

**Is the Use of Patents Promoting the Creation
of New Types of Securities?**

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Introduction

In the last few years a renewed interest in the validity of patenting business methods has emerged. The issues appeared to have been settled in 1998 with the *State Street* decision. However, in 2008 the Federal Circuit Court, following the more restrictive approach toward the patent system adopted recently by the Supreme Court, has questioned the soundness of the policy choice of extending patent protection to this type of subject matter. The change of scenario happened explicitly in *In re Bilski* when the Federal Circuit Court decided to rehear the case *en banc* and to openly solicit amicus briefs on whether *State Street* should be overruled.

The issue under consideration revolves around an empirical question: does the patent system indeed foster innovation in business methods? If so, patent protection is not only appropriate but needed, because society benefits from the increased knowledge engendered by this form of incentive. However, if an increase in the level of innovative business methods does not occur as a consequence of providing patent protection to them, *State Street* should be overruled, because society is hurt by the grant of property rights that do not produce additional knowledge in return.

The focus of this paper is on the innovation in financial methods (as a subset of business methods) and, more specifically, in the production of new types of securities over the past 25 years. Its purpose is to investigate whether after *State Street* there has been an increase in the level of innovation in new types of securities which could correlate to the adoption of patents to protect them.

Therefore, Section I of this paper is dedicated to a brief overview of the relevant cases on the patentability of business methods. Section II focuses on the studies of financial innovation which have been produced so far. Particular relevance has been given to those research studies that empirically analyze the effects produced by the recent interaction between the patent system and the financial industry. Section III describes the present research project and the method adopted to perform it. Finally, Section IV illustrates the data collected through the selected method and provides a full data analysis.

I. Patentable Subject Matter

The Copyright and Patent Clause of the U.S. Constitution gives the Congress the power “to promote the progress of science and useful arts, by securing for limited time to authors and inventors the exclusive right to their respective writings and discoveries.”¹ This constitutional provision is complemented by Title 35 U.S.C. §101, which prescribes that patent protection must be granted to anyone who “invents or discovers any new and useful process, machine, manufacture, or any new and useful improvement.”² Together, the US Constitution and the Patent Act define what is known as patentable subject matter.

The language of these provisions suggests a very broad scope of patent protection, which, however, is not unlimited. Indeed, three judicially created exceptions contribute to providing the required guidance to determine what, under U.S. law, is considered to be “good patentable material.” Specifically, these three exceptions include: laws of nature, natural phenomena and abstract ideas.

From time to time, significant debate has surrounded interpreting the meaning of the aforementioned provisions. Scholars and critics of the patent system have often speculated about determining the ultimate boundaries of patentable subject matter. Today, however, a definitive answer to this issue has yet to emerge; the only unquestionable conclusion that it is possible to derive from the overall scenario is that, primarily due to judicial intervention, these boundaries change over time, perhaps in

¹ U.S. Const. Art. I, § 8, cl. 8.

² 35 U.S.C. § 101 (2000).

relation to altered economic circumstances or to the emergence of a new field of technology. Thus the debate changes accordingly.

Why is it so important to determine what can ultimately be protected by the patent system? The answer is intuitive for those who consider the essence of patent protection-- the granting of a legal monopoly to an inventor-- and combines that concept with the possible effects that this grant can have on society, both in terms of personal liberties³ and the production of additional innovations. Furthermore, if the three aforementioned judicially created exceptions are taken into account, it is possible to see how they represent a reminder about the risk associated with providing excessive patent protection. This risk encompasses the possibility of counteracting the very same constitutional goal⁴ for which the patent system was initially established and thus, ultimately, precluding innovation rather than promoting it.

Indeed, the pursuance of the aforementioned goal has a social cost consisting in excluding society from certain knowledge with the consequent reduction of the public domain or the “common pool of information,” from which people can derive inspiration to produce new ideas and inventions. Therefore, it is possible to say that, like in a perverse circle, the patent system can both foster and limit innovation depending on the type of rights provided to the patentee and the scope of protection established by the overall system.

In this context, it is important to ascertain the correct balance between encouraging innovation on the one hand and leaving enough “raw material” upon which

³ On this point, see more specifically Thomas F. Cotter, *A Burkean Perspective on Patent Eligibility*, 22 Berkeley Tech. L.J. 855 (2007).

⁴ To “promote the progress of science and useful arts” see *supra* note 1.

people can build new ideas on the other. This is certainly not an easy task. A first step in accomplishing it is understanding whether the patent system is “doing its job” or, in other words, whether the provided protection is, indeed, inducing innovation in the specific industry. If so, if individuals are motivated by the chance to obtain a patent in their creative process or, at least, if patent is one of the factors that, combined with others, produces innovation, then the creation of proprietary rights is justified because society is compensated by the advancement in knowledge that otherwise would not occur. If, however, innovation is produced no matter what is provided by the patent system, then the creation of proprietary rights is not only useless, but also reduces the public domain and, thus, damages the society.

The specific issues that have more recently occupied commentators and judges regarding patentable subject matter is whether software, but even more so, business methods should be eligible for patent protection and, if so, to what extent.⁵ The issue appeared to be settled in 1998 and 1999 with the Court of Appeal, Federal Circuit (Federal Circuit)’s decisions *State Street Bank and Trust Co. v. Signature Financial Group Inc.*,⁶ and *AT&T Corp. v. Excel Communications, Inc.*,⁷ but more recently, this very same Court appeared to have had some second thoughts about this matter. Indeed, on several occasions the Court has expressed more restrictive views toward these two specific subject matters.

⁵ See among others Kristen Osenga, *Ants, Elephant Guns, and Statutory Subject Matter*, (2007), Cynthia M. Ho, *Lessons from Laboratory Corp. of America Holdings v. Metabolite Laboratories, Inc.*, (2007).

⁶ *State St. 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).

⁷ *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352.

The history of the patentability of business methods goes hand in hand with the one of software innovations and thus, although the focus of this paper is financial methods as a subset of business methods, a few words on how software became patentable subject matter seem to be required.

A. *Brief description of life before State Street*

During the 1950s and early 1960s it was quite clear that the United States Patent and Trademark (USPTO) considered software not to be patentable subject matter.⁸ However, the Supreme Court did not consider the patentability of software related inventions until 1972⁹ when it decided *Gottschalk v. Benson*.¹⁰ The case concerned a patent application for a method of processing data by a program to convert binary-coded decimal numbers to pure binary numbers.¹¹ The Supreme Court concluded that the process under consideration was not eligible for patent protection, because its claims in the patent application were so broad as to preempt all of the possible uses of the claimed method in a general-purpose digital computer.¹² The Courts noted that, indeed, these claims did not attempt to cover a specific invention, but rather the adopted mathematical formula itself.¹³ Consequently, the claimed method consisted of an abstract idea and was not patentable, because it conflicted with one of the three judicially created exceptions to patentable subject matter:¹⁴ laws of nature, natural phenomena and abstract ideas. In

⁸ Robert P. Merges & John F. Duffy, *Patent Law and Policy: Case and Material* 132 (3d. ed. 2002).

⁹ See Osenga *supra* note 5.

¹⁰ *Gottschalk v. Benson*, 409 U.S. 63 (1972).

¹¹ *Id.*

¹² *Id.*

¹³ *Id.*

¹⁴ *Id.*

turn, the USPTO interpreted this case as to mean that software innovations were unpatentable *per se*.¹⁵ This conclusion was confirmed a few years later when the Supreme Court in *Parker v. Flook*¹⁶ found a method for updating the variable alarm limits used for catalytic conversion to be unpatentable, because it did not comprise eligible subject matter. Despite the fact that this time the claims were not as broad as in *Benson*,¹⁷ the Court concluded that, since the only innovative element of Flook's process was the algorithm through which the recalculation of the aforementioned limits operated,¹⁸ the claimed method was not eligible for patent protection under 35 U.S.C. §101.

In 1981 the Supreme Court once again had the opportunity to rule on the issue under consideration by deciding the *Diehr* case.¹⁹ However, this time the result was quite different from that obtained in *Benson*²⁰ and *Flook*.²¹ Indeed, notwithstanding the fact that the claimed process adopted a mathematical algorithm in several of the steps required for molding and curing synthetic rubber, the Court concluded that the invention was patentable. In particular, the Court specified that “when a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent law were designed to protect (e.g. transforming or reducing an article to a different state or thing) then the claim satisfies the requirements of 35 U.S.C. §101.”²²

¹⁵ See Osenga *supra* note 5.

¹⁶ *Parker v. Flook*, 437 U.S. 584 (1978).

¹⁷ See *supra* note 10.

¹⁸ See *supra* note 16.

¹⁹ *Diamond v. Diehr*, 450 U.S. 175 (1981).

²⁰ See *supra* note 10.

²¹ See *supra* note 16.

²² See *supra* note 19.

Subsequent to the *Diehr* case, the number of software patents issued per year began to increase exponentially, reflecting “not only the growing importance of software to the nation’s economy, but also the more favorable attitude towards this kind of patents at the PTO and in the courts.”²³ Such favorable momentum for the patentability of software culminated in 1998 with the *State Street*²⁴ decision, which is described in the next section.

B. State Street and AT&T

In 1998 The Federal Circuit decided a case which arose from the District Court granting a motion for summary judgment in favor of State Street Bank & Trust Co. (State Street) based on the invalidity of Signature Financial Group, Inc. (Signature)’s patent on a data processing system for implementing a certain investment structure for mutual funds. Specifically, the system included a method of pooling mutual funds’ assets together into a single investment portfolio organized as a partnership to provide their administrators with considerable savings in managing expenses and tax reductions.

Accordingly to the District Court, the invalidity of the patent derived from the fact that the “the claimed subject matter fell into one of two alternative judicially-created exceptions to statutory subject matter”²⁵ known as the *mathematical algorithm exception* and the *business method exception*.

²³ See *supra* note 8.

²⁴ See *supra* note 6.

²⁵ *Id.*

The Federal Circuit reviewing the case noted that “mathematical algorithms are not patentable to the extent [that] they are merely abstract ideas.”²⁶ Indeed, the Court said that, if the algorithm is applied in a useful way, i.e. “it produces a useful, concrete and tangible result,”²⁷ there is no reason *not* to consider it patentable subject matter. Specifically, the Court found that Signature’s patent was not invalid under 35 U.S.C. §101, because it claimed a system based on a mathematical algorithm that transformed “data, representing discrete dollar amount (...) into a final share price.”²⁸ Such an algorithm was, therefore, applied in a useful way; thus, it was patentable. Moreover, the Court took the opportunity “to lay (...) [the] ill-conceived [business method] exception to rest”²⁹ and reverted and remanded the case.

A few months later the Federal Circuit decided the *AT&T* case³⁰ reiterating and clarifying the conclusions reached in *State Street*. With these two last decisions the Federal Circuit effectively opened the doors of the PTO to business methods and significantly simplified the already common practice of patenting software.

To be sure, it should be pointed out that even before *State Street* the PTO office issued business method patents, but very sporadically and with great uncertainty about their validity.³¹ *State Street* eliminated any doubts about the inclusion of business methods within the scope of patent protection. The result has been the creation by the PTO of a new class for this type of subject matter-- class 705-- and, particularly in the

²⁶ *Id.*

²⁷ *Id.* On this point Osenga noted that the Federal Circuit reached this conclusion by taking “its logic in *Arrhythmia Research* and *Alappat* one step further” see *supra* note 5.

²⁸ *Id.*

²⁹ *Id.*

³⁰ See *supra* note 7.

³¹ Josh Lerner, *Where Does State Street Lead? A First Look at Finance Patent, 1971-2000*, 57 *The Journal of Finance* 901, (2002).

years immediately following *State Street*, a huge wave of applications filed within this class.³² With the wave of applications a significant amount of criticism “by academics, journalist and politicians”³³ arose that focused primarily on the policy issues behind the patentability of this type of subject matter and the alleged low quality of the related patents.³⁴

Nevertheless, for almost a decade *State Street* and *AT&T* unquestionably represented the Federal Circuit’s position toward the patentability of software and business methods. In its opinions, the Court clearly held that “there should really never be a §101 rejection of these applications so long as data transformation is present and the invention produces the required useful, concrete and tangible result.” However, in the last few years a different trend appears to have emerged. Courts and the PTO have expressed more restrictive views about these subject matters. These views have been reflected in courts’ decisions and in the PTO 2005 Interim Examination Guidelines that “emphasize an element of physicality to find patent eligibility.”³⁵ The next section will provide a brief overview of the most recent cases on this issue.

C. *The world after State Street*

On September 20, 2007 the Federal Circuit decided two cases which engendered substantial attention among academics and observers. The reason for such an interest is

³² Among others, Peter R. Lando, Business Method Patents: Update Post State Street, 9 Tex. Intell. Prop. L.J. 403, (2001).

³³ See more specifically on this point John R. Allison & Starling D. Hunter, *On the Feasibility of Improving Patent Quality One Technology at a Time: The Case of Business Methods*, 21 Berkeley Tech. L.J. 729, (2006); and John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 Berkeley Tech. L.J. 987, (2003).

³⁴ *Id.*

³⁵ See Osenga *supra* note 5.

the fact that by issuing these two decisions, the Court, had once again the opportunity to address the boundaries of patentable subject matter and decided to do so in a way that appeared to be more conservative than what would have been predicted under *State Street* and *AT&T*. This shift in position was not totally unexpected since it followed several recent Supreme Court decisions³⁶ in which it had expressed a distinctly more restrictive view toward the patent system than that had prevailed during the 1980s.³⁷

Specifically, the Federal Circuit had to decide the *Comiskey* case³⁸ by determining whether the rejection³⁹ of a patent application claiming a method and a system of mandatory arbitration for disputes arising from unilateral and contractual legal documents was valid.

After having determined that Comiskey's invention fell within the general category of business methods, the Court concluded that his patent application sought to acquire property rights on the "mental process of resolving a legal dispute between two parties by decision of a human arbitrator."⁴⁰ In other words, Comiskey's patent application was seeking to monopolize the "use of human intelligence in and of itself"⁴¹ and, therefore, had to be rejected. Indeed, accordingly to the Court, mental processes alone, as well as abstract ideas, are not within the scope of patent protection. The Court

³⁶ See for instance, *eBay Inc. v. MercExchange L.L.C.*, 547 U.S. 388(2006) and *KRS Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727 (2007).

³⁷ Extremely significant is in these regard is *Diamond v. Chakrabarty*, 447 U.S. 303 (1980) in which the Court clearly asserted that under the Patent Act "anything under the sun made by man" is patentable.

³⁸ *In re Comiskey*, 499 F.3d 1365 (2007).

³⁹ It is worth noting that this appeal derived from the Board of Appeals and Interferences (Board)'s decision to affirm the examiner's rejection of claim 1-59 of Comiskey's patent application. The ground on which the Board based its decision was obviousness under 35 U.S.C. § 103 rather than a lack of patentable subject matter. In turn, the Federal Circuit decided *sua sponte* to tackle the case from the standpoint of subject matter eligibility. *Id.*

⁴⁰ *Id.*

⁴¹ *Id.*

stated that, in order for a mental process to be patentable, it must be combined with one of the statutory subject matter categories defined in 35 U.S.C. § 101. Comiskey, on the other hand, admitted that his invention did not require a machine to be operative; thus, the Court concluded that it was not patentable.

Furthermore, in deciding *In re Nuijten*,⁴² the Federal Circuit took an unexpected position when it concluded that a signal encoded according to a certain process that reduces distortions caused by watermarks was not patentable subject matter because it did not fall into any of the four categories of eligible subject matter:⁴³ process, machine, manufacture and composition of matter.⁴⁴ Specifically, the Court said that the Nuijten’s signal could not be a *process* because it did not involve an act or a series of acts.⁴⁵ It could not be considered to be a *machine* because it was not “made of ‘parts’ or ‘devices’ in any mechanical sense.”⁴⁶ It could not be a *manufacture* either, because it was too transitory and, thus, did not have the required physical characteristics. Finally, Nuijten’s signal could not be considered to be *composition of matter* because, in order to fall within this category, the invention under consideration must be either a chemical union, or a mechanical mixture or a gas, fluid, powder or solid.⁴⁷

Overall the generalized absence of physicality seems to have been fatal to the patentability of Nuijten’s signal. In this context, of interest is the dissenting opinion of

⁴² *In re Nuijten*, 500 F.3d 1346 (2007).

⁴³ *Id.*

⁴⁴ See *supra* note 2.

⁴⁵ *Id.*

⁴⁶ *Id.*

⁴⁷ *Id.*

Judge Linn who argued that it did not appear that the majority’s holding was “compelled by or consistent with precedent or the language of the statute.”⁴⁸

Subsequent to these two decisions, many commentators began to speculate about the possibility that the era of patentability of business methods was coming to an end. Ultimately, the Federal Circuit reinforced such concerns when on February 15, 2008 *sua sponte* ordered a hearing *en banc* of the *Bilski* case.⁴⁹

The appeal was based on the Board of Patent Appeals and Interferences’ decision to affirm the PTO’s rejection of Bilski’s patent application on a method for hedging the consumption risk related to the sale of certain commodities.⁵⁰ According to the PTO, Bilski’s method was nothing more than an abstract idea, or a mathematical algorithm with no practical application. The Board substantially agreed with the PTO’s conclusions and also underlined the fact that the claims under consideration on one side did not “recite the transformation of an article to a different state or thing”⁵¹ and on the other did not pass the *State Street* test because they did not produce a “useful, concrete and tangible result.”⁵² Finally, the Board noted that Bilski’s claims were so broad as to cover any possible way of performing the method and, thus, they were claiming an abstract idea. Bilski appealed the Board’s decision and the case was argued before the Federal Circuit on October 1, 2007. A few months later,⁵³ the Court ordered the hearing *en banc*; the oral argument was held on May 8, 2008. With this order the Federal Circuit solicited supplemental briefs and amicus briefs on the following issues:

⁴⁸ *Id.*

⁴⁹ *In re Bilski*, 2008 WL 417680 (Fed. Circ. 2008).

⁵⁰ *Id.*

⁵¹ *Id.*

⁵² See *supra* p.9.

⁵³ See *supra* note 49.

1. determination of whether claim 1 of Bilski's patent application claims patentable subject matter;
2. determination of the appropriate standard for understanding whether a process is patentable subject matter;
3. a) determination of whether the reason for the unpatentability of the subject matter claimed in Bilski's patent application is that it constitutes an abstract idea or a mental process; and b) determination of the circumstances that make an invention containing both mental and physical steps patentable subject matter;
4. determination of whether, in order to be patentable subject matter, a method or a process must physically transform an article or must be tied to a machine;
5. determination of whether *State Street*⁵⁴ and *AT&T*⁵⁵ should be reconsidered and, if so, whether they should be overruled.⁵⁶

It appears that at the hearing, the Federal Circuit “focused more narrowly on what types of business-related inventions should be eligible for patent [protection].”⁵⁷

⁵⁴ See *supra* note 6.

⁵⁵ See *supra* note 7.

⁵⁶ See *supra* note 49.

⁵⁷ Charles R. Macedo, Jung Hahn, Howard Wizenfeld and Norajean McCaffrey, *Guest Blog: Some First Hand Impressions on the En Banc Bilski Oral Argument*, May 12, 2008, available at <http://brooks-patent-infringement.findtechblogs.com/default.asp?item=2203549> last visited 07/10/2008.

II. What do we know about financial innovation?

A. *Financial Innovation in General*

As noted by several commentators⁵⁸ at different times in the past few decades, the financial industry has been characterized by a remarkable increase in innovation.

“Broadly speaking, financial innovation is the act of creating and then popularizing new financial instruments as well as financial technologies, institutions and markets.”⁵⁹ In this specific case, it appears that most of the changes engendered by this wave of innovation have occurred in two financial areas: securities and trading strategies/processes.⁶⁰

The literature on studies that empirically test the causes of financial innovation is sparse. As noted in one paper,⁶¹ which surveys the literature on this topic, “only 39 articles that provide empirical test of hypotheses of any kind concerning financial innovation”⁶² were found. Of these papers, only two focused on the economic/environmental conditions that encouraged innovation. Recently, a few scholars have started publishing studies that more closely examine the impact of patent protection on the innovative process of the financial industry. Since this issue is the

⁵⁸ Among others, Enrique Schroth, *Innovation Differentiation, and the Choice of an Underwriter: Evidence from Equity-Linked Securities*, 19 *Review of Financial Studies* 1041, (2006); Craig Pirrong, *A Growing Market*, (2002) available at <http://www.cato.org/pubs/regulation/regv25n2/v25n2-6.pdf>; Stephen A. Ross, *Institutional Markets, Financial Marketing, and Financial Innovation*, 44 *The Journal of Finance* 541, (1989); Ian Cooper, *Innovation: New Market Instruments*, 2 *Oxf Rev Econ Policy* 1, (1986); William L. Silber, *The Process of Financial Innovation*, 73 *The American Economic Review* 89, (1983);

⁵⁹ Peter Tufano, *Financial Innovation*, (2002) available at http://www.people.hbs.edu/ptufano/fininnov_tufano_june2002.pdf.

⁶⁰ *Id.* and also see *supra* Ross note 58.

⁶¹ Frame W. Scott and Lawrence J. White, *Empirical Studies of Financial Innovation: Lots of Talk, Little Action?*, *Journal of Economic Literature* Vol. XLII 116 (2004).

⁶² *Id.*

primary focus of this paper, a brief description of these more targeted studies will be provided in the next section.

Traditionally, the most important causes of financial innovation are considered to include the following:

1. “Increased volatility of interest rates, inflation, equity prices, and exchange rates;
2. Advances in computer and telecommunication technologies;
3. Greater sophistication and educational training among professional market participants;
4. Financial intermediary competition;
5. Incentives to get around existing regulation and tax laws;
6. Changing global patterns of financial wealth.”⁶³

As Silber⁶⁴ has pointed out, it appears that financial innovation occurs when the costs of adhering to existing constraints becomes too high. Specifically, it can be said that when exogenous changes, such as an increase in interest rates or the development of a new technology, cause the constraints under which a firm normally operate to become too expensive, the search for alternative tools to maximize the company’s objective begins.⁶⁵

On the other hand, Tufano⁶⁶ has empirically demonstrated that, in the case of the issuance of mortgage-backed securities, the innovator has a first-mover advantage,

⁶³ Franco J. Fabozzi & Franco Modigliani, *Capital Market. Institution and Instruments*, 28 (3rd ed. Peterson Education, Inc. 2003)

⁶⁴ See *supra* note 58.

⁶⁵ *Id.*

⁶⁶ Peter Tufano, *Financial Innovation and First-Mover Advantage*, 25 *Journal of Financial Economics* 213, (1990).

consisting of its ability to conquer a larger market share and then become the leading market-maker for that product. Ultimately, this edge on its competitors is translated into higher profits and the prospect of acquiring this strategic advantage represents a large enough incentive for financial firms to innovate. This conclusion appears to be confirmed by Herrera and Schroth,⁶⁷ who in 2003 showed that the advantage enjoyed by the first mover mainly comprises information asymmetry. Indeed, by dealing directly with the client and acquiring important information about its needs, the innovator can position itself ahead of the learning curve for the product under consideration as well as subsequent generations of products. In turn, the innovator is much more competitive than the imitators and can garner a larger share of the market that validates the decision to incur the original R&D expenditure.

The importance of understanding the underlying causes for financial innovation derives from the fact that, once the motives for the creative process in this sector are known, the possibility of inducing additional innovation by providing the right incentives to market players increases. The result is the emergence of new products that reduce “costs and risks and (...) [/or of new] services that meet the particular needs of the financial system participants”⁶⁸. Indeed, it is possible to say that that society inevitably benefits from a richer and more developed financial system “in which [for instance] risks are spread and the advantages of diversification are [fully] achieved.”⁶⁹

⁶⁷ Helios Herrera & Enrique J. Schroth, Profitable Innovation Without Patent Protection: the Case of Derivatives, (February 25, 2003). International Center for Financial Asset Management and Engineering Working Paper. Available at SSRN: <http://ssrn.com/abstract=384822>.

⁶⁸ Eugenio Domingo Solans, *Financial Innovation and Monetary Policy*, (February 13, 2003) available at <http://www.ecb.eu/press/key/date/2003/html/sp030213.en.html>.

⁶⁹ Arnold Kling, *Financial Innovation in Perfect Capital Market*, (August 8, 2005), available at <http://www.techcentralstation.com/article.aspx?id=080805E>.

B. *Financial Innovation and Patent Protection*

As mentioned in the previous section, recently a number of empirical studies focusing on the newly established relationship between the patents system and the financial industry have been produced. Most of these studies have been conducted by Josh Lerner, who published a first article in 2002⁷⁰ offering a systematic analysis of financial patents as they emerged immediately subsequent to *State Street*.⁷¹ In that context, Lerner emphasized the fact that between 1998 and 2000 there was a significant increase in the issuance of financial patents, characterized by a low involvement of academics and universities, i.e. the number of financial patents assigned to academics and universities, as compared to other fields, was extremely low.⁷² Lerner noted that perhaps this phenomenon could be explained by a generalized lack of interest and/or awareness of financial patents by academics working in finance. He also pointed out the paucity of citations of relevant academic works that also characterized the patents under consideration and concluded that this fact was indicative of the low level of experience and training of the examiners that, at that time, were working on these types of patents.

A year later, Lerner presented another study⁷³ focused on the interplay between the patent system and the financial industry. This time he integrated his previous research with interviews of senior patent attorneys and employees of major financial institutions. He also considered what he refers to as the "investment bank's research

⁷⁰ See *supra* note 31.

⁷¹ See *supra* note 6.

⁷² See *supra* note 31.

⁷³ Josh Lerner, *The Two-Edged Sword: The Competitive Implication of Financial Patents*, (2006) available at <http://www.frbatlanta.org/news/conferen/fm2003/lerner.doc>.

intensity,”⁷⁴ by looking at the number of bank employee serving on the editorial or advisory board of the *Financial Management* and the *Journal of Portfolio Management*. He noted, among other things, that there was an increasing interest on the part of financial institutions towards patent protection and that the majority of the financial patents issued up until that point had been issued to U.S. financial companies with strong ties to academia, i.e. with employees working for the aforementioned academic-practitioner journals.

In 2006, Lerner published another study on this issue to determine the source of financial innovation by identifying the most innovative institutions within the financial industry. He supplemented his analysis with a study of the patenting pattern of the firms under consideration.⁷⁵ Lerner’s investigation revealed that the most innovative financial institutions include:

- Small firms;
- Less profitable firms;
- Older and less leveraged firms that are located in areas with high levels of financial innovation.

On the other hand, his investigations on firms’ patenting patterns produced some surprising results. The only similarity with the findings on the characteristics of the most innovative firms was that older and less leveraged companies tended to obtain more patents. Particularly striking was the absence of any significance of spillovers in patenting patterns.

⁷⁴ Id.

⁷⁵ John Lerner, *The New Financial Thing: the Origin of Financial Innovation*, 79 *Journal of Financial Economics* 223, (2006).

More recently, in 2007 Dew also investigated the subjects seeking financial patents⁷⁶ and concluded that the majority are imitators rather than innovators. Indeed, in his opinion, patenting activity is inversely related to both companies' innovative propensity and their stock's rate of return. Moreover, he pointed out that the financial patents issued up until that point were concentrated in the hands of relatively few financial institutions and that small firms had shown little interest in this form of intellectual property protection.

Finally, in 2008, Hunt studied specifically the issue at the heart of this research—whether patent protection had fostered financial innovation over the past decade.⁷⁷ Specifically, he looked at the R&D spending of financial institutions to understand whether *State Street* encouraged additional R&D investment that ultimately could have produced more innovation in this field. Given the paucity of traditional data on R&D spending in the financial industry, Hunt focused on the composition of the workforce in this sector and in particular investigated those occupations within this context that are more likely to engage in R&D. He then compared his findings with those of other industries to determine whether it was possible to identify a trend specific to the financial industry that was somehow the result of the introduction of patent protection in 1998. Since such a trend did not emerge, Hunt concluded that “at present there is little evidence

⁷⁶ Kurt Dew, *Magicians, Reputation Trolls, Tsunamis and Floods: Has Patent Protection for Financial Innovation Encourages Financial Institution Creativity?* (April 26, 2007), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=982762.

⁷⁷ Robert M. Hunt, *Business Method and U.S. Financial Services*, (2008), available at <http://www.philadelphiafed.org/files/wps/2008/wp08-10.pdf>

to argue that business methods patents have had a significant effect on the R&D investments of financial institutions.”⁷⁸

As mentioned above, the writer is tackling the very same research question as that considered by Hunt. However, she is looking at different indicators of financial innovation in combination with the financial patent trend developed over the past decade. The next section will provide a full description of the author’s approach on this issue.

⁷⁸ Id.

III. Research and Method

A. Research Project

Should there be patents on financial methods? For most of the last century financial methods as well as business methods have been unpatentable *per se*.⁷⁹ The “result of the United States Patent Office opening its door to financial innovations”⁸⁰ is that now financial institutions, but also financial and legal departments in nearly every industry, “have to be mindful of [patent protection].”⁸¹ This consideration might appear to be inconsequential, but, if the fact that for many years the financial industry had survived based on its own creative processes⁸² and its own equilibrium among the market participants is taken into account, it is possible to understand why the changed situation is more problematic than it originally seems. Indeed, the adoption of patents to protect financial methods has created mixed feelings within the financial industry; as a result, many observers have questioned the subsistence of any benefits that the patent system might confer to this industry.⁸³

Therefore, the primary purpose of this project is to investigate the basis of the aforementioned skepticism by performing an empirical study of financial securities that would determine whether subsequent to the *State Street* decision⁸⁴ there has been an

⁷⁹ See *supra* p. 8-10.

⁸⁰ Paul E. Schaafsma, *A Gathering Storm in the Financial Industry*, 9 Stan. J.L. Bus. & Fin. 176, (2004).

⁸¹ *Id.*

⁸² See, for instance, *supra* Silber and Tufano note 58 and 66 respectively.

⁸³ See among others Robert P. Merges, *The Uninvited Guest: Patents on Wall Street*, UC Berkeley Public Law Research Paper No. 126, (2003) available at <http://ssrn.com/abstract=410900>.

⁸⁴ See *supra* note 6.

increase in the level of innovation of financial instruments that could justify the extension of patent protection to this subject matter.

B. Method and Data

To carry out this research, the author has compiled a list of innovative types of securities that have emerged over the past 25 years. The creation of such a list has three purposes: 1) to understand whether there has been an increase in the number of innovative types of securities after 1998; 2) to compare this list with the patents issued and the patent applications submitted for securities during the past decade; and 3) to understand whether the patent system has had any impact on the items included in the list. In the next section, the author presents a full description of how the securities list was created and how the data on patents and patent applications on this subject matter were collected.

1. The Creation of the List of Securities

The first and the principal obstacle encountered in compiling a list of innovative types of securities is determining what constitutes an innovation in the financial market. Indeed, as pointed out by Tufano, “most innovations are evolutionary adaptations of prior products (...) almost nothing is completely ‘new’ and the degree of newness or novelty is inherently subjective.”⁸⁵ Therefore, the author has decided to tackle this problem by focusing on determining an appropriate benchmark for identifying innovative types of securities. Since the ultimate goal of this paper is to assess what impact, if any, the patent

⁸⁵ See *supra* note 59.

system has had on the production of securities types, the writer started thinking about this issue in terms of patent law or, in other words, about how an innovative security would look from the perspective of the patent system.

The author concluded that the innovative security would have had to be new, useful and nonobvious. More specifically, the innovative security would need

- to implement a new financial function⁸⁶ or to improve an existing one i.e. the security must be new;
- to possess the intrinsic characteristic of being widespread in the relative financial market, i.e. the security must be marketable and have a definable price and risk or, in other words, the security must be useful;
- to be more than a simple aggregation of existing securities i.e. the security must be nonobvious.

The author discussed her conclusions and the overall project with experts in the field and realized that one of the elements that constitutes the mathematical models used to calculate the security's price and risk is described univocally by the financial function performed by the security itself. Therefore, when the security under consideration discharges a different, new or improved financial function, the mathematical element within the model adopted to calculate price and risk changes to reflect the different characteristics of the specific instrument. Moreover, once this change is identified, it is possible to say whether it is a known one, i.e. the instrument under consideration is performing a known financial function, or whether, on the other hand, it is a new one or an improvement of a known one, i.e. the instrument under consideration is accomplishing

⁸⁶ Some of the most common financial functions are price-risk transferring, credit-risk transferring, liquidity generating, credit-generating and equity-generating; see *supra* note 63.

a new function. In other words, by looking at the way in which the price and the risk of a security is calculated and, specifically, by looking at the mathematical function defined by the financial function that the security performs, it is possible to ascertain whether or not the financial instrument under consideration is in fact innovative. Ultimately, by adopting this criterion, a list of marketable securities performing new financial functions, i.e. a list of innovative types of securities, can be produced.

The author is aware of the fact that this method has a subjective component since she decides that the change in the mathematical function defined by the security's financial function is indicative enough to become the benchmark for identifying an innovative product. Nevertheless, the adopted method also presents several important benefits including, first of all, being exclusively linked to the most significant aspect of the innovative effort in the field of securities: the performance of a new financial function to meet an unanswered need in the market. This method is also based on the mathematical aspect of a new or improved financial function which provides objectivity to the analysis. Finally, this method operates consistently and systematically across the entire securities population.

To clarify the considerations made thus far, it seems useful to present the case in which the *mathematical function* reflecting the security's *financial function* changes from one generation of financial instruments to another. An example of this case is the transition from mortgage-backed securities (MBS)⁸⁷ and asset-asset backed securities (ABS)⁸⁸ to the collateralized debt obligation (CDO).⁸⁹ The financial function of MBS and

⁸⁷ See *supra* note 63 **Error! Bookmark not defined.** at 499

⁸⁸ Id at 528.

⁸⁹ Id. at 540.

ABS consists of credit-risk transferring. However, if a built-in credit support is added to their fundamental structure, a different type of security that performs a new or improved financial function is created. In this specific case, the new type of security is a CDO, whose function is to provide enhanced credit-risk transferring and prepayment-risk hedging. Ultimately, in calculating the CDO's price or risk, the built-in credit support is translated into mathematical terms. As a result, the overall mathematical model adopted to calculate the CDO's price or risk differs from that adopted to compute the MBS or ABS's price or risk and, it is possible to say that the two different models reflect the two different financial functions carried out by these types of securities.

Finally, it is important to mention the more intuitive case-- the one in which the security under consideration does not have a "direct predecessor" or for which the identification of a direct predecessor might be "a bit of a stretch." These securities are entirely new; therefore, an entirely new model to calculate their price and risk is required. On that basis and for the purpose of this project, these securities are considered to be *innovations*. An example of this type of securities is the credit default swap (CDS) whose financial function is to provide insurance against the risk of default by a specific company.⁹⁰ They were created in the 1990s and have been used primarily by banks "to shift the credit risk in their loans to other parts of the financial system."⁹¹ In this case, no direct predecessor can be identified; thus, the mathematical model used to calculate CDS' price and risk is completely new.

⁹⁰ John C. Hull, *Options, Futures, and Other Derivatives*, 507 (6th ed. Peterson Education, Inc., 2006).

⁹¹ *Id.* at 508.

2. The Collection of the Data from USPTO Website

In order to collect the required data about the patent applications submitted and the patents issued on securities after *State Street*, the author has used the information provided on the USPTO website.⁹² Specifically, the author has reviewed all of the patents issued after 1998 and all of the patent applications submitted after 1998 that have been assigned to subclass 35,⁹³ 36 R⁹⁴ and 37⁹⁵ of the general class 705.⁹⁶

However, although the selected subclasses are those in which patents and patent applications on securities should be assigned, Allison and Hunter⁹⁷ in 2006 have shown that a number of business method patents can be found under classifications other than 705.⁹⁸ It appears that a possible explanation for this result resides in what is known as “diversionary drafting” operated by patent attorney to avoid the second-level of review (also known as “Second Pair of Eyes Review” – SPER), that characterizes class 705.⁹⁹ In other words, Allison and Hunter have suggested that in order to elude the additional hurdle of SPER, patent attorneys draft their applications in such a way as to opt out of class 705. Consequently, the author has combined her analysis of subclasses 35, 36 R and 37 with a search of the USPTO database based on keywords. The result of this

⁹² <http://www.uspto.gov/patft/index.html>.

⁹³ Subclass 35 is defined as “Finance (e.g., banking, investment or credit).”

⁹⁴ Subclass 36 R is defined as “Portfolio Selection, Planning or Analysis.”

⁹⁵ Subclass 37 is defined as “Trading, Matching, or Bidding.”

⁹⁶ Class 75 is defined as “Data Processing: Financial, Business Practice, Management, or Cost/Price Determination.”

⁹⁷ See *supra* Allison and Hunter at note 33.

⁹⁸ *Id.*

⁹⁹ *Id.*

search allows the author to circumvent the “diversionary drafting”¹⁰⁰ problem by finding patents and patents applications on securities outside of class 705.

A full description of the results obtained in terms of innovative securities, patents and patents applications on securities will be provided in the next section.

¹⁰⁰ Id.

IV. Findings and Analysis

A. Findings

As mentioned in Section III, this section of the paper is dedicated to the description of the collected data and their analysis. Therefore, in subsections 1 and 2 the findings related to the innovative securities and to the patents issued and the patent applications submitted on securities will be provided. The final section is dedicated to their analysis.

1. Securities and Financial Methods

Several steps were required to produce the list of innovative securities. The first step involved determining macro categories into which the securities under consideration could be divided.

These categories are:

1. Debt securities (excluding mortgage-backed securities and asset-backed securities);
2. Equity securities;
3. Fixed income derivative securities;
4. Credit derivative securities;
5. Mortgage-backed securities and asset-backed securities;
6. Options;
7. Interest-rate derivative securities;
8. Currency exchange (FX) derivative securities;

9. Collective investment securities;

10. Quanto instruments.

In reality, these categories are not completely mutually exclusive; however, for the purpose of this study, financial instruments that could fit into more than one category have been included in just one of them to avoid double counting. Furthermore, by talking with experts in the field, the author realized that over the past 25 years very little innovation, if any, has been produced in categories one and two. Therefore, she focused on the remaining eight categories.

The second step involved the identification of the sources from which the relevant securities could be identified. These sources included financial manuals,¹⁰¹ financial treaties,¹⁰² financial products guides¹⁰³ and websites of financial exchanges.¹⁰⁴

A preliminary list of types of securities which have been created over the past 25 years has been produced. The list includes a total of 123 types of securities.

Finally, by adopting the method described in Part III.B.1,¹⁰⁵ 66 types of innovative securities have been selected from the preliminary list. Table 1 summarizes these findings. It is important to note that, in the case of securities, a specific “creation date” is extremely difficult to identify. Indeed, it appears that new types securities often result from the interaction between the innovators and their clients when the innovator

¹⁰¹ See Hull *supra* at note 90 and CFA, *Program Curriculum Level II*, (Peterson Education, Inc., 2008).

¹⁰² See Eric Benhamou, *Global Derivatives, Products, Theory and Practice*, (World Scientific Publishing Co. Pte. Ltd., 2007); Frank J. Fabozzi, *Fixed Income Analysis*, (John Wiley & Sons Ltd., 2007) and Frans De Weert, *Exotic Options Trading*, (John Wiley & Sons Ltd., 2008).

¹⁰³ See FEA @Interest Guide, (2008) available at http://www.fea.com/products/pdf/fea_financial_interest.pdf and FEA @Global Guide (2008) available at http://www.fea.com/products/pdf/fea_financial_global.pdf.

¹⁰⁴ See Chicago Mercantile Exchange <http://www.cme.com/>, One Chicago Exchange <http://www.onechicago.com/>, Chicago Board of Trade <http://www.cbot.com/>, Chicago Board of Option Exchange <http://www.cboe.com/> and Philadelphia Stock Exchange <http://www.phlx.com/>.

¹⁰⁵ See *supra* at page 23.

designs the specific security to meet the needs of its client. This can occur as the result of a demand by the client or on the innovator's own initiative. On the one hand, the creative process already described is consistent with the work of Tufano¹⁰⁶ and, on the other, with the research by Herrera and Schroth,¹⁰⁷ which were discussed in Section II.A.¹⁰⁸ Indeed, as these researchers have pointed out, by dealing with the client, the innovator learns salient information about the business and its needs. Ultimately, this knowledge allows the innovator to beat his competitors in the race for innovation and to satisfy its client's present and future needs. Much more should be said about this process of producing new types of securities. Indeed, this analysis requires a different kind of investigation which extends beyond the scope of this paper and will be the subject of the writer's next project. For now, it is important to emphasize the fact that if the aforementioned innovative process is correct, new types of securities are designed in private deals between two companies. By the time the securities under consideration become widespread and well known in the market, a few years can elapse, depending on the characteristics of the security and the specific market conditions. Therefore, rather than providing a specific "creation date," it appears to be more appropriate to identify a range of years, based on the time during which the type of securities at issue first became known in the market.

¹⁰⁶ See *supra* note 66.

¹⁰⁷ See *supra* note 67.

¹⁰⁸ See *supra* at page 16 and 17.

2. Patents and Patent Applications

Some interesting findings have emerged from the analysis of the selected patents and patent applications which were issued and submitted before June 8, 2008, respectively.¹⁰⁹ A first relevant result is the fact that no “diversionary drafting”¹¹⁰ emerged for the type of subject matter under consideration. Indeed, no patents or patent applications on securities were found outside subclasses 35, 36R and 37 of class 705.¹¹¹

A total of 1,985 patents and 5,921 patents application were reviewed. However, only 18 patents and 132 patent applications on securities were found.¹¹² Indeed, most of the claimed inventions within the selected subclasses represented different categories of financial innovations, such as portfolio and risk management (investment, strategies, pension and mutual funds etc.), banking (transactions, billing, payments, etc.), financial information systems (software, e-commerce, data etc.), financing (loans, leasing, mortgages etc.) and asset evaluation (equity, real estate, interest rates etc.). At first, this result could appear to be quite surprising, considering the fact that, as pointed out by some scholars,¹¹³ during the last few decades securities have been one of the two most innovative areas of the financial industry. However, this conclusion does not take into account the fact that most of the patents and the patent applications assigned to the subcategories of interest consist of some technological implementation of a financial process. Therefore, if the technological element is excluded from the present analysis

¹⁰⁹ The search on the USPTO website was conducted on June 8, 2008. The collected data include all of the patent applications in the subclasses of interests which were published by that date.

¹¹⁰ See *supra* at page 27.

¹¹¹ *Id.*

¹¹² In the last ten years of the patent and the patent applications assigned to the selected subclasses, only 0.91% and 2.23% respectively were for securities.

¹¹³ See *supra* Tufano and Ross at page 15.

and only patents and patent applications for “pure financial matters” are considered, the percentage of patents and patent applications on securities as compared to those for other forms of financial innovation might change significantly.

Of great interest are also the results obtained from the in-depth analysis of the identified patent and patent applications for securities. Indeed, by applying the criterion described in section III.B.1¹¹⁴ that was adopted to produce the list of innovative types of securities,¹¹⁵ it is possible to conclude that only a few of the patents and patent applications under consideration represented real innovations. Indeed, as summarized in Table 2, only 39% of the identified patents and 29% of the patent applications were for innovative securities.

Finally, it seems useful to note that all of the patents issued on securities have been assigned to financial institutions. In the next section, a full analysis of the reported data is provided.

B. Analysis

A first consideration regards the distribution of innovative types of securities over time. As illustrated in Figure 1, no specific trend in the creation of innovative types of securities can be identified. However, it seems that in this sector the 1980s were slightly more productive than the remainder of the period under consideration. Furthermore, and perhaps more importantly for the purpose of this research, it is possible to note that no particular increase in innovation has occurred after 1998.

¹¹⁴ See *supra* at page 24.

¹¹⁵ See Table 1.

On the other hand, if Figure 2 (which describes the distribution of patent applications on securities over time) is taken into consideration, it appears that, after an initial “fascination” for this form of intellectual property protection, innovators have lost interest. This is also true if one considers that the decline observed after 2004 could be mitigated by the difference of time that in certain cases exists between application date and publication date of the patent application.¹¹⁶ In this specific case, this lapse of time, on average, equals two years; therefore, it is conceivable that, in reality, the number of patent applications on securities filed in 2006 and 2007 is higher than that depicted in the graphic. Nevertheless, this last consideration does not change the overall conclusion that after 2004 a substantial decline in patent applications for securities has occurred, whereas, on the other hand, the level of innovation for new types of securities during the same period of time has remained constant.

The reason for such a decline in the number of patent applications for securities and of the registered “mismatch” with the general level of innovation of this kind of subject matter is beyond the scope of this paper. Indeed, a different research study including interviews with market participants is required to shed light on this matter. As mentioned above, the author will conduct this kind of investigation in her next project and will combine those results with the ones produced in this paper. This will hopefully produce more convincing evidence for the possible impact of the patent system on the production of new types of securities. For now, based on the aforementioned data, no conclusive answer to this issue can be found.

¹¹⁶ Figure 2 only describes the distribution of patent application over time based on their application date. However, some applicants decide not have their patent application published until a long time after their filing date. This means that Figure 2 only describes those applications which were reported (i.e. published) on the USPTO website at the time in which the search was made, i.e. June 8, 2008.

Conclusion

After 10 years from the issuance of the *State Street* decision, the patentability of business methods is still so controversial that the Federal Circuit Court has recently considered overruling its own precedent by rehearing *In re Bilski en banc*. The heart of the problem is understanding whether the patent system in the specific sector is “doing its job” or, in other words, finding out whether that patent system is fostering the creation of additional business methods.

To answer this question, an empirical study is required. For this reason, the author has decided to conduct an empirical investigation of financial methods (as a subset of business methods). Specifically, the author has studied the innovative types of securities that have emerged over the past 25 years. She also investigated the patent practice of this industry and identified the patent applications submitted and the patents issued for different types of securities. Finally, the author discussed her findings and concludes that, recently, creators of new types of securities have shown less interest in the patent system. Nevertheless, the rate of innovation in this field has remained constant.

The author also noted that, at this time, the available data are not sufficient to reach a conclusive determination on whether the patent system has affected the design of new types of securities. Indeed, more investigation, including interviews with market participants, seem to be required to ultimately shed some light on whether the last ten years of patent protection has, in fact, fostered innovation in the financial industry in general and in the world of securities in particular.

Appendix

Tables

Table 1

Bond Future Options	Asset-Backed Securities (ABS)
Interest Rate Options	Collateralized Debt Obligations (CDO)
Digital Interest Rate Options	Collateralized Mortgage Obligation (CMO)
Swaptions	Equity Index Futures
Caps	Equity Index Options
Floors	Contracts For Difference
Constant Maturity (Interest Rate) Swaps	Chooser Options
Averaging Amortizing Compounding/Accreting swaps	Forward Starting Options
Autocap	Lookback Options
Chooser Cap	Shout Options
Flexi Cap	Whisper Options
Callable Reverse Floater	Cliquet Options
Target Redemption Notes (TARN)	Dual-asset Options
Spread TARNS	Contingent Options
Snowball	Two-factor Barrier Options
Spread Options	Compound Options
Range Accruals	Knockout Options
Spread Range Accruals	Kick-in Options
Power Reverse Duals	Window Options
Cumulative Inverse Floaters	Soft (Proportional) Options
Snow Range	Ladder Options
Laddered Inverse Floater	Digital Options
Thunderballs	Average-price Options

Snowblades	Average-strike Options
Variance Swaps	Crack Options
Volatility Swaps	Basket Options
Credit Default Swaps (CDS)	Options on Best/Worst
CDS Baskets	Option on Better/Worse
CDS Options	Option on Minimum/Maximum
Total Return Swaps	Exchange Traded Funds (ETF)
Basket Credit Linked Notes	Quanto Options
Credit Linked Notes	Quanto Interest Rate Swaps
Equity Default Swaps	Quanto Interest Rate Futures

Table 1. List of new securities for the period 1980-2007.

Table 2

(a) Number of patents reviewed	1985
(b) Number of patent applications reviewed	5921
(c) Number of patents on securities found (1)	18
(d) Number of patent applications on securities found (2)	132
(e) Number of patents on new securities found (3)	7
(f) Number of patent applications on new securities found (4)	38
Ratio (c)/(a)	0.91%
Ratio (d)/(a)	2.23%
Ratio (e)/(c)	38.89%
Ratio (f)/(d)	28.79%

Table 2. Numbers of patents and patent applications.

Figures

Figure 1

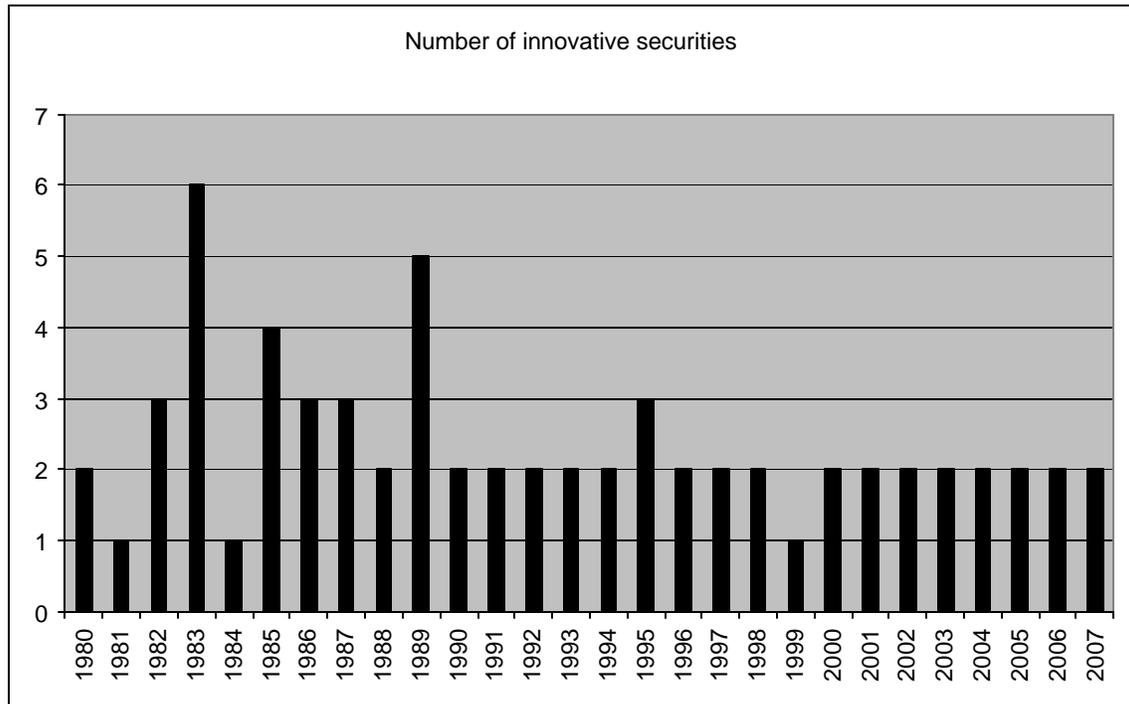


Figure 1. Distribution of new securities during the period 1980-2007

Figure 2

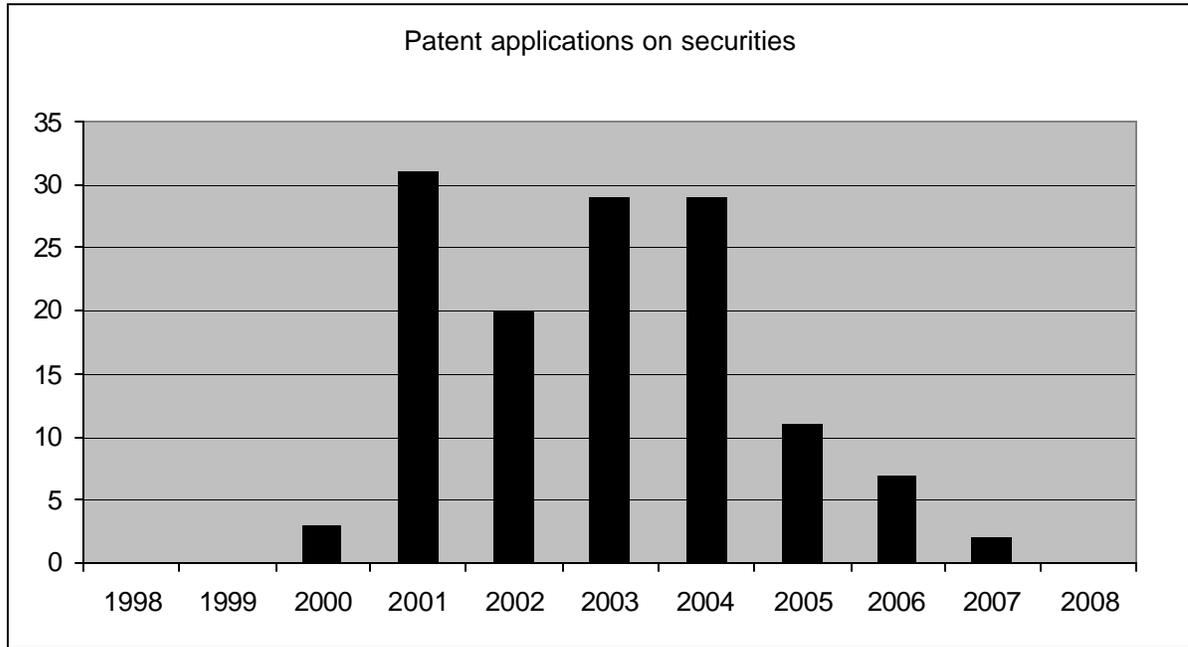


Figure 2. Distribution of patent applications on securities in the period 1998-2008

Figure 3

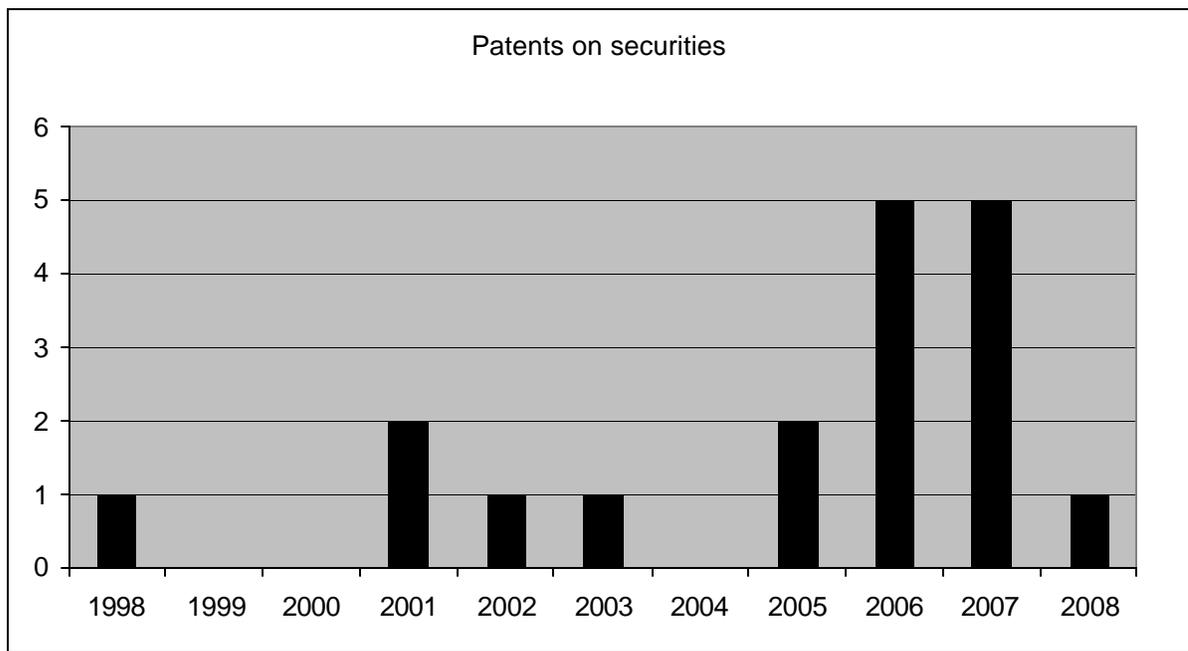


Figure 3. Distribution of patents on securities in the period 1998-2008

Figure 4

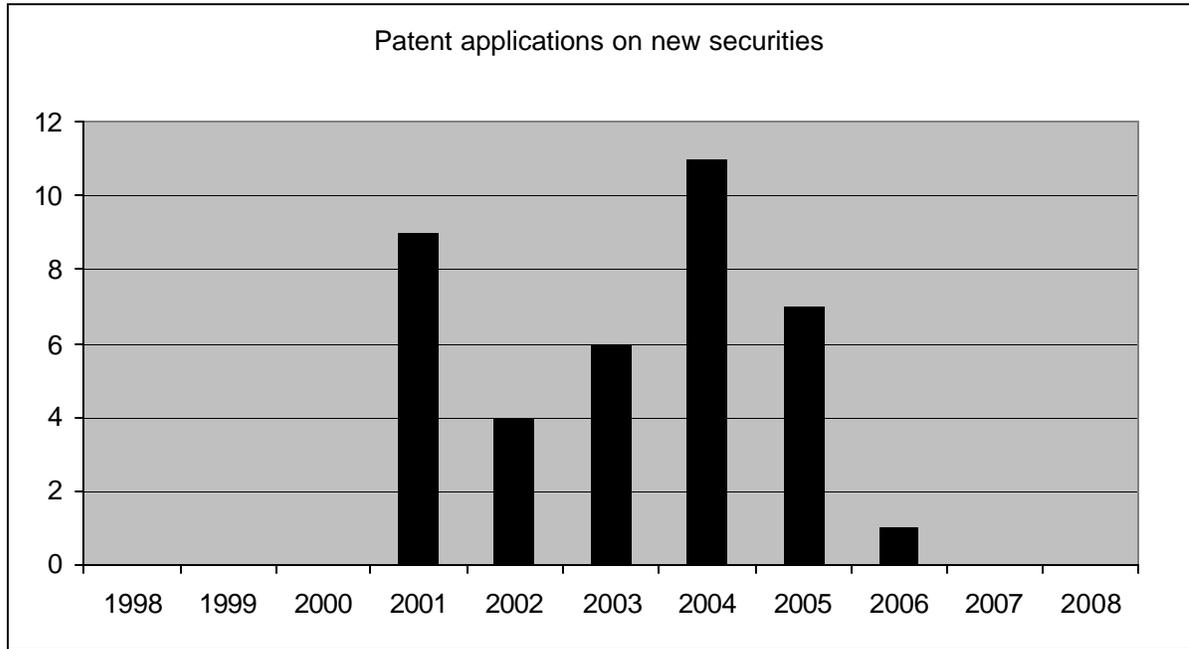


Figure 4. Distribution of patent applications on new securities in the period 1998-2008

Figure 5

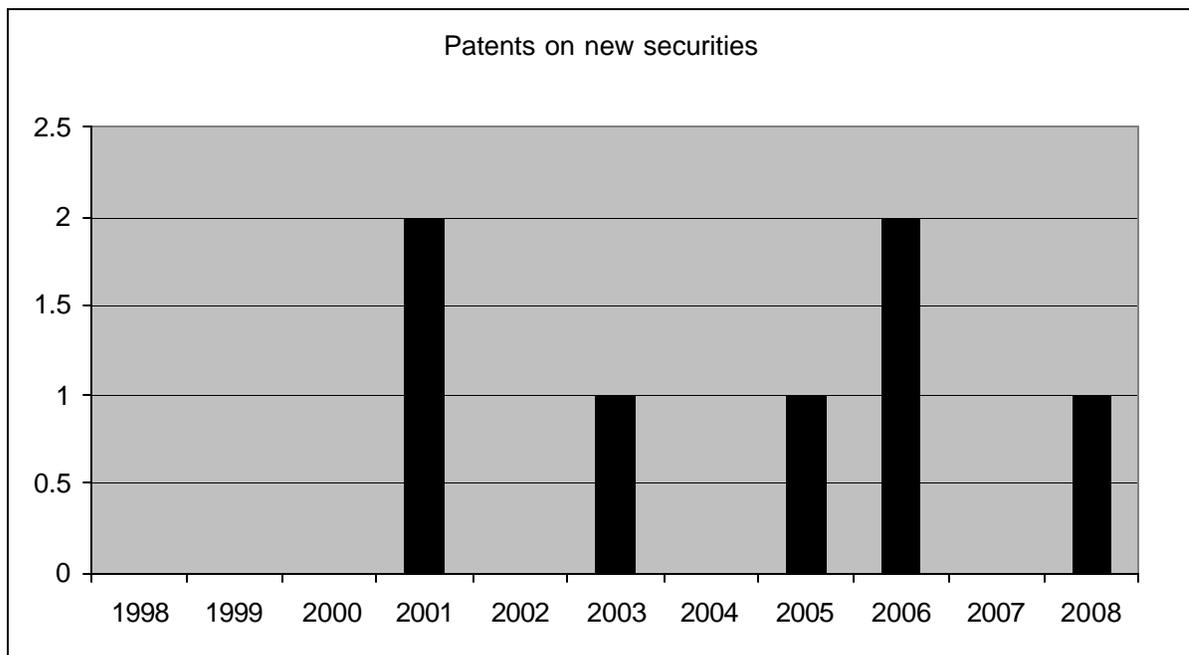


Figure 5. Distribution of patents on new securities in the period 1998-2008