		
Missing sales data?					-0.465		
					[0.547]		
Year of issue dummy variables	Y	Y	Y	Y	Y	Y	Y
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	2757	2941	2941	2941	2941	2941	2941

Notes:
Robust standard errors in brackets.
*,**, and *** denote significance at the 10%, 5% and 1% significance level.
The seventh regression is the second stage of a set of equations that controls for probability of no litigation occurring at all.

Table 7: Estimated Litigation Probabilities

The sample consists of 2942 financial patents issued 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 *Log Forward Citations per Claim*	+2 Standard Deviations in *Log Forward Citations per Claim*	+1 Standard Deviation in *Log Backward Citations per Claim*	+2 Standard Deviations in *Log Backward Citations per Claim*
Probability of Litigation (regression #1 in Table 6)	3.22%	8.45%	18.37%	5.57%	9.08%	5.71%	9.49%
Count of Lawsuits (#3)	0.024	0.064	0.170	0.049	0.099	0.040	0.067
Count of Lawsuits (#4)	0.014	0.032	0.076	0.026	0.048	0.022	0.034
Count of Lawsuits (#5)	0.005	0.010	0.021	0.009	0.014	0.007	0.010

	At means	*Patent Holder is a Public Corporation*	*Patent Holder is an Individual*	*Patent Holder is from the United States*	+1 Standard Deviation in *Log Employment*	+2 Standard Deviations in *Log Employment*
Probability of Litigation (regression #1 in Table 6)	3.22%	-	-	-	-	-
Count of Lawsuits (#3)	0.024	-	-	-	-	-
Count of Lawsuits (#4)	0.014	0.005	0.021	0.051	-	-
Count of Lawsuits (#5)	0.005	0.005	0.007	0.020	0.002	0.000

Table 8: Regression Estimates for Litigation Intensity

The sample consists of 2942 financial patents issued between January 1976 and August 2003. The dependent variable is the count of filings in all lawsuits involving the patent. All regressions employ Tobit specifications.

	Dependent variable: Number of lawsuits involving patent			
			Tobit	
Logarithm of number of claims in patent	253.611	217.638	196.733	200.241
	[37.234]***	[36.742]***	[36.109]***	[36.166]***
Log of forward citations per claim	132.278	116.131	98.600	108.184
	[41.201]***	[40.902]***	[40.800]**	[40.739]***
Zero forward citations?	22.383	6.912	5.720	2.863
	[140.695]	[144.327]	[146.102]	[145.230]
Log of backward citations per claim	284.909	252.231	231.944	228.618
	[52.237]***	[51.074]***	[51.109]***	[50.852]***
Zero backward citations?	-2261.379	-2254.871	-2241.221	-2233.043
	[14490.399]	[9749.142]	[8798.306]	[9032.619]
Share of forward citations that are self-citations	-144.901	-3.578	28.058	17.151
	[225.276]	[132.905]	[130.783]	[130.221]
Share of backward citations that are self-citations	5.834	27.042	40.690	36.589
	[54.521]	[41.425]	[44.194]	[41.247]
Was assignee a public corporation?		246.571	243.371	234.984
		[76.882]***	[78.424]***	[76.193]***
Was assignee an individual?		-29.671	-44.860	-56.751
		[50.894]	[52.851]	[51.193]
Was assignee based in the United States?		-225.985	-35.122	14.706
		[49.876]***	[69.367]	[75.584]
Log of employment in year of issue (000s)			-89.986	
			[22.204]***	
Misssing employment data?			-18.262	
			[65.354]	
Log of sales in year of issue (millions of 2003 $s)				-41.595
				[12.535]***
Missing sales data?				-30.959
				[93.387]
Year of issue dummy variables	Y	Y	Y	Y
p-Value	0.000	0.000	0.000	0.000
Observations	2941	2941	2941	2941

Notes:
Standard errors in brackets.
*,**, and *** denote significance at the 10%, 5% and 1% significance level.

Table 9: Regression Estimates of Financial Patent Litigation Defendants

The sample consists of 15,397 annual observations of financial firms and financial innovators (see text) in Compustat between 1990 and 2002. The dependent variable is the count of filings in all patent lawsuits with the firm as a defendant in the year of the observation. All regressions employ negative binomial specifications.

	Dependent variable: Number of lawsuits involving firm		
	Negative Binomial		
	Entire Sample	U.S.-Based Firms Only	1999 and After Observations Only
Log years firm has been publicly traded	0.18	0.428	0.305
	[0.249]	[0.285]	[0.259]
Log of firm's assets	0.458	0.36	0.442
	[0.144]***	[0.127]***	[0.136]***
Profit margin	-0.134	0.043	-0.069
	[0.390]	[0.555]	[0.408]
Leverage	-1.615	-1.667	-2.038
	[1.142]	[1.351]	[1.089]*
Firm based in Bermuda	-15.367		-15.779
	[0.607]***		[0.621]***
Firm based in Japan	-17.254		-17.514
	[0.645]***		[0.556]***
Firm based in Canada	-14.515		-15.143
	[0.623]***		[0.716]***
Firm based in U.K.	1.733		1.428
	[0.659]***		[0.646]**
Firm based in other foreign nation	-16.142		-16.655
	[0.621]***		[0.579]***
Innovations by firm	0.524	0.384	0.201
	[0.396]	[0.344]	[0.265]
Academic connectedness	-0.763	-1.395	-0.615
	[1.020]	[2.804]	[0.459]
Other innovations in ZIP code	-0.27	-0.168	0.013
	[0.240]	[0.234]	[0.207]
Industry controls	Y	Y	Y
p-Value	0.000	0.000	0.000
Observations	15937	15034	5472

Notes:
Robust standard errors in brackets.
*,**, and *** denote significance at the 10%, 5% and 1% significance level.

Chart 1: Annual Dummy Variables from Regression 3 in Table 6

The table presents the coefficients from the 3rd regression in Table 6. The coefficient for 1976 is normalized to zero. No financial patents awarded in 1979 through 1981 and 1984 were litigated.