The Uninvited Guest: Patents on Wall Street

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> *Academic research could help to understand whether patenting will encourage or discourage innovation, change the nature of financial innovation, encourage more innovation by smaller players, or change the competitive/cooperative interactions among financial service firms. In part, this yet-to-be completed work will simply build upon the extensive body of work in the industrial organization field on patenting. However, trying to understand what—if anything—is different about the financial services industry, and the implications for protection of intellection property and the nature of competition, is likely to be a fertile area for future work.*

-- Peter Tufano (2002: 37).

1. How Did We Get Here?

Up until a few years ago, State Street Bank was just another big bank in Boston. But in 1998, the Federal Circuit Court of Appeals used a patent case filed by the bank to transform the law concerning what is patentable. From now on, the bank's name will be irrevocably linked to a landmark case. Like Linda Brown of "Brown vs. Board of Education" fame, or Ernesto Miranda, who lent his name to the famous Miranda Warning ("You have the right to remain silent . . ."), State Street Bank will be forever linked with a major inflection point in U.S. law.

For many in the financial services industries – banking, investment banking, stock brokerage firms, and the like – "*State Street Bank*: the case" was a bolt from the blue.

How could patents apply to something as amorphous as the design of a new mutual fund system? Light bulbs, telegraphs, integrated circuits, foolish gadgets like self-tipping hats, maybe; but *financial products*?[1] As my young son might put it, "what's up with that?" And more to the point, regardless of where these new patents came from, how would they affect the financial world? Would they help or hurt the financial services industries in the long run? And had anyone thought this all through before making State Street Bank a household name outside Wall Street and Boston?

In this paper I tackle some of these issues. My primary goal is to review what we know about innovation in the financial services industries, and try to discuss intelligently the effect patents will have. But first, as a service to readers drawn from these industries who might still wonder how these questions got on the agenda, I will try to explain how the patent system got to *State Street Bank* in the first place.

There are two strands to the story: (1) the subversive effects of computer software; and (2) the growing fascination with intellectual property generally. I consider each in turn.

1.1 The Long and Winding Road to Software Patentability

From the point of view of patent law, the infusion of computer technology has completely changed how the legal system conceptualizes financial services. From a

[1] As many readers will be aware, the *State Street Bank* decision actually goes well beyond financial services. The case authorizes patenting of any "method of doing business," or more precisely, removes "business methods" from the list of things that are not patentable. In this paper I limit my discussion of *State Street Bank* to its impact in the industry in which it arose – financial services. For more general observations, particularly on the knotty issues of patent quality control the case raises, see Merges (1999).

patent lawyer's point of view, many aspects of the financial services industries look like elaborate computer software applications. Despite the differences in climate and dress, Wall Street may as well be Palo Alto, Berkeley, or Redmond, Washington. After all, one can hear the patent lawyer saying, it's all just software now.

Given this mindset, the patentability of financial services is simply a subset of a larger issue: the patentability of software. This was one of the most troublesome and longstanding issues in patent law for many, many years. Since the early days of the mainframe computer business, when IBM and others tried to get patents on software just as they always had for adding machines and then computer hardware, the patent system tried to grapple with a fundamental conundrum. How could written code – symbols on paper, basically – be a form of technology? Was the patent system of Thomas Jefferson, the MacCormick reaper, Orville Wright, and Thomas Edison the proper home for a series of instructions written down to tell a machine what to do?

The tale of how the patent system stopped worrying, and learned to love computer software is a long one. I will only hit the highlights here. After the Supreme Court expressed grave doubts about the whole enterprise in the early 1970s, software went underground in the patent system. It reemerged, in the form of patents claiming essentially various pieces of machinery that were assisted by computers running programs (i.e., software). Thus the famous 1980 case of *Diamond v. Diehr*,[2] which upheld the validity of a patent on a rubber curing machine – a machine that happened to be assisted by a computer running software.

From 1980 until the mid-1990s, patent lawyers pushed the envelope defined by the *Diehr* case. Software was buried in patent claims. Wherever possible, attention was directed to conventional industrial processes that were accomplished using a computer, which computer just happened to run software. As these inventions were characterized, software was never an end in itself. Yet patent lawyers were forced to resort to ever more

[2] 450 U.S. 175 (1980).

creative feats of characterization, because software was in fact increasingly separate and distinct from the hardware it ran on. Eventually, the elaborate game of "hide the software in the claims" culminated in a series of claim types. I will explain one of several – the "general purpose computer" claim.

In these claims, the invention is described as a "general purpose computer," i.e., one capable of running many different programs. The claims go on to state that this computer is "configured" a certain way – configured by software as the computer runs it, that is. Thus to a patent lawyer, when I shut down my Word for Windows application and open Microsoft Excel, I am not just moving in and out of different computer programs. I am creating a new computer! When I open Excel, I am ***reconfiguring the hardware***, rather than running a new program.

Although no judge ever actually articulated it, everyone seemed to understand that these characterization games had gotten out of hand. Legal practice did not reflect underlying technological reality. And the computer software industry had simply gotten too big by the 1990s for the patent system to ignore it. Throughout the 1990s there were a series of decisions concerning software that subtly signaled the beginning of the end of many of the old games. Software *qua* software was no longer strictly forbidden. By the mid-1990s, software in useable commercial forms could be effectively patented.

Despite the sense of change, no single case had clearly stated the end of the old regime. Then along came *State Street Bank*. This case represented a perfect opportunity to clear up any lingering doubts about the patentable status of software. And the Federal Circuit took advantage, with its sweeping opinion now so well known to the financial community.

From the perspective of the history sketched here, then, *State Street Bank* did not come out of the blue. Far from it. It was the culmination of a very long digestive process. After initially choking on software, and then letting only a little bit slip through, in

disguise, the patent system finally gave in. Financial services software just happened to be on the menu when the Federal Circuit got serious about software.

1.2 The "Shifting Baseline": or, The Propertization of Just About Everything

I have tried so far in this section to put business methods in the context of the evolution of software patent law. But an even broader change has been taking place, one that is also important for an understanding of how *State Street Bank* came to pass.

Not too long ago, intellectual property scholars could speak confidently of "the competitive baseline" – the idea that property rights were a deviation from commercial norms embodied in our legal system. Patents, copyrights, and trademarks were the ***exception***; open access to rivals' products was the rule. All this has changed in recent years. As I argued in a recent review article, the principle of philosopher John Locke – labor yields property – has displaced the competitive baseline:

> The shift that has occurred has taken place at the deepest substratum of the field, down where the foundational principles bump and grind against each other. One massive construct, the principle of the competitive baseline, has started to give way. Under this notion, IP rights were envisioned as a rare exception. The general rule--the law's deep default--was open and free competition. This was always opposed by a counter-principal, the idea that labor equals property. On this view, property rights are a matter of desert: in true Lockean fashion, property arises when you mix your effort with the found assets of the natural world. When seen from the perspective of laboring creators, the proper baseline is to protect all manifestations of creativity that take more than a trivial amount of effort. This was a powerful principle, to be sure, but until recently not usually powerful enough. The great tectonic shift of recent years has reversed this, however. Now it often seems as though the labor-equals-property principle dominates. Increasingly, courts and legislators seem to believe that if one type of labor deserves a property right, then others do as well. And so all manner of intangibles

> meet with protection--even when, in the past, the competitive baseline would have militated against it.

(Merges 2001:2239-2240).

The rise and fall of fashionable ideas is certainly nothing new to the world of finance. One paper on financial innovations is even entitled "Boom and Bust Patterns in the Adoption of Financial Innovations" (Persons & Warther, 1997). My point here is simply that these are boom times for the ***concept*** of intellectual property. Businesspeople, the media, policymakers, and academics all seem fascinated by it. It is thus no wonder that, when confronted with a claim to property rights over some novel subject matter, a judge living in this environment is less likely to ask "why?" and more likely to say "why not?". This is a simple fact of our world, and no doubt has some influence in cases such as *State Street Bank*.

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So where are we now? The following table gives us some idea. It presents totals for patents in class 705 of the U.S. Patent Classification system which is titled, "Data Processing: Financial, Business Practice, Management, or Cost/Price Determination," for the years 1994 until 2001.[3]

[3] Class 705 is conventionally associated with business method patents, even though some relevant patents are found in other classes. The patent at issue in *State Street Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 47 U.S.P.Q.2d 1596 (Fed. Cir. 1998), *cert. denied*, 119 S. Ct. 851 (1999), the case that changed the law in this area**,** is in this class. *See* U.S. Patent 5,193,056, "Data Processing System for Hub and Spoke Financial Services Configuration," filed 3/11/91 and issued 3/9/93. Note the issue date –

Year	Patents
1994	165
1995	94
1996	167
1997	198
1998	469
1999	833
2000	1006
2001	837

As with so many things, the numbers tell the tale. Financial innovations are very much patentable subject matter now. Now that patents are here, the question is, are they really necessary? To answer that, we need to know something about how financial firms protected their investments in innovations before the advent of patents.

2. The "Appropriability Environment" of Traditional Financial Services Industries

The financial services industries appear to be highly innovative. In the area of traded securities alone, it is estimated that in the period 1980 to 2001, the securities industry generated between 1200 and 1800 new types of securities (Tufano, 2002: 7).

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an indication that financial services innovations were finding their way into the patent system even before the practice was explicitly blessed by the Federal Circuit in 1998.

Innovation in securities occurs to fill gaps in available instruments. New securities are constantly being devised to shift risks in ways not otherwise possible, and to provide payoffs for outcomes that current securities do not cover (what financial economists call "market completeness"). Outside securities per se, there is no shortage of innovations in the world of finance. New contracts, new transactional technologies such as ATMs, and even entire new exchanges have all been common in the past twenty-five years.

Scholars of innovation are well aware that intellectual property rights are not the only mechanism firms employ to recoup product development investments. The general term for this issue in the literature is "appropriability" (Teece, 1986). The empirical evidence establishes that patents are considered *essential* to appropriability in only a few industries – most notably, pharmaceuticals and some branches of the chemical industry (Cohen, Nelson & Walsh 2000). In other industries, the standard non-patent appropriability mechanisms include:

- Lead-time or "first mover" advantages;
- Co-specific assets, uniquely adapted for use with the innovation;
- Trade secrecy/ tacit knowledge

In financial services, lead-time, co-specific assets, and trade secrecy/tacit knowledge seem to be important. I consider each in turn.

2.1 Cost-Saving Lead Time

In a series of highly illuminating studies, Peter Tufano documented the financial innovation process. Tufano's original paper (1989) studied 58 financial innovations introduced between 1974 and 1986. The innovations were in mortgage-backed securities, asset-backed securities, non-equity-linked debt, equity-linked debt, preferred stock, and equities. These innovations were created "almost exclusively" by the largest investment banks, with six banks in particular accounting for over 75% of "pioneering deals"

(Tufano, 1989: 219). Large banks were more dominant in innovative deals than in deals overall – making financial innovation very much a game for "big players."

Tufano's finding regarding the dominance of large firms in the "innovation game" is echoed by Frame & White (2002: 13 Fn. 16):

> For example, casual empiricism leads us to notice that relatively large financial services providers have been important innovators. Merrill Lynch was the developer of the "cash management account"; Salomon Brothers was the leader in developing stripped Treasury securities; the larger commercial banks led in developing and offering "sweep" accounts, ATMs, and Internet transactions for customers. But it would be useful to have a more formal "census" of innovations and their originators and the characteristics of those innovators.

Tufano studied the appropriability strategies of financial innovators. He found that innovation was indeed costly; he estimates that

> Developing a new financial product requires an investment of $50,000 to $5 million. This investment includes (a) payments for legal, accounting, regulatory, and tax advice; (b) time spent educating issuers, investors, and traders, (c) investments in computer systems for pricing and trading, and (d) capital and personnel commitments to support market-making. In addition, investment banks that innovate typically pay $1 million annally to staff product development groups with two to six bankers.

Tufano (1989:213).

Tufano finds that investment banks recoup these investments through reduced costs in the market for innovative financial products. The pioneer of a new product has lower costs than its imitative rivals, allowing it to capture a larger market share than imitators. This in turn permits higher profits in the related secondary market for the

pioneering product – i.e., there are economies of scope. Essentially, even after imitators observe the pioneering product and copy it, the pioneer retains a long-term cost advantage. At the market price set by imitating rivals, the pioneer enjoys "inframarginal costs," and hence supra-competitive profits. Innovators actually charge less than imitators, particularly at first. In addition, a reputation for innovation helps banks in other ways. For example, Tufano describes a class of specialized, client-specific innovations that are rarely imitated (Tufano, 1989: In the market to produce these, a reputation for innovation is of course helpful.

This cost-advantage mechanism for appropriating innovation costs is not unknown in other sectors. It seems to explain a good deal of readily-copied process innovations in certain industries, for example. The important feature of this appropriability mechanism for our purposes is that it does not rely on property rights to be effective. It does not even rely on informal methods of retaining exclusivity: everyone in the industry understands that "most new products can be reverse-engineered easily and cheaply" (Tufano, 1989: 230). Indeed, rapid diffusion of information about an innovation is actually a marketing advantage for pioneering firms.

2.2 Tacit Knowledge and Reputational Advantage

A major area of financial innovation in the past thirty years is securitization, the transmutation of difficult-to-value assets into easily tradable securities. Securitization expert Professor Tamar Frankel has asked why the originators of new securitization practices have not generally sought property rights for them. She begins by noting the difficulty of adapting exiting intellectual property categories to the protection of unique securitization ideas. Next, she considers some of the more subtle appropriability mechanisms – tacit knowledge and reputational advantage. Tacit knowledge can be thought of as know-how: the highly detailed, often context-specific knowledge actually required to do a complex job (Polanyi, 1967). It is hard to specify (as more than one "artificial intelligence" expert can testify), even harder to write down (or "codify"), and

even harder still to transfer from one person to another (Cowan, David & Foray 2000). Tacit knowledge is usually therefore defined in contrast to more easily codifiable information.

Frankel argues that tacit knowledge of how to create a novel securitized asset provides a subtle appropriability mechanism to financial innovators:

> [P]aradoxically, "giving away" an innovation provides many monetary benefits. To begin with, these giveaways may not be complete. Unlike disclosure in applications for patents, disclosures of innovations in advertising, presentations or professional publications are not as complete and detailed. Certain experiences, drawbacks and danger points are likely to be omitted. Some say that following cookbooks of famous chefs rarely seems to produce dishes that taste as the chefs' dishes do. That is not necessarily done by intentionally avoiding an important ingredient from the recipe (although some cooks would be tempted to do so). In a complex area with different actors, it is difficult to transfer fully information in such publications so that the reader can replicate the activity without hands on guidance. Just as the water, cooking utensils, and ingredients may not be identical to those used by the author-chefs, so will the quality of the financial assets, the type of clients and the legal environment of the transactor differ from those of the innovators. These differences may produce difficulties for the novices.

Frankel (1998: 271).

Frankel also provides evidence of reputational advantages accruing to the creators of securities innovations. In this field, lawyers who help transmute illiquid assets into tradeable securities comprise a small, specialized corner of the legal profession. According to Frankel, "innovators reap the rewards of prestige from enhancing their reputation. For some people, these rewards may be the main driver." (Frankel, 1998: 272). This is also consistent with findings by Tufano, who recounts the bankers' view that innovation is the best way to advertise expertise (Tufano, 1989: 235).

While one case does not make a trend, a recent trade secret case indicates that appropriability mechanisms other than lead time may occasionally be important. In 1995, Morgan Stanley submitted a proposal to the State of California in response to an unusual request. The State was looking for innovative approaches to securitizing the risks associated with earthquake losses, an insurance market that the State had recently entered in response to perceived market failure in the private insurance business. Investors Guaranty Fund., Inc. ("IGF") is a small firm that apparently specializes in coming up with securitization concepts, and helping large investment banks to implement them. IGF claimed that Morgan Stanley's submission to the State was based on IGF's "total integrated system" for securitization of insurance risks. IGF had, it argued, successfully employed this system in other securitization projects in conjunction with other banks.

The trade secret suit was dismissed.[4] The court stated that the IGF system was based on public domain concepts, and was not in fact proprietary to IGF. The court also ruled that the system did not confer a competitive advantage on Morgan Stanley, as the State terminated the securitization experiment and implemented a more conventional reinsurance scheme instead.

2.3 Industry Appropriability and The Prior User Defense to Patent Infringement

There is good evidence that the financial services industry sought to protect established appropriability practices in the wake of *State Street Bank*. Financial services firms lobbied for and obtained a limited defense to infringement which is now part of the U.S. patent statute. Under this "prior user right," firms that have developed and implemented secret internal methods of doing business may not be precluded from using them by later inventors who obtain a patent. A special provision was required to secure

[4] Investors Guaranty Fund, Ltd. v. Morgan Stanley & Co., Inc., 50 U.S.P.Q.2d 1523 (S.D.N.Y. 1998).

this result, as generally U.S. law disfavors a secret prior user compared to a later user who files a patent application.

Prior user rights are common in other countries, particularly in Europe. They provide a measure of protection for firms that develop innovations but do not wish to patent them. They insulate earlier developers from the very expansive reach of property rights granted to later inventors. Many commentators, drawing on the empirical evidence concerning the centrality of trade secret protection as an appropriability mechanism in some industries (Cohen, Nelson & Walsh, 2000), have argued in favor of a general prior user right under U.S. law. But the actual law enacted in the wake of *State Street Bank* is much more limited: it protects only prior inventors of "a method of doing or conducting business" from infringement liability.[5]

Lawyer/lobbyists for the financial services industry very likely drafted this provision – a common occurrence in intellectual property legislation, as elsewhere.[6] In

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[5] 35 U.S.C. § 273(a)(3) (2002). For more detail, see *See* Robert P. Merges and John F. Duffy, *Patent Law and Policy* 172-173 (3d ed. 2002).

[6] For a limited defense, see Merges (2000) (reviewing literature on alternatives to rent-seeking and capture theories of lobbying). It should also be noted that the sponsor of the bill that included what is now § 273 of the Patent Act stated that this provision was not intended solely for the benefit of the financial services industry:

The earlier-inventor defense is important to many small and large businesses, including financial services, software companies, and manufacturing firms – any business that relies on innovative business processes and methods."

addition, industry representatives also appear to have drafted comments to be entered into the Congressional Record under the names of lawmakers from New York and New Jersey – Wall Street territory. These comments provide helpful insight into the perceived threat posed by the *State Street Bank* decision. Thus the Senate version of the Congressional Record includes this entry from Senator Charles Schumer (D.-N.Y.):

> The first inventor defense will provide the financial services industry with important, needed protections in the face of the uncertainty presented by the Federal Circuit's decision in the *State Street* case. . . [T]his decision has raised questions about what types of business methods may now be eligible for patent protection. In the financial services sector, this has prompted serious legal and practical concerns. It has created doubt regarding whether or not particular business methods used by this industry – including processes, practices, and systems – might now suddenly become subject to new claims under the patent law. In terms of every day business practice, these types of activities were considered to be protected as trade secrets and were not viewed as patentable material.

145 Cong. Rec. S14,836 (daily ed. Nov. 18, 1999), at S.14,994 (statement of Sen. Schumer).

Congressional Record --- Extension of Remarks In the House of Representatives Thursday, August 5, 1999 AMERICAN INVENTORS PROTECTION ACT OF 1999, 145 Cong. Rec. E1788-02, at E1789 (Statement of Rep. Howard Coble, D.-N.C.).

The identical statement was entered under the name of Representative Jerrold Nadler (D.-N.Y.).[7] And a similar comment was entered by Senator Robert Torricelli (D.-N.J.)., who states that

> Without this defense, financial services companies face unfair patent-infringement suits over the use of techniques and ideas (methods) they developed and have used for years.

145 Cong. Rec. S14,836 (daily ed. Nov. 18, 1999), at S14,995 (statement of Sen. Torricelli).

As Senator Schumer is quoted as saying, financial product innovations have traditionally been "protected as trade secrets." Based on what we know, lead time and reputation might be added to the list. The point of the legislation is to defend these traditional mechanisms against the onslaught of patents. Because of certain technical features of the defense, however, it is not clear that the defense alone will protect financial services firms from the patents of "outsiders." This explains why large Wall Street firms are at the same time beginning to acquire some patents of their own.[8]

2.4 Property Rights Enforcement and Information Sharing in "Traditional" Areas of Innovation

[7] Congressional Record --- House of Representatives Thursday, November 18, 1999 CONFERENCE REPORT ON H.R. 3194, CONSOLIDATED APPROPRIATIONS AND DISTRICT OF COLUMBIA APPROPRIATIONS ACT, 2000 145 Cong. Rec. H12798-01, at H12805.

[8] For example, in December, 2002, CitiCorp had 28 patents, Merrill Lynch 26.

One crucial point of importance at this stage of the discussion is to note that not all property rights are enforced. This is often lost on critics of property rights, who positively thrive on presenting and embellishing a gruesome "parade of horribles." With proliferating property rights, we are told, businesspeople could no longer do many things they are accustomed to. Every patent owner could prevent everyone else from using their patented technology. And because they ***could***, we are told, they ***would***. Does this claim hold up based on what we know about other fields where intellectual property has arrived suddenly on the scene?

In a word, no. One example comes from academic science. Here open exchange of research findings was long thought to serve as a model of information dissemination in the absence of property rights. Many observers thought the sudden advent of patents on the fruits of basic scientific research – particularly in the life sciences – was sure to kill the scientific enterprise, or at least inflict a mortal wound. But it did not. The reason was that although scientists (and particularly the research universities that employ them) aggressively acquire property rights, they almost never assert them against other scientists engaged in academic research. A scientist who draws on the work of peers in doing his or her own research follows a well-understood norm in the field: patents are asserted only against commercial entities. Fellow scientists operating within the same research community are off limits. In effect, there is an inner circle within which property rights are mutually "waived." They are only deployed against private firms operating in the outside circle of the corporate biotechnology industry. Even though many academic scientists work across both circles on a regular basis, they recognize that property rights are appropriate only in the outer circle. Patents are "checked at the door" when a researcher enters the domain of pure research. This is why, long after the advent of the property rights revolution in science, pure academic research – and the open, property rights-free exchange of information it depends on – continues to thrive.

A variation on this theme involves cooperative cross-licensing. In some industries, most notably semiconductors, firms aggressively acquire patents. But they are not typically asserted against commercial rivals in litigation. Instead, firms cross-license

large patent portfolios. Sometimes two evenly matched firms cross-license with no royalty payments. For technologically unequal trading pairs, lump sum payments or ongoing royalties change hands. In either event, patents serve as "bargaining chips" in an elaborate industry scheme of information transfer. Patents mediate, rather than obstruct, the flow of information.

Would patents lead to continued exchange in the financial services industries? It is hard to say. There is some indication that little has changed in the wake of the *State Street Bank* decision. Perhaps the large firms continue to share information amongst themselves, banking patents only as a hedge against outsiders' attempts to use patents to hold up existing firms. And lobbying for a "prior user right" exception to infringement (see section 2.3 above) hints that financial firms' main goal in the post-patent era is to make the world safe for their existing practices. So perhaps the free exchange of information about new innovations will continue for the most part.

3. Past Responses to the "Patent Plague"

Wall Street's reaction to the threat of patents runs contrary to the simplistic theory of incentives inherent in the patent system. But there are other cases where an industry has greeted the introduction of patents as more of a threat than an incentive. It may be instructive to review several of these episodes, with the goal of determining how serious the patent threat turned out to be, and how effective industry responses were.

3.1 Nineteenth Century Railroads

Our first brief study may seem to come from far afield – temporally and conceptually. But in may ways, the coming of patents to the railroad industry in the nineteenth century looks very like the post-*State Street Bank* world on Wall Street. So far, financial firms have undergone the same shock and surprise as the railroads when they

first came to grips with the disruptive effects of patents on established routines of innovation. And Wall Street has responded the same way, though much more quickly – with an aggressive counterthrust to the legal system's incursion into familiar turf. As with the railroads, financial firms have lobbied for legislation to overturn the most damaging aspects of the new patent regime. Indeed, judging by results, Wall Street's response has been more effective so far; the railroads never did succeed in getting favorable legislation passed. By contrast, the railroads slogged things out in the legal trenches for many years before beating back the most threatening aspects of the legal onslaught. Despite the differences, there is much to gain in a quick overview of the patent episode in railroad history.

To begin, there was a great deal of similarity in the way innovation progressed in nineteenth century railroading and late twentieth century Wall Street. Innovation in both industries was "an inside job": it was dominated by large, vertically integrated firms (Usselman, 2002). Nineteenth century railroads not only laid track and scheduled shipments. They also performed service on and made routine improvements to locomotives, switching technology, rails, and all other aspects of railroad technology. Moreover, innovations diffused rapidly to rivals, and this was an accepted part of the business. Far from preventing this flow of information, the chief technology players at the major railroads saw themselves as part of a larger, cross-firm enterprise. They shared a common culture that included an implicit norm regarding new techniques: I share with you, you share with me (Usselman, 2002: 65). There was pride in an innovation that others could use, perhaps even some increment to firm or individual reputation.

The "appropriability regime" was dominated by complexity and capital constraints. Locomotive technology, for example, was simply too complex for many firms to get into the industry. There were few rivals around that could gain much from learning about an innovation. New technology alone was rarely seen as conveying a competitive advantage. Reaping the rewards from it required access to the wide array of co-specific assets comprising a full-service rail line. Property rights played a very small role in such a setting.

All this began to change by the 1870s. This era saw a host of "outside inventors" descending on the railroads. They promoted a long series of improvements and enhancements, some centering on safety devices invented in response to highly publicized rail disasters. But many came from mechanics and tinkerers of all varieties, swept up in the fascination with rail and steam that (then and now) seems to hold many in its thrall. The number of patents awarded for various aspects of railway technology grew steadily throughout the nineteenth century (Schmookler, 1967).

A modest number of "outside inventions" were adopted by the railroads during this period. But the patent system really burst into prominence when courts began awarding huge damage awards to the holders of patents who had sued the railroads.[9] In the wake of several much-discussed infringement suits, patent matters rose to the highest levels of discussion within the railroad companies. Although the corporate response took some time to coalesce, by the 1880s the industry was fully mobilized. Two large industry organizations supervised and carefully monitored the progress of important infringement suits, including several at the Supreme Court. Meanwhile, a legislative response took shape. Railroad executives lobbied hard in Congressional hearings against the extension of patents that had been costly to the industry. Lobbying also centered on a bill to overturn a particularly costly doctrine that had arisen in the courts. The "doctrine of savings" used a firm's estimated cost savings due to the use of a patented device as the basis of damage calculations. In the hands of a sympathetic judge or jury, it could lead to very expensive judgments. The industry labored to pass a bill to overturn the doctrine –

[9] *See, e.g.*, Chicago & N.W. Railway Co. v. Sayles, 97 U.S. 554 555-556 (1878) (summarizing district court proceedings from 1865 through 1875); *In re Caewood Patent*, 94 U.S. 695 (1876) (concerning patent for "swedge block" used to repair and straighten worn railway rails).

and very nearly succeeded. But when the Supreme Court in 1878 adopted a more favorable interpretation of the "savings doctrine," the industry finally backed off.[10]

Apart from an increase in lobbying expenditures, did the introduction of patents affect the railroad industry? In particular, did the introduction of patents in any way slow down the course of railroad industry development?

The answer is clearly no. Jacob Schmookler documented railroad industry investment, additions to railroad track mileage, and stock prices for the period 1837 until 1950. All three measures showed robust increases throughout the nineteenth century (Schmookler, 1967: 116). Of special note is the fact that particularly sharp *increases* in these measures were recorded at the same time patents were arriving as a major force on the railroad scene (roughly, between 1860 and 1890). Whatever the effects of patents on the railroad industry, they did not bring it to a halt. Of course, growth might have been even more robust in the absence of patents. But realistically, they did not appear to slow the development of this industry in any significant way.

3.2 U.S. Software Industry

The U.S. software industry voiced very similar concerns when software patents became a reality in the 1980s. Cries were heard throughout the community of computer programmers that patents would kill the goose that had laid the golden egg of software creativity in the U.S. (Merges, 1997: Chapter 2). A particular concern was that software patents would give an advantage to large firms, in particular IBM; there was fear over the clash of a "patent culture" – with its attendant high overhead costs – and the freewheeling and productive culture of programmers who were said to write code not strictly for profit, but for technical sophistication and elegance.

[10] Chicago & N.W. Railway Co. v. Sayles, 97 U.S. 554 (1878) (reversing lower court opinions and reining in "doctrine of savings").

A funny thing happened on the way to the demise of the software industry. It never happened. Standard-setting organizations ameliorated some of the problematic effects of having multiple components of complex software products and protocols owned by separate firms. Several early "test cases" found the courts being quite reasonable about scope and validity issues with respect to computer software. And most telling of all, programmers forming startups found that venture capitalists placed a premium on companies with a robust patent portfolio. So leading-edge firms such as Inktomi moved quickly to establish effective patent portfolios. One reading of the history here is that software entrepreneurs found that patents were decidedly ***not*** just "for the big guys." In any event, the industry continues to move ahead, despite – and in some cases even perhaps because of – the advent of patent protection.

On the other hand, software patents have not changed many of the basic features of the industry, including the importance of "network effects" to many of its products (Saloner and Shepherd, 1995). Perhaps there is a deeper path dependency in industrial development than we are aware. An industry, once started on a patent-free basis, establishes an innovation path that later proves relatively impervious to the imposition of patents. Perhaps patents overall simply do not affect the "big variables" of economic life – industry structure, the basic pace of innovation, etc. – in such an industry to any great extent. While these are somewhat humbling thoughts for a scholar who places the patent system at the center of the economic universe, the historical case studies certainly support such a view. Apart from their role in fostering "outside entry," and perhaps a marginal but significant role in making old industries safe for small, entrepreneurial firms, patents do not seem to have shifted the basic parameters of innovation in either railroading or software. If this pattern holds true, we may predict that patents will not significantly impact the overall structure or innovativeness of the financial services industry. To sound a Chandlerian theme: While patents may play a key role in individual firms' ***strategies***, they may not have much impact on industry ***structure***.

4. Property Rights and the Market for "Financial Technology"

Research on the emergence of "markets for technology" may have something to teach here as well. According to this literature, for a number of reasons active interfirm markets for technology are increasingly popular. The major factors are: (1) increasing creativity in "mining" intellectual assets for profit; (2) reduced fear of selling ideas to major competitors; and (3) improving and expanding know-how about how to propertize and value intellectual assets. (Arora et al., 2001; Davis & Harrison, 2001).

Viewed from the perspective of this literature, one interesting question is what effect patents will have on formalizing the exchange of information about financial services innovations. In the past, this information diffused out from innovators to other firms in the relatively "closed circle" of experts in each area.[11] Now, with the advent of

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[11] One piece of evidence from a theft of trade secret case involving techniques for securitization suggests that some explicit information transfers have taken place, under the rubric of trade secret licensing. *See* Investors Guaranty Fund, Ltd. v. Morgan Stanley & Co., Inc., 50 U.S.P.Q.2d 1523 (S.D.N.Y. 1998):

> Plaintiff contends that five . . . banks--First Boston, Goldman Sachs, Donaldson Lufkin & Jenrette, Salomon Brothers, and JP Morgan--had received information from IGF about its system under "confidentiality, proprietary, trade secrets acceptance conditions."

The case was dismissed anyway, on the ground that the plaintiff had not adequately backed up its assertions in this respect.

patents, these innovations can be (to use the language of economists who study information transfer) "codified." Patents play a role here in helping identify discrete units of information for transfer. They also facilitate valuation, by clearly demarcating the boundaries of a discrete idea, and by feeding into a system of legal and technical experts who specialize in valuation.[12]

Patents can therefore push information exchange from an informal basis to a more formal one. Whether this is beneficial depends on the number of transactions that result under each of the two regimes. Currently, information about financial services innovations diffuses rapidly – through informal contacts among the principal designers of innovations, trade press articles, simple observation of what competitors are doing, etc. These information exchanges are easy to miss, as they involve essentially zero transaction costs. Every time a businessperson learns something about a competitor's new practice in some area, after all, information has been transmitted. One reason it is easy to miss overlook the economic significance of these learning events is that the information is acquired free of charge.

What happens when information such as this is propertized – when an intellectual property right (IPR) attaches to it? Total transactional volume may well be affected. But how?

If a sizeable proportion of the information is suddenly covered by a property right, the flow of information may well decrease at first. What had been essentially free is suddenly more costly; information acquirers move up their demand curves. Over time, however, a number of offsetting gains might compensate for or justify this additional cost. It is a bedrock assumption of the intellectual property system that certain information will not be produced without the special incentive of a property right. Thus

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[12] Embodying technical information in a formal property right such as patent can significantly lower the cost of exchanging it with another firm (Arora & Merges, 2002).

the addition of property rights to the equation will – in theory at least – call forth new and greater creative efforts, resulting in a larger number of innovations. True, some transactions that would have been free will now cost more. But the conventional wisdom from inside the IP system would predict a net increase in innovations. To put it bluntly, there is a possibility that while free transfer of ideas to competitors will end, a robust market in the formal exchange of new financial innovation ideas will lead to more exchanges of more valuable information.

4.1 Spinoffs

A related possibility involves spinoffs. Because much of the know-how associated with financial innovations currently resides in large firms, the people to staff new entrant firms will likely come largely from the established players. We are all familiar with many cases of startup companies emerging from the ranks of established players. The dynamic nexus of restless entrepreneurs, venture capitalists, and corporate lawyers is an important component of the institutional infrastructure of Silicon Valley and other innovation-rich regions. Established firms, confronted with this reality, have responded in recent years by saying in effect, "If you can't beat them, join them." The result is a greater number of spinoffs.

Spinoffs could become an important part of the scene in financial services, for a number of reasons. In financial services, broad expertise is required to innovate, at least in some areas. So innovation begins in many cases in large firms. In the language of appropriability, access to the co-specific assets of a large, integrated firm is essential for successful innovation.

But once an innovation is made, there may be reasons why a separate firm makes a better "home" for it. First is the simple fact that huge, integrated firms may not reward the development of the innovation as directly or effectively as a small, highly focused firm. This "incentive intensity" effect is a well-known advantage of small startups. It explains why startups often push more aggressively to expand applications of their basic

technology into markets far afield from the business of the parent (see the eSpeed story, just below). Second, in some cases rival firms are far more likely to do business with a small separate entity than with a division of a large integrated rival. When a sophisticated technology-intensive input is being supplied, the buyer may have to reveal sensitive information about its product design or operations. A company may be reluctant to share this information with a direct competitor. This logic seems to be at work at times in the chemical industry, where sophisticated process technologies owing their origins to large, integrated chemical firms are sometimes spun off into independent startups (Arora & Merges, 2002).

Patents appear to play an important role in spinoffs in some industries such as specialty chemicals (Arora & Merges, 2002). Without patents , the risk that the technology will be copied by the spinoff firm's customers is too high. While trade secrecy is a common appropriability mechanism for established chemical firms, spinoffs by definition lack the co-specific assets necessary for a trade secret-oriented strategy to be effective. The only answer is to have strong patent protection.

Is this model possible in financial services? Much depends on the extent to which independent firms can find a market for new financial product and service ideas. If the transaction costs are too high for deals involving these "goods," independent firms will not be viable – regardless of presence or absence of property rights. Markets for pure, disembodied ideas are after all fairly rare. Another consideration is whether independent firms can devise and develop enough of these ideas to remain viable. Perhaps it requires access to many operational details and many different professionals to devise new financial products and services. The dearth of "financial idea startups" to date certainly suggests as much. If "financial idea startups" face the problem of a dry product development pipeline, they will not be viable.

Perhaps the Cantor Fitzgerald spinoff eSpeed is an indication of things to come.[13] eSpeed develops and sells pricing and trading software for various securities markets. It started in the bond market of course, where Cantor Fitzgerald was and is a major player (despite the best efforts of terrorists). Building on Cantor's original $200 million investment in new trading technology, eSpeed is branching out into other markets: energy, bandwidth, futures, telephone minutes, etc. (see www.Cantor.com). It appears that eSpeed is serious about research and development; according to a recent 10-K filing,

> We devote substantial efforts to the development and improvement of our electronic marketplaces. We will work with our clients to identify their specific needs and make modifications to our software, network distribution systems and technologies which are responsive to those needs. We are pursuing a four-pronged approach to our research and development efforts: (1) internal development; (2) strategic partnering; (3) acquisitions; and (4) licensing. We have approximately 150 persons involved in our internal research and development efforts. . . . We are continuing to develop new marketplaces and products using our internally developed application software having open architecture and standards. In addition, we have forged strategic alliances with organizations such as Sungard/ASC and QV Trading through which we will work to develop sophisticated, front-end trading applications and products. We expect to license products from and to companies . . . .

(ESpeed 1999 Form 10-K, avail. www.sec.gov/archives/edgar, at 42).

[13] eSpeed commenced operations on March 10, 1999 as a division of Cantor Fitzgerald Securities. In December 1999, eSpeed was spun off from Cantor Fitzgerald in an Initial Public Offering. http://www.treasuryconnect.com/top_nav/invest_faq.htm#6.

At the same time, eSpeed is also a fairly intellectual property-intensive firm; according to a 10-K filing,

> We expect to rely primarily on patent, copyright, trade secret and trademark laws to protect our proprietary technology and business methods. Our license with Cantor includes four issued United States patents as well as rights under domestic and foreign patent applications, including foreign applications currently filed by Cantor.

(ESpeed 1999 Form 10-K, avail. www.sec.gov/archives/edgar, at 8-9).

And, to the extent the trade press can be believed, the firm has aggressively pursued markets far distant from Cantor's home base of bond trading.[14] Indeed, its efforts to enforce some of its patents have brought some criticism already.

4.2 Startups, or, Silicon Valley Comes to Wall Street

Peter Tufano asks whether financial services patents will "encourage more innovation by smaller players." (Tufano, 2002: 37). This section explores the possibility that the answer might be "yes," that apart from spinoffs, true startups may become a more common sight in financial services.

To a large extent, a long-time observer of the patent system cannot help notice that the best justification – and sometimes, to be truthful, the *only* one – for the system appears to be to promote the financing of dynamic new entrants. The connection between patents and venture capital financing is a well-accepted part of Silicon Valley practice,

[14] "eSpeed is Hungry for B2B Markets," Red Herring, Jan. 14, 2000.

though economists are just now taking at a stab at explaining why. (Gans and Stern, 2002; Hellmann and Puri, 2000).

Scholars operating in the tradition of Joseph Schumpeter have made connections between entry by startup firms, patent protection, and industry structure and competition. Just as Merges & Nelson (1990) argue that multiple, rivalrous sources of innovation often promote faster economic growth, Boot and Thakor (1997) model how different institutional structures might lead to different levels of innovation. They predict less innovation in a financial system of "universal banking," especially where it involved significant market concentration. On the other hand, where commercial and investment banking are functionally separated, they predict more innovation. As with Merges and Nelson, the basic idea is that competition yields increased innovation.

It is too early for a systematic test of these concepts. But some intriguing possibilities for the future are suggested by firms exploring the startup/patent orientation in financial services.[15]

One such firm is Financial Engines, Inc. This is a Silicon Valley startup, with its headquarters in Palo Alto and backing from a number of prominent venture capital funds.[16] Financial Engines makes a business of providing sophisticated, automated online investment advice for various investors, typically employees of large companies that subscribe to its services. It services dozens of clients which employ thousands of employees. Notable for our purposes is the fact that Financial Engines has a patent-

[15] By some accounts, startup activity in this area appears to be on the increase. *See* Heaton (2000) (Stating, in discussion of particular startup, that "[m]any other financial patents are held by similarly situated start-ups and entrepreneurs.").

[16] *See* www.financialengines.com.

intensive strategy. As of fall, 2002, the firm held five U.S. patents.[17] It also partners with other firms, by licensing its financial advice software systems as components in larger investment services packages.[18]

Another firm with a similar profile is FolioFN, which permits institutional and individual investors to put together customized investment portfolios included fractional shares of various investment instruments. This brings the benefits of diversification to a broader market, and deepens the degree of diversification possible with a given investment amount. The FolioFN approach is based on a series of patents, including U.S. Patent 6,338,047, "Method and System for Investing in a Group of Investments that are Based on the Aggregated, Individual Preference of Plural Investors," issued to Wallman, et al., Jan. 8, 2002. As with Financial Engines, the FolioFN business model requires partnering with other firms to broaden the business, particularly individual and institutional investment advisors.

4.3 Patents, Contracts, and the Viability of Startups

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[17] *See, e.g.*, U.S. Patent 6,125,355, "Pricing Module for Financial Advisory System," issued Bekaert, et al. (patent providing a single pricing module that models both fixed-income securities and equity securities into the future in an arbitrage-free model); U.S. Patent No. 6,292,787, issued to Scott, et al., Sept. 18, 2001, "Enhancing Utility and Diversifying Model Risk in a Portfolio Optimization Framework."

[18] See, e.g., Tom Lauricella, "State Street, Citigroup Venture To Give Advice on 401(k) Plans," Wall St. J. 6/10/2002:

> For the first time, investors in some 401(k) retirement plans soon will be able to get advice to buy or sell specific investments through the financial-services company administering their accounts. Citistreet, a joint venture of Citigroup Inc. and State Street Corp. that is one of the largest retirement-plan providers, announced the service Monday. Advice provided to investors in the Citistreet plans will be based on analysis and recommendations from Financial Engines Inc., an independent investment-advisory firm.

Both startups described in this section plan to rely on partnering. Recent research teaches that patents may play a role in facilitating technology- or information- intensive transactions such as these (Arora & Merges, 2002; Hall & Ham- Ziedonis, 2001). If this research is accurate, it suggests that patents may influence not only the overall rate of innovation, but also the sources of innovation, and through this, perhaps even industry structure. The basic idea in this literature is that property rights can make small entrants viable at the margin in settings where entrants without property rights rarely survive. Hall and Ham- Ziedonis (2001), for example, study the emergence of small "design boutiques" in the U.S. semiconductor industry. This industry is characterized by very large, vertically integrated manufacturing firms. The small entrants gain access to necessary manufacturing assets by licensing their designs – which is possible only in the presence of strong patents, given the strong probability that manufacturing firms could easily copy expensive designs. In the language of appropriability, patents facilitate contractual access to co-specific assets. The general phenomenon is modeled by Arora and Merges, who also describe a case study drawn from the biotechnology industry. There a supplier of sophisticated inputs used in the manufacturing of biotechnology products survives and thrives dealing with customers whose expertise and know-how would make it easy to copy its "crown jewel" technology. Again, broad patent protection is the key.

It is impossible to say at this point whether financial services patents will permit the emergence of similar success stories. But it is intriguing that experimentation along these lines may be beginning already. Together with the eSpeed case study, these startups show that patents in the financial services industry have the potential to increase the diversity organizational forms available to innovating firms in this industry.

5. Conclusion: Patents and the Ecology of Wall Street

It is not possible to calibrate the impact of patents on financial services with any degree of precision. There will be upheavals – patent lawsuits that roil the industry; announced patent grants that trouble industry leaders and threaten established firms and

practices; and an overall concern that patents have changed old practices in unwelcome ways.

But beyond this, in the long haul, I will venture a prediction: patents will not cause any real and lasting problems. I offer this assessment based not on hard empirical predictions, but on two detailed historical case studies, one from the nineteenth century (the railroad industry), one from recent times (the software industry). I chose them because in both industries, the adjustments to patents followed the same general pattern. And in both, early concerns that patents would fundamentally undermine innovation were proven quite wrong.

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Wall Street did not need patents. It certainly did not ask for them. Innovation was flourishing without them. And when they came, these strange "incentives" were greeted with skepticism, akin to the Reagan-era joke, "We're from the government. We're here to help."

But now they are here. What will happen? The early fear was that they would upset the natural ecosystem that had evolved without them. Like a civilization cut off from the outside world, Wall Street would suddenly be infected with a novel pathogen. There would be sickness where there had been health and balance.

There may be a patent-related epidemic in Wall Street's future. But I doubt it. The industry-backed prior user rights exemption was an early inoculation. And the industry "immune system" is less likely to be surprised now: firms are more aware that they need to be vigilant in watching what issues from the Patent Office, and in acquiring some defensive patents of their own. There will probably be some high-profile patent infringement lawsuits, but a wholesale blindside of the industry appears less and less likely.

At the same time, some unintended benefits may flow in the wake of patents. Perhaps a few new entrants will be viable that would not have been. Perhaps patents will call forth some extra efforts at innovating in some sectors. Stranger things have happened.

Even if not much good comes of it, Wall Street ought to pause before criticizing the advent of patents. Perhaps in an ideal world, policymakers would have studied the financial services industry carefully for a decade before extending patent protection to financial innovations. Hearings would have been held, factfinding missions conducted. No surprises would have been sprung on an unsuspecting industry by an outsider court with no Wall Street bona fides. The whole exercise would have been much more rational, premeditated, and predictable.

But, as the *State Street Bank* decision demonstrates, that's not how it works in our system. Because our judges are totally independent, they did not have to worry about upsetting Wall Street. And the separation of powers principle enshrined in our constitution means that the Federal Circuit court did not need Congress' permission, or the President's blessing, to throw a monkey wrench into the operations of a major U.S. industry. The court followed the logic of its own area of expertise, and in so doing upset received practices and conventional wisdom. Meanwhile, Congress did not have to clear it with the court when it passed the prior user rights exemption. This sort of institutional dialectic of challenge and response, this series of random outside shocks, is often unsettling at first. Yet it gives our economic and political system vitality, energy, and even – am I really writing this in an academic paper on financial services patents? – a sense of adventure. Ecologists and students of evolution often talk of the beneficial effects of random shocks in the natural world. Perhaps Wall Street ought to pause before criticizing this one. Something good may come of it. In the meantime, old practices will have to be examined. Implicit routines will have to be made more explicit. Received wisdom questioned. This may not be all bad. After all, nature teaches that regular events like this are good – that the uninvited guest is sometimes the most interesting one of all.

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