Disclosure and Financial Patents: Revealing the Invisible Hand

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"A major factor in the current financial crisis is the lack of transparency in the activities of principle players in the financial markets"

Robert Morgenthau
District Attorney for New York County, New York
Wall Street Journal (September 30, 2008)[1]

"Beware of geeks bearing formulas."

Warren Buffett
American Investor
The Charlie Rose Show (Oct. 1, 2008)[2]

The fall of 2008 has brought difficult times to the world's financial markets, and while many diverse sources are likely to receive some blame for causing the crisis, frequent and repeated attention is already being directed toward two pervasive attributes of modern finance—the limited "transparency" and the high degree of "financial innovation" associated with some of the most troubled assets. The first quote above is emblematic of the blame being directed toward the limits of transparency, but it is hardly unique. As global financial markets have shown increasing signs of strain over the last few months, public and private commentators have repeatedly called for greater disclosure and transparency as one potential remedy, or at least a preventive measure for the future. This call for and interest in transparency is not new to the current financial markets crisis. Increased disclosure and transparency were also among the panaceas

[1] Robert M. Morgenthau, *Too Much Money Is Beyond Legal Reach: New York-based funds are abusing 'secrecy jurisdictions,'* Wall Street Journal A21 (Sept. 30, 2008).
[2] Buffett is quoted in Steve Lohr, *Like J.P. Morgan, Warren E. Buffett Braves A Crisis*, New York Times (Oct. 5, 2008).

thought to be corrective of the Enron scandal, and these notions were central pillars of the Sarbanes-Oxley legislation enacted after that debacle.[3]

Similarly, financial innovation is also a suspect for bringing about the current situation. Though lacking the cleverness of Warren Buffett's classical allusion, other commentators have also decried the "alphabet soup" of new financial products and have confidently asserted that "[w]hat's happening is a result of financial innovation getting out of control."[4] Even Nobel laureate Robert Merton, a leader in developing modern theories of "financial engineering,"[5] candidly poses and answers the obvious question: "Is there a structural relation between innovation and crisis? I think there has to be."[6] (emphasis added). By framing the question in terms of a "structural relation," Merton insightfully views financial innovation as a key part of market structure and thus partly responsible for its successes and failures. Certainly this line of inquiry is to be expected, for even a student of history within living memory will recall that "[t]he outcry against financial innovation was particularly virulent after the crash of 1987 and after the spate of derivatives disasters in the mid-1990s."[7]

To the extent anything new is arising in this policy debate, it appears to be the interest in the absence of "transparency" together with the presence of "financial

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[3] Indeed, Representative Oxley's version of the bill was originally titled the "Corporate and Auditing Accountability, Responsibility, and *Transparency* Act." H.R. 3763, 107th Cong., 2nd Sess. (2002).
[4] Joseph Yam , Chief Executive of the Hong Kong Monetary Authority, as quoted in Aaron Pan and Jake Lee, *Yam Hears Echoes of Markets Betrayed in U.S. Rescue* (available at http://www.bloomberg.com/apps/news?pid=20601109&sid=ap7qgkf2KaKE&refer=home).
[5] Among his many works on financial innovation, Merton is the co-author of a casebook on the subject, see Scott P. Mason, Robert C. Merton, et al., *Cases in Financial Engineering: Applied Studies of Financial Innovation* (1994).
[6] Martha Lagace, *Financial Crisis Caution Urged by Faculty Panel*, Harvard Business School Working Knowledge (Sept. 29, 2008) (available at http://hbswk.hbs.edu/item/6013.html) (quoting Merton).
[7] Rene M. Stulz , *Merton Miller and Modern Finance*, 29 Fin. Management 119, 125 (2000).

innovation."[8] To an intellectual property scholar, the combination of those two factors is naturally associated with a particular legal regime—namely, trade secrecy, which fosters innovation but at the expense of disclosure. Trade secrecy has long been one of the primary, and perhaps even *the primary*, legal engine by which financial firms could keep their innovations proprietary. Yet current developments in both financial markets and legal institutions call for a reexamination of the effects of secrecy in the financial industry and the increasingly viable legal alternatives to secrecy that might be deployed to encourage not only initial innovations, but also the development, testing and distribution of those innovations.

Historically, financial service firms have been presented with a difficult choice between maintaining trade secrets and fostering transparency of their operations. Operational transparency — i.e., the disclosure of detailed information about the financial firm's processes and methods — can be desirable for multiple reasons. Transparency increases customers' ability to monitor the financial firm, protects against self-dealing and other agency costs, and may also be desirable in the operation of market. Yet such transparency typically sacrifices trade secrecy and allows numerous innovations ranging from an exchange's market rules and technology to an individual financial firm's trading strategies and financial products to be quickly copied by competitors. The ease of copying reduces any individual firm's incentive to create,

[8] U.S. Treasury Secretary Henry Paulson is one of many to suggest a connection between innovation and transparency. See Remarks by Secretary Henry M. Paulson, Jr. on Recommendations from the President's Working Group on Financial Markets (March 13, 2008) (available at http://www.treas.gov/press/releases/hp872.htm) ("Financial innovation has also brought, inevitably, the challenge of complexity. In my judgment, some financial products have become overly complex. Excessive complexity is the enemy of transparency and market efficiency.").

develop and invest in such innovations. Thus, the financial sector has traditionally had to balance the need for disclosure against the need to preserve incentives to innovate.

Recent developments have, however, altered the context of this traditional choice. First, the ability of financial firms to maintain trade secrets has tended to decrease both as regulatory agencies have demanded greater transparency in the financial industry, and as the rise of the internet has increased the ability of even a single individual to disseminate information widely. A second major development is the rise of so-called business method patents over the last two decades. Legal case law decisions over the last ten years have fostered the notion that innovations in the financial industry—even if described as "business methods"—are permissible subject matter for patenting in the United States and subject to the same standards applied to other categories of inventions. Such patents offer an alternative for financial innovation that permits transparency without diminishing, at least in theory, the incentives for innovation.

This paper is a first step in exploring the relationship between business method patents and transparency in the financial sector. In theory, increased business needs or regulatory requirements for transparency in particular parts of the financial industry should also serve to increase the demand for patents. Furthermore, the ultimate issuance of such patents may, again in theory, lead to an increase in voluntary disclosures of information—including information on the specific operational details of the patented financial innovation.

The second section of the paper examines a data base of 100 patents and 100 patent applications to determine the attributes of patents being sought and issued in the financial industry. Our major conclusion is that patenting in the financial industry—

especially in some of the more sophisticated segments of the financial industry—remains to date very much the exception rather than the rule. In the entire category of patents classified by the Patent Trademark Office as financial patents, only a few patents seem directed toward sophisticated trading mechanisms, valuation metrics, or innovative financial products.

One reason for the hesitation to patent is obvious from our data—pendency times are now running above 7 years. Even just a few years ago, Josh Lerner reported average pendency times below four years in financial patents issued from 1971-2000.[9] The ballooning pendency times seriously compromise and in many cases may destroy the incentives to patent, given that patent rights begin only upon issuance and yet disclosure of the patent application may occur a mere 18 months after the application is filed. Another significant disincentive to patent financial innovation is the limited geographic scope of coverage. While innovations in other industries are generally patentable throughout most of the developed world, financial innovations face enormous barriers to patenting in Europe and other countries, which view advances in the economic and financial disciplines as "non-technical" and therefore outside their definition of patentable subject matter. Because capital may move to European markets to avoid infringing the U.S. patent, the incentive to patent is diminished. Indeed, a U.S. patentee may find that the mere threat of European competition may drive down the rents that can be extracted from an issued and valid U.S. patent on a financial product.

The limited geographic availability of certain types of financial patents also means that applicants for such patents in the U.S. are more likely to avoid early

[9] Josh Lerner, *Where Does State Street Lead? A First Look at Finance Patents, 1971-2000*, 57 J. Fin. 901, 927 (2002).

disclosure of the application (which would occur 18 months after the application's filing). U.S. law generally allows a patent applicant to opt out of 18-month application publication if the applicant is seeking *only* a U.S. patent, not foreign patents. The applicant's ability to opt out of disclosure makes the patent system somewhat more attractive to the patent applicant because trade secrecy can be maintained until the patent has been issued. To the extent other nations refuse to issue patents on financial innovations, those geographical limitations will lower the opportunity cost of opting out of 18-month disclosure and thus increase the number of applications who choosed to opt out.

The lower cost of opting out of early disclosure creates the plausible but currently unobservable prospect that a disportionately large set of undisclosed "submarine patent applications" covering financial innovations are currently pending. Given the long average pendency time, those applications may remain unobserved for many years.. Thus our observations about the state of patenting in the financial industry can relate only to the state of patenting years ago.

We conclude with some discussion of the policy implications of our study. While a robust academic literature on financial engineering and innovation has developed in the past several decades and industry is quite clearly employing very sophisticated mathematical economics in the design of financial products and strategies, these innovative techniques have remained largely outside of the (currently observable) patent system. If this is true, then it is suggests not only that secrecy remains a rather entrenched and perhaps still an attractive strategy, but also that the patent system, far from undergoing a revolutionary transformation through its acceptance of business

method patents, has actually been rather slow to accommodate the cutting edge technology arising out of late twentieth century's "revolution" in financial methods.[10]

I. Secrecy, Disclosure, and Legal Mechanisms in the Financial Industry.

Legal and economic scholars have long recognized that a significant tension exists between basic assumed principles of a classical free market and the conditions necessary for the efficient production and disclosure of information. One manifestation of that tension is the now well known Arrow Information Paradox: In order for buyers to know what to pay for information, they need to have it disclosed to them. But once it is disclosed, the buyers have acquired the information and the seller has nothing left to sell.[11] Arrow's scenario is paradoxical at least in part because it reveals a inherent conflict between two commonly assumed parts of the normal market mechanism: Firms typically look to markets to obtain value for the goods they produce, but they also typically need to disclose information about the good in order to entice purchasers to bid on the good. Where the relevant good is information, the assumed behaviors cannot easily co-exist.

Moreover, even physical goods often include some informational component and, in the absence of legal protection for that information, the seller will confront the Arrow Information Paradox with respect to that information. For example, the manufacturer of a new type of mousetrap possesses not only physical copies of the mousetrap but also the design information associated with the better mousetrap. Marketing the mousetrap to

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[10] Merton H. Miller, *Financial Innovation: The Last Twenty Years and the Next*, 21 J. Finan. And Quant. Anal. 459, 459 (1986) (noting that "the word revolution is entirely appropriate for describing the changes in financial institutions and instruments that have occurred in the past twenty years").

[11] Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in The Rate and Direction of Inventive Activity: Economic and Social Factors 609, 614-15 (Princeton 1962).

potential buyers may reveal the design information and, while still having physical copies of the mousetrap to sell, the seller will have lost exclusive possession of the design information. That loss may, in turn, diminish the price at which the better mousetrap can be sold because even current buyers will rationally expect imitations to appear on the market soon. Transparency of product design information thus does not necessarily produce an efficient result.

Arrow's paradox is, however, only one example of a set of complexities associated with building realistic market models that take into account the complexities of information production and distribution. As Hayek observed, market mechanisms can generally be viewed as producing valuable information about market supply and demand through the price mechanism.[12] From that viewpoint, market price information can be seen as a public good, and a central paradox of the market is that private self-interested action simultaneously produces a public good. But the process by which the private information of market participants gets incorporated into this public good is complex and has itself spawned an entire literature on market microstructure.[13] Here again, as with the Arrow Information Paradox, complete market transparency is not necessarily a stable or efficient solution.

Markets, therefore, may be viewed as involving not only a trade in goods and services, but also complex flows of information by and between the market participants. In subsection A below, we establish distinct categories of information and relate these categories to the theories set forth in the patent literature. In subsection B, we examine the broader set of legal and business strategies for protecting the value associated with

[12] F. A. Hayek , The Use of Knowledge in Society, 35 Am. Econ. Rev.519, 526 (1945).
[13] Maureen O'Hara, *Making Market Microstructure Matter*, 28 Fin. Managem't 83, 83 (1999) (noting that market microstructure research focuses on "the process by which information is incorporated into prices").

information, including trade secrecy, first mover strategies, government sanctioned intellectual property right, and systems of data exclusivity or data compensation. In discussing these concepts, it is useful to have in mind three simplified components of a financial marketplace: (i) a financial product suitable for trading (e.g., a bond, share, credit default swap contract, etc.); (ii) a financial strategy or valuation metric for the existing class of financial products; and (iii) a trading platform and associated technology, including security features, technologies for expediting trades, trading rules, etc. While we recognize that some overlap exists between these three market components (e.g., an insight into valuing existing assets might also be the genesis of a new financial product), we nonetheless believe that the categories are distinct enough for providing examples in the discussion.

A. Categories of Information.

The mass of information contained in a marketplace can be set into three distinct categories. First, there is the information necessary to construct and provide the products and services appearing in a market. We will refer to this category as "**enabling information**." It closely corresponds with the information that would be required to obtain a patent. A patent application is required by law to contain an "enabling" disclosure—one with sufficient information "to enable any person skilled in the art … to make and use" the innovation.[14] United States law also requires patent applications to contain disclosure of the "best mode"—i.e., the optimal version of the innovation—known to the inventor at the time of filing. Under the classical legal theory of patents, this set of information—full disclosure of how to make and use the innovation—constitutes the "quid pro quo" for which the government-awarded exclusive rights are

[14] 35 U.S.C. 112.

conferred.[15] In a financial marketplace, enabling information would include information necessary to make of a new type of security, an algorithm for valuing or trading assets, or the set of rules and associated software necessary to run a trading platform.

The information necessary to make and use an innovation is only part of the total set of information associated with an innovation in the commercial setting. An important second class—which we will call "**attribute information**"—concerns the properties and attributes of an innovation, including the effects associated with its uses. For example, an innovative drug might be fully disclosed in a patent application, but it nonetheless remains subject to extensive testing for safety and effectiveness by national pharmaceutical agencies such as the U.S. Food and Drug Administration (FDA). A parallel example in the financial industry might be attribute information associated with a new type of financial product like a credit default swap (CDS). All of the details associated with such a product might be well known (and thus it might be the subject of a patent). Still, a purchasing party might be interested in attribute information—for example, a purchaser may want to know whether the basic CDS structure has been adequately tested so that its risks under adverse conditions have been adequately discovered.[16]

Attribute information—including the full set of side effects and other product attributes—is typically not required to be disclosed as a legal precondition to patenting of

[15] *Kewanee Oil Co. v. Bicron Corp*., 416 U.S. 470, 484 (1974) (describing disclosure as "the quid pro quo of the right to exclude").

[16] Even in traditional mechanical, not financial, engineering, colossal failures are not unknown. One well known instance is the first Tacoma Narrows Bridge, which was completed in July 1940 and collapsed four months later due to a previously unknown phenomenon later described as "self-excitation" or "negative damping." K. Billah and R. Scanlan, *Resonance, Tacoma Narrows Bridge Failure, and Undergraduate Physics Textbooks*, 59 Am. J. Physics 118 (1991). The attributes leading to that bridge collapse are so complex that they are still inaccurately described even in standard textbooks. See id. at 118-19 (discussing errors in standard account found in texts).

the product. Although it is true that a patent disclosure must contain sufficient disclosure so that the innovation can be determined to work for its intended use, the patent law defines "use" broadly to include almost any beneficial use without regard to possible economic or technical drawbacks.[17] In some circumstances, the patent system is capable of providing legal protection for attribute information. If a newly discovered attribute of a product establishes a "new use" of the old product—e.g., a previously known heart medication is discovered to work as a baldness cure when applied topically to the scalp—that discovery would be patentable as a new process for using the old product.[18] At least in some circumstances, however, attribute information cannot be protected at all by the patent system. A researcher who discovers a beneficial effect associated with eating broccoli sprouts may find no effective way to protect that new information through the patent system since eating broccoli sprouts is not new.[19]

Yet even in those circumstances where the patent system does not require extensive disclosure of attribute information or does not afford any separate protection for the information, the exclusive property rights associated with previously granted patent may provide an incentive for the patentee to develop such information. Consistent

[17] Thus, for example, a patent application disclosing a novel antitumor agent effective for a certain strain of tumors in laboratory mice may be allowed even though the application contains no information concerning whether the antitumor agency would be safe and effective for humans. See *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995) (distinguishing between "the requirements under the law for obtaining a patent" and "the requirements for obtaining government approval to market a particular drug for human consumption"); see also Scott v. Finney, 34 F.3d 1058, 1063 (Fed. Cir. 1994) ("Testing for the full safety and effectiveness of a prosthetic device is more properly left to the Food and Drug Administration (FDA). Title 35 does not demand that such human testing occur within the confines of Patent and Trademark Office (PTO) proceedings.").

[18] See 35 U.S.C. 100(b) (expressly authorizing patents on "new uses").

[19] See *In re Cruciferous Sprouts Litigation*, 301 F.3d 1343, 1350 (Fed. Cir. 2002) (discovery by Johns Hopkins researchers that eating broccoli sprouts fights cancer is unpatentable because the process of eating such sprouts is centuries old, and broccoli sprout lovers of past eras would have inherently obtained the anti-cancer effects of the sprouts).

with Edmund Kitch's "prospect theory" of patents,[20] a patentee granted exclusive rights over an embryonic and untested innovation will have an incentive to develop the prospect by refining the innovation, testing it, and marketing it. Such post-patenting activities may generate extensive additional information about the innovation, even though that information itself is not legally protectable. Thus, pharmaceutical patent holders still have an incentive to engage in extensive testing in order prove the safety of their patented products because their exclusive rights will ensure that they can obtain a return on the testing information they generate after patenting. But where no one owns any active patents on a product and the product is being produced competitively (e.g. CDSs), the incentives to generate new attribute information may be seriously diminished.

A third and final category of information worth distinguishing is what we shall term "**market information**." This category includes at a minimum all of the information about supply and demand that, as Hayek theorized, is effectively incorporated into market prices. The total set of information is, of course, more complex than a single number, for a firm considering expansion or contraction of production activities would also be interested in the slopes and shapes of demand and supply curves, as well as the time evolution of those curves. To some extent, such market information may be viewed as a special category of attribute information and, like attribute information, the insights of Edmund Kitch's prospect theory are fully applicable here too: Holders of prior patents will have significant incentives to generate this information because their exclusive rights may put them in the best position to reap the rewards from the information. Despite the similarity to attribute information, market information is worth distinguishing because it

[20] Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J. L. & ECON. 265, 266 (1977).

is not related to information that could be gained in laboratory tests. It requires *market* rather than *technological* experimentation.

Although traditional intellectual property theories have not focused much on the production of market information as a justification for exclusive rights, more recent research suggests that at least some traditional forms of exclusive rights and some aspects of existing rights can only be explained in terms of encouraging the production of market information.[21] For example, current law allows new innovations that would otherwise fail patent law's nonobviousness requirement to be patented if the product has exhibited a surprising degree of commercial success. Such a doctrine allows a patent to be justified as a device less for encouraging the production technological information and more for encouraging market experimentation and the production of market information.

This final category of information is important to evaluating patenting in a particular area because encouraging the production of market information provides a justification for issuing patents with comparatively modest technical disclosures where the underlying innovation has uncertain market prospects and no one is willing to risk marketing without the protection of exclusive rights. This category of information might also need the encouragement patent protection because it can be impossible to protect through secrecy: If the true uncertainty associated with an innovation is its market prospects, then the information produced by the market experiment will be the fact of market success or failure. Those market facts are exceptionally difficult to hide from competitors, and indeed as Hayek noted, the price mechanism may be all competitors need to capture that information.

[21] Michael Abramowicz & John F. Duffy, *Intellectual Property for Market. Experimentation*, 83 N.Y.U. L. Rev. 337 (2008)

To be clear (and to preview our patent survey result somewhat), appreciating the differences between market information and technical enabling information may be very important for explaining the relative dearth, in a particular area, of patents having limited technical disclosures and yet covering innovations with risky market prospects. Where patent coverage is just being extended into a new field of technology; where the patents are weak, untested, uncertain, and subject to significant geographic limitations; and where trade secrecy has been effectively used effectively in the past to control highly technical information; then we might expect that the initial wave of patents in the field might cover *innovations that reap the highest marginal benefit from patent protection.* Such innovations are likely to be those representing lower levels of enabling information (which makes disclosure requirements of patent law less burdensome) but greater level of market risk (which, if successful, will generate market information that cannot be hidden). By contrast, a firm may rationally decide to keep as trade secret a highly complex, cutting edge financial technology for hedging risk, for example, because the disclosure requirements of patent law are comparatively more burdensome and the protections of patent law less necessary and not immediately available. It may thus be part of the natural evolution of the area away from trade secrecy and toward patenting that the early wave of patents in the financial field includes comparatively few highly technical disclosures and "as many as six [seemingly] impossible patents before breakfast."[22]

[22] Robert B. Merges, *As Many as Six Impossible Patents Before Breakfast*, 14 Berkeley Technology Law Journal 577 (1999).

B. Legal and Practical Mechanisms to Appropriate the Value of Information.

Four reasonably distinct legal and practical mechanisms for appropriating the value of new information include trade secrecy, first mover advantages (coupled often with some secrecy or at least opacity), intellectual property rights, and data exclusivity or data compensation schemes. These mechanisms have differing degrees of usefulness in encouraging the production of particular kinds of information. For example, data compensation schemes are often designed to encourage the production of attribute information. Thus, producers of new insecticides may be required under a specific regulatory-approval framework to submit test data concerning the attributes of the new product. Follow-on producers can then rely on that data too, but must compensate the original producer. This scheme encourages the production and dissemination of attribute information, but it may not encourage the production of market information since firms considering the risky introduction of a new product will know that other firms can readily copy a market success (and will of course avoid copying products that are market failures). Despite the compensation for producing the attribute data, the data compensation approach may still not provide innovative firms with adequate incentives to invest substantially in a level of market experimentation necessary to yield information about market success or failure.

We detail below the various mechanisms for encouraging information production and discuss the strengths and weaknesses of that mechanism for producing different kinds of information.

1. Trade Secrecy.

A conventional example of exploiting a trade secret is an innovative industrial process used for making products cheaper or better than the competition. Such a process may be relatively easy to hold in secret inside a firm, and since trade secret protection is theoretically infinite in time, the innovator may be able to exploit the innovation for a longer period of than afforded under a patent.

The advent of the Black-Scholes option pricing formula provides a good example of trade secrecy being used in a trading strategy. The Black-Scholes formula provided a better way to price option, and thus the early possessors of that formula had knowledge that allowed them to identify mis-priced assets in the financial markets. One way to exploit that secret knowledge was to trade the assets themselves. Indeed, that very strategy was employed by one student at the University of Chicago, Roger Ibbotson, who knew Fisher and understood the implications of the new option pricing model.[23] Prior to the publication of the Black-Scholes paper (and even for a short period of time thereafter), options remained sufficiently mis-priced so as to allow Ibbotson to make money on the trading strategy. Once practical secrecy was lost, however, the opportunity to obtain rents from the closely-held knowledge of the Black-Scholes formula soon dissipated.

Such an example illustrates that, at least in circumstances where the innovation can be held in confidence, trade secret law can be useful in encouraging the production of enabling information—the information about how to practice an innovation—and perhaps also yield attribute information. Even in situations where an innovation cannot be closely-held for long, trade secrets may be exploited in ways other. As Jack Hirshleifer has noted, new technological information may also have distributive impacts—e.g.,

[23] See Perry Mehrling, Fisher Black and the Revolutionary Idea of Finance 138. Ibbotson is now the head of a quantitative hedge fund and a Professor in the Practice of Finance at the Yale School of Management. See http://mba.yale.edu/faculty/profiles/ibbotson.shtml.

causing some asset prices to rise and others to fall. The first possessor of such information can exploit it by temporally holding it as secret, speculating in the assets which will be affected by the new information, and then revealing the information.[24] Thus, Eli Whitney could have harnessed the value of his new cotton gin by temporally keeping the fact of the invention secret, buying cotton producing land the value of which would be increased by the gin (or by purchasing call options on the land), and then revealing the innovation.

Trade secrecy may not, however, be good at encouraging the production of market information. If the success or failure of an innovation cannot be concealed (the price and market demand being too difficult to conceal), then the possibility of keeping an innovation secret will not necessarily encourage the development of the information. Consider, for example, a fully enabled innovation that faces a risky market launch. Even if the first innovator can keep the enabling information secret long enough so that any potential competitor will have to duplicate that research to produce a competitive product (and therefore presumably would not enter the market unless a duopoly pricing would allow recovery of such costs), competitors will follow only a success, not a failure. In effect, competitors can free ride on the first innovator's market experimentation, and the threat of free riding may deter the first innovator from undertaking the market experimentation at all.

Finally, one highly important, but often overlooked, point about trade secrecy is that the existence of a patent system makes trade secrecy *less attractive* than it would otherwise be in the absence of a patent system. This is so because, in a trade-secret-only

[24] Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 AER 561 (1971

regime, a first inventor experiences less of a threat from the possibility of later, independent invention. The second inventor might decrease the rents available to the first inventor, but the first inventor can still practice the invention. In fact, if the second inventor also maintains the inventions as a secret, the first inventor may continue to reap supra-competitive profits as one member of a duopoly. If a patent system exists, however, the first inventor worries that any second inventor might patent the invention. Armed with government-enforced exclusive rights and the compulsory discovery processes of civil litigation, the second inventor may be able to stop the first from practicing the invention. Thus, the institution of a patent system could induce inventors to disclose information that would have otherwise been held in secret, even though the anticipated private rents from the patent are *the same or even less* than the rents which the inventor would obtained from holding the invention confidentially in a trade-secret-only regime.[25] Thus, as patenting begins to proliferate in the financial industry, trade secrecy strategies become correspondingly less attractive, and innovations that would have been otherwise produced but held in secret may be instead disclosed..

2. First Mover Advantage, Opacity and Mixed Disclosure-Secrecy Strategies.

Closely related to trade secrecy is a set of strategies that involve a mixture of disclosure and secrecy. A first mover advantage is one good example. In order to gain

[25] In his famous review of patent theory, Fritz Machlup seems not to have considered this aspect of patent law. Fritz Machlup, *An economic review of the patent system*, Study No. 15 of Commission on Judiciary, Sub comm. on Patents, Trademarks, and Copyrights, 85th Congress, 2d Sess. (1958). He asserted that the exchange-for-secrets justification of the patent system is undermined "by the simple reflection that inventions probably are patented only when the inventor or user fears that others would soon find out his secret or independently come upon the same idea. It would follow that the patent system can elicit only those technological secrets which without a patent system would be likely to be dispersed even sooner than they became free for public use under patent protection." Id. at 76. That reasoning does not recognize (1) that, without a patent system, a single independent invention is not equivalent to public disclosure and (2) that the advent of the patent system makes independent invention by another a much greater problem for the first inventor.

the maximum benefit from the strategy, the first mover must keep its business plans secret until it markets its product or service. At the time of marketing, all of the previously hidden business and technological secrets are revealed, but prior to that time, the first mover has the advantage of holding that business and technological information exclusively for some period of time. The importance of the first mover advantage in any particular industry will depend upon the ease with which competitors may copy the first mover.

Other strategies are similar to the first mover strategy in that day also involved a mix of disclosure and secrecy. Fisher Black used one such strategy in temporarily exploiting his early knowledge about the importance of the Black Scholes option pricing model. Rather than attempting to keep the Black Scholes formula secret into trade options using it, Black decided to sell information about the appropriate price of options using the formula. This early exploitation of the Black Scholes formula can be viewed as a variant of the first mover strategy. Though Black published the formula, he knew before others that it would be published, and he appreciated its importance. That knowledge is helpful in deciding whether to launch an options pricing service. Black also developed a proprietary stock volatility index, which he did not publish but was instead used as an input to his formula in producing option pricing data.

Black's option pricing service shows the complexity associated with actual trade secrecy strategies, which may involve a mix of disclosure and secrecy. For example, some financial scholars theorize that firms may disclose some of their financial innovations while keeping complementary innovations secret.[26] Alternatively, the firm

[26] See, e.g., Kurt Dew, *Why Are Profits from Financial Innovation So Difficult to Identify? Innovation Clusters and Productive Opacity.*

can create a desirable innovation, release sufficient enabling information to allow others to make and use the innovation, but retain detailed attribute information about the innovation. If the disclosed financial innovation is successful in the marketplace, the firm can reap rents from using the complementary, but still secret, innovation. Fisher Black's strategy of disclosing the option pricing model, but then exploiting his trade secret volatility measure, provides a good example of this strategy.

Such combined strategies of disclosure and secrecy may be privately profitable, but may also have overarching implications for the marketplace as a whole. The innovating firm has an incentive to credit the disclosed innovation as the source of its observable profits associated with the innovation, for such praise for the innovation may encourage further adoption of the disclosed innovation. The complementary secret information may be the real source of the innovator's success, and the innovative firm may therefore be seen as pursuing not merely a strategy of secrecy or opacity, but of affirmative "misdirection."[27] U.S. patent law, it should be noted, possesses a legal doctrine that attempts to foreclose such a strategy: The U.S.'s "best mode" requirement requires disclosure of all information necessary for the optimal practice of an innovation, and thus theoretically prevents an inventor from holding back complementary secret information.

Yet the strategy need not be so nefarious. The retained information might be merely detailed "know-how" associated with the innovation that is very difficult to teach. The proliferation of the innovation may give rise to a market for consultation services

[27] See id. at 6 (detailing the incentives of innovating financial firms to "become masters of misdirection" by "draw[ing] attention to external [disclosed] innovations" even though "it is associated internal [secret] innovations that produce value added for the innovating firm when external innovation is adopted by its counterparties").

associated with the innovation, and the innovator reaps rents in this fashion. This strategy appears to be practiced by IBM, which touts its leadership in creating and maintaining the free open source Linux software while also offering consultation services to support Linux operation.[28]

The mixed disclosure-secrecy strategy may create incentives for market innovators to favor opacity over transparency. The demand for consulting services may be higher where the relevant innovation is not especially user-friendly. Also a lack of transparency may serve as a barrier to entry for competitors seeking to offer complementary consulting services. Thus the incentive for the innovator may be to create a product that, although publicly available, is opaque or hard to comprehend and therefore hard to replicate or hard to support without expert help.

Derivatives appear to be good examples of financial products that are non-secret but yet opaque. The basic form contracts to create derivatives are widely available on the website of the International Swaps and Derivatives Association (ISDA).[29] Despite this apparent transparency, the form agreements are so complex as to make them difficult for persons outside the drafting group to comprehend. The ISDA "Master Agreement" is sufficiently complex as to require its own "User's Guide," which the trade association touts as "designed to assist in the understanding and use of the 2002 ISDA Master Agreement."[30] Moreover, the bankruptcy of Lehman Brothers required the publication of a "Protocol" that is "is to offer market participants an efficient way to address the

[28] See http://www-03.ibm.com/linux/ (stating that "IBM is a leader in the Linux community with over 600 developers in the IBM Linux Technology Center working on over 100 open source projects in the community"); id. (also making a sales pitch for Linux-complementary IBM hardware and services, "IBM supports Linux on all IBM servers, storage and middleware, offering the broadest flexibility to match your business needs").

[29] See https://www.isdadocs.org/cgi-bin/indexbookstore.html . This website include form derivative contracts maintained by the ISDA.

[30] See https://www.isdadocs.org/publications/isdamasteragrmnt.html

settlement issues relating to credit derivative transactions referencing Lehman."[31] The need for a protocol to address issues associated with prior derivative contracts suggests that the original agreement was not so clear.

Mixed strategies of disclosure and opacity are similar to trade secrecy in that, while the existence of the strategies may provide incentives to create enabling and attribute information about products and services, the strategies would seem to be less effective in encouraging the development of market information. Again the fact of market success may be difficult to obscure or hide. Thus, even if a mixed strategy of disclosure and opacity is successful in preventing competitors from using the research of the original innovator, competitors could always simply duplicate the research and product development of the original innovator. By copying the original innovator's successes and not failures, competitors could easily appropriate the value of the market information generated by the original innovator.

3. Conventional Intellectual Property Rights (Patent and Copyright).

Of the two major forms of government-enforced intellectual property rights, copyright protection is generally too weak to protect the structural features of financial innovations. Copyright does not protect against independent creation, and thus copyrighted financial products serve at best as a modest barrier to entry. For example, the ISDA protects its form derivative contracts through copyright, and that legal protection provides some incentive to construct and perhaps even to test the financial instrument documents. Thus, copyright may facilitate a first mover strategy, but because it does not protect the more conceptual or functional structures of the financial

[31] https://www.isdadocs.org/cgi-bin/indexbookstore.html.

instruments, copyright may not provide optimal incentives for the creation of information about those features.

Patents are qualitatively different from copyrights or trade secrets because patent law can protect the basic structural and functional features of a financial innovation even where those features are highly transparent and easy to comprehend. This is not to say that patents necessarily produce full disclosure of all the information held by the innovator. While patent law does require the disclosure of enabling information, detailed information concerning attributes of the invention might remain secret, especially where the information was developed after the filing of the patent application. Yet by providing legal protection even where an innovator pursues a strategy of full transparency, patents decrease the costs of additional disclosure. The marketplace provides other incentives for innovators to make disclosures about the attributes of their innovations, for such information may encourage others to adopt the innovation. Patents allow innovators to be more responsive to those incentives.

Although patent law also does not require the disclosure of market information, the patent system does provide incentives for such disclosures by allowing market success to count in favor of patent validity. Moreover, information concerning market success and failure is typically very difficult to conceal. Patents operate indirectly to encourage the production of market information because they confer market exclusivity and thus prevent competitors, during the life of the patent, from free riding on the information about market success..

4. Data Compensation Systems.

Systems of data compensation are typically used to provide additional incentives for the production of attribute information. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is the typical example of such a system. That statute requires parties seeking registration of insecticides to produce detailed information concerning the product's attributes. After the first registrant produces the information and succeeds in obtaining registration, follow-on competitors are allowed to use that information but must pay compensation to the developer of the information.[32]

Systems for data exclusivity have been viewed as a general regulatory tool for producing information about the externalities associated with particular products or activities.[33] To the extent that regulators believe that the system wide risks associated with particular financial products should be investigated prior to the marketing of those products, a data compensation scheme could provide a means for encouraging the production of such information. Such a system could be a complement of, rather than a substitute for, patent rights.

* * *

Each of strategy for protecting information is imperfect. The comparative strengths and weaknesses explain patterns in what sort of inventions will be patented.

II. One Hundred Recent Financial Patents

The advent of financial patents could reveal much information previously held in secret or protected through some partial secrecy or opacity strategy. Patents could help to reveal new parts of the previously hidden "invisible hand" that governs financial markets.

[32] *Thomas v. Union Carbide Agric. Products Co*., 473 U.S. 568 (1985)
[33] See, e.g., Wendy E. Wagner, *Common Ignorance: The Failure of Environmental Law to Produce Needed Information on Health and the Environment*, 53 DUKE L.J. 1619, 1729 (2004).

As an initial step toward developing more rigorous methods of measuring the effects of patenting on the financial industry, we collected a database of 100 patents recently issued in the Patent and Trademark Office's class 705/35, which is designed to include all patents on "finance," including patents on "banking, investment or credit."[34] We then conducted our own analysis of each patent by reading the specification and claims to determine the particular contribution made by the inventor in terms. Based on this analysis, we assigned a set of five codes:

Code:	Relation of patent to the financial industry:
0	**Little or no connection to finance**. E.g., electronic commerce and other technologies applicable to its many industries including the financial industry.
1	**ATMs** or mechanical or electronic technologies that have some connection to the financial industry.
2	**Trading technologies**, including anti-fraud techniques, mechanisms for implementing trades, and trading structures and market microstructure.
3	**Valuation technique or other financial strategy.**
4	**Financial products**, broadly construed to include sophisticated products such as a new credit default swap or a more consumer-oriented product.

This classification scheme reveals two significant results. First, a significant number of patents are classified as "finance" but have little or nothing to do with the field. General commercial patents, including e-commerce patents, accounted for 23% of the 100 patents. Patents on ATMs and similar technologies accounted for another 8% percent. The percentages for all categories are:

[34] The database includes the 100 patents most recent in class 705/35 issue on or before September 23, 2008. The patents date back to June 17, 2008, and thus cover approximately one-quarter of the year.

Code:	Relation of patent to the financial industry:	Percentage of "Financial" Patent Sample
0	**Little or no connection to finance**. .	**23%**
1	**ATMs** or similar.	**8%**
2	**Trading technologies**.	**33%**
3	**Valuation technique or other financial strategy.**	**26%**
4	**Financial products**,.	**10%**

Categories 0 and 1 (31% total) might be considered patents relevant to the financial industry, but they are not financial innovations. Categories 3 and 4 (36%) would qualify as financial patents, in the sense that the innovation claimed in the patent relates directing to a financial product or a service. The trading technologies category was probably defined too broadly, as it includes some innovations related to financial techniques (e.g., setting an opening price for a trading system) and some that cover the fraud prevention technologies, the construction of trading workstations and network technologies. While such innovations are all relevant to the financial industry, the innovations are not advances in finance.

The second major observation was that, even among patents having some substantial connection to finance, very few even *purported* to disclose the type of cutting edge financial engineering in valuation or product and market design that would be cognizable as a significant development in financial theory (with significance judged by the standards that would be applied in business schools or economics departments). To reach this conclusion, we used three methods. First, we looked to see whether the patent cited at least one of the seven top academic journal on finance and economics that were

identified by Lerner in 2002. We counted nine such patents. In other words, our sample of finance patents includes roughly the same number of ATM patents as patents that even cite a top academic journal related to finance or economics.

As a second measure, we counted all patents citing at least one academic journal dedicated to finance or economics. We excluded citation to academic journals from other disciplines such as electrical engineering or information technologies (e.g., journals from the Institute for Electrical and Electronics Engineers (IEEE)). We obtained 16 patents having such cites—a number smaller than the patents having no connection to finance.

We believe both these measures were overinclusive of disclosed innovations that arguably advance the finance as a discipline, so as a third method, we read the specifications and claims to determine whether the patent was claiming some advance *to the academic literature* as opposed to some *application* of existing knowledge to a new or particular set of circumstances. We identified five patents that appeared to be claiming advances over the academic literature of finance. The remaining patents which cited academic works did so merely in passing—as a means of identifying settled knowledge useful for application in a particular context.

Patents claiming significant developments in finance thus appear to be very much in the minority among issued finance patents. Moreover, we are not entirely convinced that the asserted advances in finance were real. The patents were, however, issued to sophisticated parties such as IBM, Josh Lerner and his co-authors and Longitude (a much heralded start-up firm that did not ultimately survive).

We were also interested in the number of patents that might represent sophisticated applications of financial principles. Here, the distinction we drew was

between general business models possible attractive to particular consumers (e.g., IBM's patent on "Method and system for creating banking sub-accounts with varying limits") versus some application of financial theory (.e.g., the Chicago Mercantile Exchange's patent on "Financial method for computing margin requirements"). In this category, we sought a subjectively determined degree of sophistication suggesting the practice a relatively high-level financial techniques. With this broader net, we identified 28 additional 22 patents. This larger category of patents includes inventions that might be *practiced* at top financial firms, but none of these inventions seem to incorporate new advances in finance theory that would merit publication in an academic journal on finance.

Our results here are consistent with the results reported six years ago by Josh Lerner, but we draw a different conclusion from the results. Lerner reported that the level of citation to seven leading academic economic and financial journals was 4.3 citations per 100 patents. Using a similar standard, we report 15 citations per 100 patents. Lerner then compared his academic citation rate in finance patents to the academic citation rate in patents from the patent subclasses *having the most extensive level of academic patenting.* Those subclasses tended to be fields such as chemistry or microbiology that are closer to basic research. Lerner found about a ten-fold difference in academic citation levels between finance and these other areas, and he considered the difference to be "extraordinary." In his view the lack of academic citations suggested "that the financial patent examiners' lack of familiarity with academic research may be having detrimental effects on patent quality."

While our data shows that the number of academic citations may be increasing in this field, a substantial gap remains. We offer a different interpretation from Lerner. Our data shows that patents in the finance subclass are not necessarily related to fundamental advances in finance theory. This observation is not meant to disparage the patents in that class nor to suggest that a patent quality problem exists among these patents. Patent law does not offer property rights solely to the theoretical inventor who accomplishes a significant advance cognizable at an academic level. Indeed, one line of caselaw suggests that patent rights may not be available for innovations that are too theoretical and insignificantly grounded in the practical. But whether or not the patent system is available for more theoretical innovations, patents have always been available to protect the fruits of what might be called "practical innovation"-- the type of innovation that builds a better mousetrap using a clever new arrangement of existing parts but that is unlikely to be memorialized in an academic textbook. Numerous such patents are routinely granted with examples including patents on coffee cup holders, light switches, consumer packaging, corkscrews, diapers, luggage, and even simple but clever medical technologies. Such everyday innovations have always been thought to be proper subject of patents.

Many of the patents in the PTO's "finance" subclass seemed to involve innovations that exhibit such a practical cleverness. For several reasons, this should not come as a surprise. First, the PTO's subclass of "finance" patents is a broad category covering diverse innovations from innovative ATM machines to new financial hedges. A good analogy would be if the PTO established a subclass called "materials engineering" that encompassed everything from innovations in supermarket packaging to nanotubes

and buckyballs. Indeed, because the "scope" of the PTO's art subclasses are not calibrated to any standard, comparisons of the average number of academic citations between subclasses are largely meaningless. The data may merely reveal which subclasses have been defined or interpreted by the PTO in a way that tailors the subclass to an academic discipline. Even a comparison between the academic citation level in one subclass and citation level in the whole body of patents reveals only the degree to which that subclass is drawn to an academic field more or less than the norm. No conclusions could be made about patent quality from such data.

Our discussion in part I provides a second reason to expect the heavy practical bent in the financial subclass of patents. The financial industry is clearly in a transition from prior strategies of protecting information to increasing reliance on the patent system. The innovations that are first to migrate from the traditional strategies to the patent system are likely to be those innovations that were protected least by the traditional strategies and that have the most to gain from the patent system. Simple pragmatic inventions are easily copied; a strategy based on secrecy or opacity does not work well for such innovations. The market exclusivity offered by the patent system is most valuable for those inventions, and the patent system's disclosure requirements least burdensome. Sophisticated strategies that could be held in secret are much more costly to patent because the disclosure requirements require giving up so much for perhaps little addition protection. .

Third, as mentioned in the introduction, application pendency times have ballooned in recent years, especially in the business method category. Long pendency times may be problematic for all patents, but firms are least likely to gamble on a distant

possibility of receiving a patent for those innovations where trade secrecy continues to work well.

Fourth, the international discrimination against business method patents is probably most detrimental to the more theoretical and academic finance patents. If the innovation is tied to specific machinery, such that it appears to be more like an apparatus like an ATM machine or a trading monitor, the innovation has a higher chance of receiving patent protection worldwide. Even assuming that the United States patent system stays friendly towards pure business method patents encompassing theoretical advances in finance theory, the hostility of other nations towards that precise class of patents will limit the number of such patents observed in the US system.

Fifth, there has always been some lingering uncertainty about whether the United States, and especially the federal courts, might change course on business method patents. That uncertainty makes patentng less attractive in general and will once again cause innovators to withhold from the patent system those innovations that can be protected through other means.

In sum, our analysis suggests that financial patenting in the United States remains very much in its infancy even though, in the financial field, the view is general the financial innovations are a product of engineering that bears all the hallmarks of a traditional applied science. Most "financial patents" are awarded for innovations at the periphery of the field -- -- i.e., for machines that clear financial transactions, for the software that assists professionals or consumers in monitoring their financial positions, and for practical financial innovations that bring incremental improvement to even

ordinary banking activities.[35] This is innovation for the financial industry, but it is not necessarily financial innovation.

III. Financial Innovations in the Dock.

Government policy toward financial innovation is now being rethought in multiple fora. The United States Court of Appeals for the Federal Circuit will soon announce its en banc decision in *In re Bilski*, a case in which the USPTO has asked the court to cut back somewhat on the scope of patentable subject matter. The federal courts have almost never—and never in living memory—taken a more restrictive approach to patentable subject matter than that taken by the Patent Office. If that historical trend does not change, then our sample of the last 100 finance patents provides some indication of what sort of inventions will remain patentable, for all 100 of the patents in the sample were issued *after* the PTO developed its current position. The issued patents show a continuing solicitude for allowing patents on meritorious business innovations. The patent in the database issued on September 23 to Josh Lerner and his co-inventors is an excellent example. The patent covers a method for valuing private equity investments; it is a pure finance patent created by inventors whose expertise is in finance and business (including two Harvard Business School professors as the first two named inventors). Still, the PTO allowed the patent, presumably because the equity valuation technique is claimed as "[a] computer program product, disposed on a computer readable medium …" Such software-on-a-disk claims remain viable even under the agency's newly developed

[35] There are however science the more sophisticated innovations are being drawn into the patent system. Though the total number patent citing top level financial journals remains small in comparison to all financial patents, the total number has ballooned in the last eight years. [insert data]

view on business method patents, and Lerner's patent shows that financial patents can adjust into that format.

The patent system's approach to financial innovation is, however, the most minor of the ongoing controversies surrounding financial innovation. The legislative and regulatory components of the United States Government will surely be demanding greater regulatory transparency of the financial system in general, and of financial innovation in particular. New disclosure requirements will disfavor secrecy and opacity as strategies for protecting innovations, and thereby push additional innovations into patenting. Regulatory authorities may also demand greater testing of financial innovations and will seek devices to encourage firms to develop such attribute information perhaps even as a precondition to marketing the financial instrument. However, if testing requirements are imposed without some way for parties to recoup their expenditures on tests, then the requirements could retard the pace of financial innovation. Some combination of patent protection and data compensation has worked tolerably well in other areas, and an analogous model may be applied to the financial system.

All of this assumes that financial innovation should continue, but even that proposition has become controversial. Yet the Luddite response has never held sway for very long in other industries. Inventions at the forefront of technology often have unexpected problems—sometime disastrous ones. The prevailing response in such situation is not to blame innovation but to blame unwise, untested and unsuccessful innovation as the root cause of the problem. The solution is therefore to require more

proof, testing and clarity. A patent system facilitates those worthwhile goals, even if it cannot assure that they will be met.