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Does State Street lead to Europe? The case of financial exchange innovations

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Mari Komulainen – Tuomas Takalo

**Does State Street lead to Europe?
The case of financial exchange
innovations**




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Does State Street lead to Europe? The case of financial exchange innovations

The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank of Finland.

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Bank of Finland Research
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Abstract

We study whether and to what extent financial exchange innovations are in practice patentable in Europe. We find that exchange-related applications initially increased significantly after the *State Street* decision but subsequently decreased. The clear majority (65%) of applications come from the U.S. investment banks and exchanges themselves being among the most active innovators. But patents were not easily granted in response to these applications (only 3% of them led to valid patent). The high post-grant opposition rate (41%) for granted patents indicated that competitors tightly monitored each other's patents. The evidence, as augmented with clinical case studies, supports the notion that, for an invention to pass the inventive step requirement for obtaining a European patent, it should have technical features for solving a sufficiently challenging technical problem. Our evidence suggests that patentability standards for financial methods have not weakened in Europe in the aftermath of the *State Street* decision and that the inventive step requirement constitutes a major obstacle for applicants to overcome in order to obtain a financial exchange patent in Europe.

Keywords: finance patents, financial innovation, business method patents, patent policy, management of intellectual property in financial services

JEL classification numbers: O34, O32, G24, G28, K29

Viekö State Street Eurooppaan? Arvopaperimarkkinakeksintöjä koskeva tapaustutkimus

Suomen Pankin keskustelualoitteita 22/2009

Mari Komulainen – Tuomas Takalo
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa selvitetään, miten arvopaperimarkkinakeksinnöt ovat patentoitavissa Euroopassa. Arvopaperimarkkinoihin liittyvät patenttihakemukset Euroopan patenttivirastossa lisääntyivät nopeasti State Street -päätöksen jälkeen, mutta ovat sittemmin vähentyneet. Suurin osa (65 %) hakemuksista on peräisin Yhdysvalloista. Patenttihakemustilastojen valossa investointipankit ja pörssit ovat alan johtavat uusien menetelmien ja teknologioiden kehittäjät. Vain murto-osa (3 %) hakemuksista kuitenkin näyttää johtavat varsinaiseen patenttiin. Harvoja myönnettyjä patenteja vastaan esitetään usein väitteitä, mikä osoittaa, että kilpailijat seuraavat toistensa innovaatio- ja patenttistrategioita tarkasti. Tutkimus osoittaa, että patentoinnin edellytykset eivät ole heikentyneet Euroopassa State Street -päätöksen jälkeen ja että keksinnöllisyysvaatimus – pikemminkin kuin poissuljenta – on keskeinen este rahoitusalan innovaatioiden patentoitavuudelle Euroopassa

Avainsanat: rahoitusalan patentit, rahoitusalan innovaatiot, liiketoimintamenetelmäpatentit, patenttipolitiikka, aineettoman oikeuden hallinta rahoituspalveluyrityksissä

JEL-luokittelu: O34, O32, G24, G28, K29

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1 Introduction

Well-functioning financial markets and innovation infrastructures are crucial for economic growth. Hence the intellectual property environment of financial markets has become a central economic and political issue (cf., eg, Greenspan, 2004). Yet these environments differ between major financial centers: The Court of Appeals for the Federal Circuit's landmark decision in *State Street Bank & Trust Co. v. Signature Financial Group* in 1998 drastically changed the management of financial innovations in the U.S. financial services, enabling a large scale use of patents as an appropriability strategy (at least over the subsequent decade).¹ In contrast, Article 52 of the European Patent Convention (EPC) is typically interpreted as prohibiting patents on business and financial methods as such, restricting the European Patent Office (EPO) to grant patents only to technical inventions. However, while the European law, as it stands, makes obtaining a patent on a financial method more difficult than in the U.S., it is believed that patenting bar on business methods may have fallen in Europe in the aftermath of the State Street decision. As a result, it is not clear whether and to what extent the financial innovations are patentable in Europe in practice. Are there 'pure' financial method patents in Europe? What is the demanded technical contribution for a European financial method patent? Nor it is clear what, if any, repercussions the changes in the U.S. legal and corporate management practices have had in Europe.

We examine whether and how financial methods are patented in Europe by analyzing European patent applications and their technical character and contribution from system and method inventions related to financial exchanges, settlement and trading.² Of finance-related inventions, financial exchange systems and methods are a priori more likely to involve 'pure' business methods than say, payment technologies, making them a prominent case to study the patentability of financial methods.³ Securities exchange and settlement is also an area where European financial market integration is widely hoped to progress further to enable investors and companies to reap benefits from economies of scale, lower

¹ In a recent decision, *In re Bilski*, the Federal Circuit appears to have limited the possibility of obtaining business method patents in the U.S. It is too early to derive practical implications of this decision. However, if *In re Bilski* indeed considerably limits the patentability of financial methods, our paper, covering the data up to *In re Bilski*, provides a window to the unique experiment where the major jurisdictions used wildly different patentability criteria for financial exchange inventions.

² We focus on patent applications and outcomes at the EPO, abstracting for brevity from the national interpretations of law. Studying national case law in Europe concerning financial method patenting is clearly a challenging but an important topic for further research.

³ Obviously when financial-exchange related inventions in general are considered, they may also deal with 'hard' information and communications technologies and machines, but, as we argue in Section 3, this is less of an issue in our case.

transaction costs, and improved liquidity (see, eg, Schmiedel and Schöenberger, 2005). Such integration would deepen financial markets, improving allocation of savings and investments, and thereby foster economic growth (Levine and Zervos, 1998; Rousseau and Wachtel, 2000; and Guiso et al, 2004). Despite the recent advances, however, the integration of European financial exchange infrastructures has turned out to be a slow process. One problem has been that different national financial exchanges, clearing and settlement systems have been using different technologies and methods. In such an environment it is essential to know the type and ownership of intellectual property protection available to interfaces that allow interoperability between various parts of exchange infrastructure.⁴

We first characterize European patent applications from the new European Patent Classification's (ECLA) class G06Q 40/00B Exchange, which is a subclass of G06Q 40/00 concerning methods and systems adapted for finance. Our sample includes all applications that were filed before November 20th 2008, totalling 482 applications. We carefully go through all the applications and closely examine their fate in the examination process. We then complement the analysis by clinical case studies of selected applications. We find that financial exchange-related applications first increased significantly after the State Street decision, but decreased subsequently. The majority of applications came from the U.S. (65–75%, depending on the method of calculation), investment banks and exchanges themselves being among the most active inventors. But patents were not granted easily to these applications. Only a small share of the applications (3–11% depending on the method of calculation) had resulted in a patent by the end of our sample period and over 40% of applications were either rejected or withdrawn. The few granted patents were opposed vigorously (41% of the awarded patents encountered opposition) and successfully (55% of the oppositions led to the revocation of the patent), suggesting that competitors monitored each other's patents carefully. These figures are in a striking contrast with the EPO averages according to which slightly less than half of applications (42%) actually result in a patent, of which roughly 5% face opposition.⁵

Our analysis of technical characters and contributions of patent applications and the case studies show that most applications encounter preliminary rejection from the EPO on the grounds of containing non-patentable subject matter. But when challenged by applicants, it seemed easier for the EPO to use the lack of

⁴ For example, in information, communications and other network industries where patents are commonplace, the management of patents and other intellectual property rights plays a pivotal role in integration and standardization processes (see, eg Chiao, Lerner, and Tirole, 2007; and Hunt, Simojoki, and Takalo, 2009).

⁵ The EPO averages we refer to are calculated from the EPO's *Facts and Figures* publications for the years 1998–2007. Ignoring pending cases, granting a patent accounted for approximately half of the EPO's decisions in 2007 (EPO 2008). Upon some more careful calculations, Wagner (2008) and Hall, Thoma and Torrisi (2009) report even somewhat higher average granting rates (close to 65%).

inventive step as the decisive bar to patenting rather than the lack of a technical character or the subject matter exclusion. In line with the decision T641/00 ('Two Identities/Comvik') by the Boards of Appeal of the EPO, the determination of the inventive step was focused on the technical problem being solved so that much of the financial aspect of the claimed innovation could be set aside by the examiner. Applicants had difficulties in coming up with a technical problem, and in cases where such a problem was found, its solution was often too obvious to make an inventive step.

Our findings suggests that that the State Street decision created a period of uncertainty where the boundaries of the European patent system were tested by the U.S. firms with superior intellectual property management capabilities. In response, the EPO enforced a strict interpretation of patentability criteria of the EPC, and implemented procedural changes to facilitate the elimination of low quality applications. The high post-grant opposition rate should further have raised the patentability bar. In sum, contrary to what has been speculated, we find that the patentability standards for financial innovations have not weakened in Europe in the aftermath of State Street decision. More recently, uncertainty about the boundaries seems to have begun to resolve, indicated by a falling number of patent applications.

Our results have bearings to the current policy discussion both in Europe and the U.S. First, we show that law matters, albeit the link from the law on the books to the actual enforcement is complicated. In our sample period one should not have been able to get a patent on financial method invention without technical features in Europe but one should have been able to get one in the U.S. Our results suggest that broadly speaking that seems to have been the case in practice over the past decade. The results mean, for example, that if raising the patentability standards for business and financial methods is desirable in the U.S. (as a number of scholars such as Jaffe and Lerner, 2004; Bessen and Meurer, 2008; and Hunt, 2008, argue), emphasizing technical contribution with respect to prior art could be a more powerful tool to that end than subject-matter restrictions. Our results indicate that a similar effect could also arise from the introduction of a European-style opposition procedure in the U.S. patent system, supporting the view advanced, eg by Jaffe and Lerner (2004) and Hall and Harhoff (2004). In contrast, reassessing restrictions against finance patents in Europe might be necessary, if the current financial market crisis warrants greater transparency of new financial instruments. The contract or disclosure theory of patents maintains that patent protection inherently fosters information disclosure (see, eg, Denicolò and Franzoni, 2003). Hence, as pointed out by Duffy and Squires (2008), tightening transparency regulation in the financial service sector would make patent protection of financial innovations more attractive both from a private and a social point of view. Similarly, a wider patentability of financial innovations might be necessary in Europe if the supervision of financial markets were reformed towards

drug-industry type regulation emphasizing product-safety guarantees, as advocated, eg, by Stiglitz (2008).

Second, given the important role of traditional sources of financial exchange innovations in filing patent applications, and given the difficulty to obtain European patents for these innovations, the risk of patent hold up in the European financial exchange and settlement integration process should be limited (but not eliminated).

Third, in a world where innovation and finance are global, we show that a change in the patent law in one jurisdiction may result in unintended effects on other jurisdictions. The State Street decision triggered a surge of patent applications in the EPO, which had to choose whether to invest in defending the strict interpretation of the EPC or broadening the interpretation and allow the financial method patents to issue. The EPO also had to change its procedures to facilitate the elimination of low quality patent applications. We find evidence that one procedural change, the introduction of a ‘no-search’ strategy, may have contributed to reduction of the number of exchange-related patent applications.

Our paper belongs to the small but growing literature on financial method patenting. As pointed out by Tufano (2004) and Frame and White (2004), traditional appropriability strategies of financial innovations were based on secrecy, lead time and reputation, patenting not considered as an option. This changed drastically in the aftermath of the State Street decision as shown by the seminal paper by Lerner (2002). In a subsequent paper, Lerner (2008) shows that financial patents are litigated at a rate 27 times higher than patents in general. This is in line with our findings which suggest that a European financial patent is much more likely to face an opposition than an average European patent. Litigation and opposition intensity could suggest that a finance patent is more valuable than an average patent (Harhoff, Scherer, and Vopel, 2003; and Lerner, 2008). This interpretation is supported by Boscaljon, Filbeck and Smaby (2006) who find a positive stock market reaction when a finance-related business method patent issues. But even if the finance patents are valuable, they seem to fail to provide incentives to innovate in contrast to what would be predicted by the standard economic theory (Hunt, 2008).

The closest paper to ours is an independently and simultaneously written contribution by Hall et al (2009b) who also study financial patenting in Europe. While their study covers a broad range of financial patenting in Europe, there appear to be an emphasis on patenting of payment methods. They uncover the determinants of quality and value of European financial patents and compare characteristics of financial patents with other European patents. Our contribution complements that of Hall et al (2009b) since we exclusively focus on the patenting patterns of financial exchange innovations. Many of our findings, eg, those concerning time trends and home regions of financial patents, are similar to Hall et al (2009b), but there are some notable differences. For example, we find

that the most active patent applicants come from the financial service firms that are traditional sources of innovation in financial exchanges, whereas non-financial ICT and payment media firms dominate the list of top applicants in Hall et al (2009a).⁶

Our paper is naturally linked to the literature on business method patenting in Europe. In particular, Wagner (2008) studies business method patenting in Europe and shows, in contrast to our results, that business method innovations are fairly easily patented in Europe. However, Wagner (2008), like us, reports a very high opposition rate of granted patents (44%) in his case study of the franking device industry and he, too, finds that the majority of applications originate from the U.S. and that examination of business method patent applications takes usually longer than examination of an average application.

A limitation should be acknowledged at the outset. Since so little is known about the primitives of patenting of financial exchange-related innovations in Europe, we focus on uncovering descriptive facts about the patenting of financial-exchange related innovations in Europe, supported by clinical case studies. To this end, we have read the applications by ourselves, and in many occasions we have also gone through some other documents linked to patenting process. While we feel our approach provides an appropriate first pass on the issue, we hope that our work will stimulate more structural empirical research in future.⁷

The rest of the paper is organized as follows. In Section 2 we first review innovation and appropriability issues in financial exchange sector and then the different patentability standards of financial methods in the U.S. and in Europe. In Section 3 we describe the data and our definition of a financial patent (application). Section 4 presents the results. Section 5 summarizes the cases (with details being relegated to Appendix 4), and Section 6 concludes.

2 Institutional background

2.1 Innovation and intellectual property in financial exchanges

Financial exchanges are two-sided markets exhibiting strong network externalities which make the value of an exchange increasing in the market depth and liquidity. The more there are buyers and sellers of a security the better is price discovery and smaller is the bid-ask spread. In addition, in a deep market, large orders do

⁶ The table of the largest finance patent holders from Hall et al (2009a) no longer appears in the published article version of their study (Hall et al, 2009b).

⁷ But our results suggests a reliable and interesting structural econometric analysis will be challenging unless more patents are issued.

not create large price effects. As a result, trading of a security or a commodity is typically concentrated on a few exchanges. Not only trading but also clearing and settlement of trades exhibit network externalities (see, eg, Milne 2007). Centralized settlements economize collateral and intra-day liquidity requirements, and reduce counter-party risk. For these reasons, the European policy makers have been pushing for integration and consolidation of European financial exchange infrastructures. However, despite formation of alliances and mergers between exchange and settlement providers, obtaining a full integration has turned out to be elusive.⁸ One problem has been that different national financial exchanges, clearing, and settlement systems have been using different technologies and methods.

In any environment where different market participants and digitalized infrastructure parts must be able to communicate with each other, compatibility and interoperability of information and communications systems is crucial to maximize the benefits from network effects. Such interoperability is typically accomplished via standard setting, by market participants themselves, by policy makers or by both.

The relationship between standard-setting and intellectual property is complex. The goal of intellectual property is to give its owner a right to exclude others from using the innovation, whereas the goal of standardization is to stimulate the use of innovations adopted as a standard. In particular, a network can be vulnerable to opportunistic behavior by participants who own patents on a technology or a method essential to the standard. There is a risk that network participants could make large investments to implement a new technology or a method only to be held up by a firm threatening to withhold a key piece of innovation.⁹

Traditionally the hold-up risk in financial exchanges has been limited since the principal innovators and holders of intellectual property in the field have been exchanges themselves or active market participants such as investment banks (see, eg, Tufano, 2004; and Hunt, 2008). However, it is not clear whether this innovation pattern has continued after the *State Street* decision and whether the active innovators have also been patenting actively. It could be possible that financial firms and exchanges, in particular the European ones, are not patenting their innovations and hence exposed to the companies conditioned by a different culture of intellectual property. Such an intellectual property ownership environment could potentially seriously slow down the integration and

⁸ An indication of the economic benefits at stake is that mere formation of these alliances has improved liquidity and efficiency of the European equity markets (see Hasan and Schiedel 2004).

⁹ In a notorious example, the patent holding company Rambus participated in a semiconductor standard-setting organization while secretly patenting the same technology. After the standard was adopted, Rambus filed patent infringement lawsuits against other semiconductor manufacturers.

consolidation of European financial exchange infrastructures.¹⁰ This concern would be consistent with Lerner (2008) who shows that financial patents are litigated extensively but the plaintiffs typically are not the major financial service firms or exchanges.

2.2 Intellectual property protection of financial innovations in the US

One special feature of financial services is that, until recently, patents were only rarely used to protect financial innovations as such (Frame and White, 2004; and Tufano, 2004). This innovation management strategy overlooking patent protection was partly rooted in the common belief that financial methods are not patentable subject matter. This view was quite suddenly dismissed in the U.S. by the Federal Circuit's decision in *State Street Bank & Trust Co. v. Signature Financial Group* in 1998. The case originated from software used to fix closing prices of mutual funds for reporting purposes, on which Signature had obtained U.S. Patent No. 5193056 in 1993. State Street Bank sued in 1996 to have the patent invalidated on the grounds that it covered a financial method and that financial methods belong to the categories of subject matter that cannot be patented. This position was upheld by the district court. But the Federal Circuit decided that, under U.S. law as it stands, financial and other business methods should not be excluded from patenting.

In 1999, the Federal Circuit left no doubt on the interpretation of the State Street decision in the *AT&T Corp. v. Excel Communications* case involving U.S. Patent No. 5333184. The Federal Circuit concluded that the criteria of usefulness, concreteness and tangibility of the claimed invention is decisive for the patentability of inventions and not the technicality of the underlying invention. Therefore, any computer-based invention that performed business or financial operations should be patentable subject matter as long as it was novel, utile and non-obvious as defined in the Title 35 of the U.S. Code (35 U.S.C.).

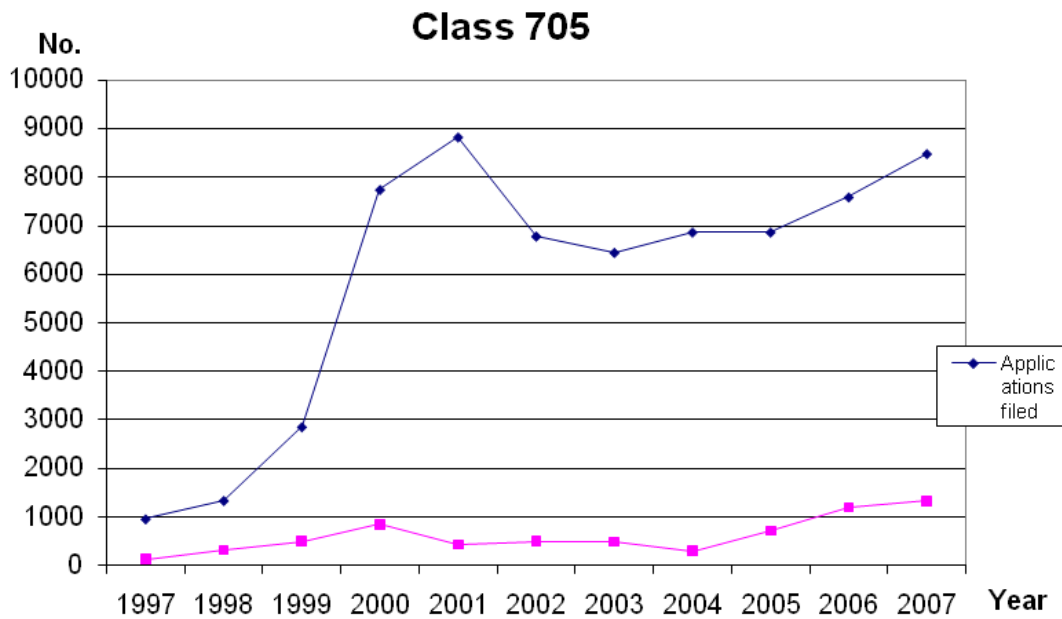
Besides expanding the subject matter, the Federal Circuit appears to have simultaneously weakened the non-obviousness requirement for patentability. While this should affect all types of technologies, it is conceivable that patenting of business and financial methods is particularly sensitive to the non-obviousness requirement, as suggested, eg, by Dreyfuss (2000), Lunney (2001) and Bessen and Meurer (2008).

Figure 1 shows the dramatic effect of the Federal Circuit's decisions on the number of business method patent applications in the U.S. As the figure shows,

¹⁰ Hunt et al (2009) argue that similar intellectual property concerns could hamper the Single Euro Payment Area project that aims at integrating European retail payment market.

the effect on the granted patents shows up only over the couple of recent years, which is understandable given the lag between the filing in an application and the granting of a patent.

Figure 1. **Business method patent applications and patents in the U.S.**



Source: U.S. Patent and Trademark Office (USPTO)

Many academics and commentators promptly raised the concern that the flood of applications and the lack of experience at the USPTO on how to examine business method patent applications would result in questionable patents and that could hamper the smooth operation of the U.S. financial markets (for the early debate of the impact of State Street on financial services, see, eg, Hunt, 2001; and Stanford, 2003). The U.S. legislators and the USPTO tried to counteract these concerns: the American Inventors Protection Act of 1999 introduced limited prior-user rights in the U.S. patent law, protecting infringers of business method patents from legal charges if they used the patented method commercially in the U.S. before the filing date of the patent application. The Act also expanded the reexamination procedure to accommodate outside parties. In 2000, the USPTO reformed the examination of the business method patents by introducing the Second Pair of Eyes Review (SPER). Among other features, the SPER program calls for a second-level review upon allowance for patent applications with a main class 705. The SPER lengthened the examination duration and may have resulted in slower acceptance rate of business method patent applications (Hunt, 2008). It may also

have encouraged strategic drafting of business method patent applications to other classes than to 705 (Allison and Hunter, 2006).

There has also been some uncertainty about the boundaries of patentable subject matter in financial services since the State Street and AT&T decisions. Despite these decisions, the USPTO attempted to implement a ‘technological arts’ test to assert that business method innovations should have a technological dimension to render them patentable. But the possibility to use of such a test was firmly ruled out by the USPTO Board of Appeals and Interferences’ decision *ex parte Lundgren* in 2005. However, in the recent *In re Bilski* decision the Federal Circuit emphasizes that the ‘machine-or-transformation’ test, derived from the U.S. Supreme Court decisions in *Gottschalk v. Benson* and *Diamond v. Diehr* in 1972 and 1981, is the applicable test for the patentability of business methods. While it is too early to draw practical conclusions of this decision, it appears to significantly tighten restrictions against business method patents without barring them categorically.

2.3 Intellectual property protection of financial innovations in Europe

The law on the books concerning the general patentability criteria of novelty, inventive step and industrial applicability is similar between the U.S. and Europe.¹¹ However, the legal environment of intellectual property management in financial services in the U.S. (and in some other jurisdictions such as Australia and Japan) stands, at least in our sample period, in contrast with Europe where financial formulas and methods are thought to be beyond the scope of patentable subject matter. Indeed, Article 52(2) of the EPC explicitly defines that ‘schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers shall not be regarded as patentable inventions.’

However, while the European law makes obtaining a patent on a financial method more difficult than in the U.S., it is hardly impossible. According to Article 52(3) of the EPC the provisions of Article 52(2) only exclude inventions from patentability ‘to the extent to which a European patent application or European patent relates to such subject-matter or activities as such.’ There is no legal definition of what the ‘as such’ formulation means. As the study by Wagner (2008) shows, business methods can be and are patented in Europe. The EPO and national patent offices can legally award patents on financial and other business

¹¹ Article 52(1) of the EPC outlines the general patentability criteria: ‘European patents shall be granted for any inventions which are susceptible of industrial application, which are new and which involve an inventive step.’ Instead of requiring industrial applicability and an inventive step, 35 U.S.C. § 101 and 103 warrant that patentable inventions must be ‘useful’ and ‘non-obvious’ improvements over the prior art. Cf. footnote 14.

methods if these methods make a technical contribution, ie, they add something new to a technical field. For example, an apparatus for carrying out a financial method is not excluded from patentability. Similarly, a financial method is not excluded from patentability if the invention is not merely an abstract method but relates to technical means, such as computer networks, to carry out the method, and the invention solves a technical problem in a non-obvious way.

Skillful patent lawyers could also draft patent applications on ‘softer’ financial and business methods to emphasize their technical character and contribution. Sometimes a patent applicant adds a technical feature to a ‘softer’ financial method to render it patentable.¹² In this respect writing applications for business methods patents in Europe today might remind the way that software patents were drafted during the 1980s and early 1990s in the U.S. (see, eg, Hunt 2001, for the evolution of the patentability of software in the U.S.).

The European Commission has attempted to clarify the complex situation. For example, in a controversial draft for a directive on the patentability of computer-implemented inventions the Commission (2002) proposed to harmonize national patent laws and practices concerning the patentability of software and business methods. While the software aspect of the proposed directive was highly controversial, it should be noted that the proposal also sought to clarify business method patenting in Europe, by unambiguously excluding business methods from patentable subject matter.¹³ Since the directive was ultimately rejected by the European Parliament on July 6, 2005, the law in this area continues to be open to interpretation.

While in the absence of an EU directive, the interpretation of law is generally a responsibility of national courts, there are situations, eg, when a European patent application is refused or when a European patent is revoked in opposition proceedings, in which the EPO has the final say regarding the interpretation of the EPC (see Appendix 1 for a description of the patenting process at the EPO). The Boards of Appeal of the EPO, which examines appeals of the EPO decisions, has ruled that the ‘as such’ criterion cannot be decisive for the distinction between patentable and non-patentable business methods (see, eg, Wagner, 2008). Instead,

¹² A famous example is Amazon’s ‘one-click’ shopping method patent, which was granted in the U.S. in 1999 (U.S. Patent No. 5960511). As it turned out, in Europe the invention was not patentable, but a one-click shopping method with a gift option was patentable (European Patent No. 927945).

¹³ *Ex lege*, the ambiguity concerning the patentability of software in Europe is close to the business method situation, many business method innovations essentially consisting of software applications. In practice, however, it is clearer that the barriers to patenting created by Article 52 of the EPC have been shaking in the case of software. For example, the European Commission (2002) states that ‘since the EPC came into force in 1978, at least 30,000 patents for computer-implemented inventions have already been issued [by the EPO]’. Opponents of the proposed directive claimed that it was disguised attempt to eliminate the remaining restrictions against software patents. See Beresford (2000) for a full treatment of the patentability of software-related inventions in Europe.

the case law of the Boards of Appeal emphasizes the technical character or technical contribution of an underlying invention or a method determining its patentability.¹⁴ However, repeated difficulties in using a ‘technical character’ or ‘technical contribution’ test to assess the patentability of software suggest that the word ‘technical’ is inherently vague and does not pin down an unambiguous patentability criteria for business methods.¹⁵ In practice, as confirmed by our study, a key criterion determining patentability has been Article 56 of the EPC which establishes an inventive step requirement for a patentable invention. But, as mentioned, here the law on the books concerning the corresponding non-obviousness requirement of the U.S. is very similar to Europe.¹⁶

It is thus not clear which financial innovations can be protected by patents within the European patent system. As we show in Section 4, not only the USPTO but also the EPO encountered a dramatic increase of patent applications for financial innovations after the State Street decision. The EPO felt that its employees were increasingly spending time and resources on examination of patent applications that were unlikely to issue as a European patent. As a result, the EPO began, around 2000, to issue ‘no search’ and ‘partial search’ declarations as a communication under Rule 45 of the EPC. In essence, ‘no search’ declaration is a fast-track rejection of a patent application on the grounds that it will most likely never finish in a European patent. A partial search may be limited to the technical aspects of an application. By starting extensively to use the incomplete search strategies, the EPO wanted to send a strong and clear signal to applicants and the public that Europe is different from the U.S. patent environment.¹⁷ However, also shown by our study, the applicant may still after a ‘no search’ declaration amend the claims of her application and persuade the EPO to perform a substantive search and examination.

The effectiveness of the EPO’s ‘no search’ policy could further be diluted by the international cooperative agreements such as the Patent Cooperation Treaty

¹⁴ See EPO (2006) and, eg, decisions T769/92 (‘General-Purpose Management System/Sohei’), T931/95, (‘Pension Benefits System Partnership’), T1173/97 (‘Computer Program Product/IBM’), T641/00 (‘Two Identities/Comvik’), and T258/03 (‘Auction Method/Hitachi’). It is not clear whether the case law of the Boards of Appeal has remained consistent in this issue. In particular, the emphasis seems to have shifted from the use of a technical character in assessing patentable subject matter to the use of technical contribution in assessing the involvement of an inventive step.

¹⁵ The difficulties in the use of ‘technical contribution’ test consistently in practice prompted the EPO president, Alison Brimelow, to ask for a clarification of how to assess the patentability of computer programs from the Enlarged Board of Appeal of the EPO on October 22, 2008 (G3/08).

¹⁶ Article 56 EPC defines the required inventive step as follows: ‘An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art.’, whereas 35 U.S.C § 103(a) reads as ‘A patent may not be obtained...if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’

¹⁷ Partial search is arguably a less transparent signal and it is more difficult to implement in practice, because it is not often easy to extract technical features from claims or generic features.

(PCT) which have been formed to facilitate patenting internationally (see Appendix 2 for an illustration of international patenting process). Once an application is filed in a chosen priority country, the applicant can file an international (PCT) application within a year from the priority date. There is only a limited number of patent authorities, called International Searching Authorities (ISAs), who are authorized to conduct search (and preliminary examinations) of international applications, resulting in an International Search Report (ISR) with a statement of patentability.¹⁸ After obtaining an ISR, the applicant can pursue the application process separately in the desired countries. In other words, an international application in itself does not lead to a ‘world-wide’ patent; rather the idea of the PCT is that national patent offices could use the PCT search results when granting a patent, enabling the applicant to obtain the assessment of patentability of her invention with a single procedure.

Problems arise when patentability criteria differ across jurisdictions. Moreover, under Article 17 (2)(a)(i) and Rule 39 of the PCT, an ISA can decide whether to exclude some controversial subject matters such as business methods from international search (or from international preliminary examination), and the EPO used these rules to extend its ‘no search’ policy to international applications. The EPO subsequently went even further by categorically refusing to carry out a thorough international search (and examination) of business method applications originating from the U.S. after March 1, 2002. But since the USPTO is an ISA, too, it can conduct international searches and examinations in the cases which would be disregarded by the EPO.

3 Data

The definition of a financial method patent is not always straightforward. Many such as Lerner (2002) and Hunt (2008) equate financial method patents with relevant subgroups of business method patents of Class 705 (Data Processing: Financial, Business Practice, Management or Cost/Price Determination) of U.S. Patent Classification System. Such a broad definition is bound to lead to Type I error, ie, capture not only financial method patents but also business method and software patents not related to finance (see, eg, Duffy and Squires, 2008). Moreover, if financial innovation is defined broadly, it encompasses innovations

¹⁸ There are currently 13 ISAs. After receiving an ISR, the applicant has an option (but not an obligation) to request an international preliminary examination from an authorized International Preliminary Examination Authority (IPEA). All ISAs are also IPEAs but for a given application, the ISA and the IPEA may be different. In particular, when demanding an international preliminary examination the applicant has an opportunity to amend claims and argue the relevancy of the ISA’s statements. For brevity of presentation, we do not distinguish between ISAs and IPEAs and their statements in Section 4 unless otherwise indicated.

that clearly have a technical character such as a new payment media. Such innovations have always been patentable also in Europe. A narrower definition would, eg, complement the subgroup by involving use keyword search. This strategy is for example followed by Hall et al (2009b). Reading carefully patent documents and hand-picking financial method patents as eg in Duffy and Squires (2008) would further narrow the definition.

While the narrow definitions certainly minimize Type I error they are vulnerable to Type II error. Since we are interested in the question of whether the financial methods are patentable in Europe and whether the non-financial firms are among the active patent applicants, we bias our results towards affirmative answers and use overly broad definition based on the patent classification system. We can nonetheless take the advantage of the recently reformed European Patent Classification (ECLA) scheme, which is better geared toward financial innovations. We have also carefully investigated the patent documents to eliminate obvious misclassifications.

More specifically, we use from ECLA's new business method class G06Q subclass G06Q 40/00, which is devoted to finance, eg, banking, investment or tax processing methods and systems. From this specific finance class we pick subclass G06Q 40/00B, which contains patent applications of systems and methods adapted for financial exchanges, eg, stocks, commodities, derivatives, and foreign exchange (see Appendix 3 for the hierarchy and detailed description of class G06Q). Besides the economic relevance of our choice (see Section 2.1), such exchange systems and methods have a less obvious technical character and might include more financial methods as such. The key reason we may encounter Type I error is that financial-exchange related inventions generally may also concern with 'hard' information and communications technologies and machines, but these are not necessarily classified in G06Q 40/00B. This focus also differs from Hall et al (2009b) who appear to emphasize payment media innovations.

Our data was retrieved from esp@cenet database using G06Q 40/00B as an ECLA class and EP as a publication number, resulting 482 European patent applications on November 20th, 2008. We investigated all the applications one by one, and also studied the relevant documents linked to the esp@cenet from epoline database, which contains an extensive set of documents related to patent application process in Europe. For all applications we studied search reports, reports on patentability, and possible oppositions or appeals. In some cases we also studied other epoline documents and the corresponding U.S. patent documents from the USPTO web pages, as well as augmented information on applicants from the applicants' homepages.

Three applications were removed from the dataset after the investigation, because they were clearly misclassified.¹⁹ The final sample hence consist of 479 applications, for which we gathered data on applicant, priority year and country, application status, other classifications than G06Q 40/00B, possible PCT authority, the statement of patentability, oppositions, and appeals. Six applications, summarized in Section 5 and described in detail in Appendix 4, were chosen for a closer scrutiny.

4 Results

4.1 Characteristics

4.1.1 Priority years

In Figure 2 we present the priority year of applications. This is the year when the first application in a patent family was filed, and it marks the year when the protection time to the patented invention begins if the patent is granted. If there are several priority applications, the first priority date has been chosen, taking into account the U.S. provisional applications.²⁰

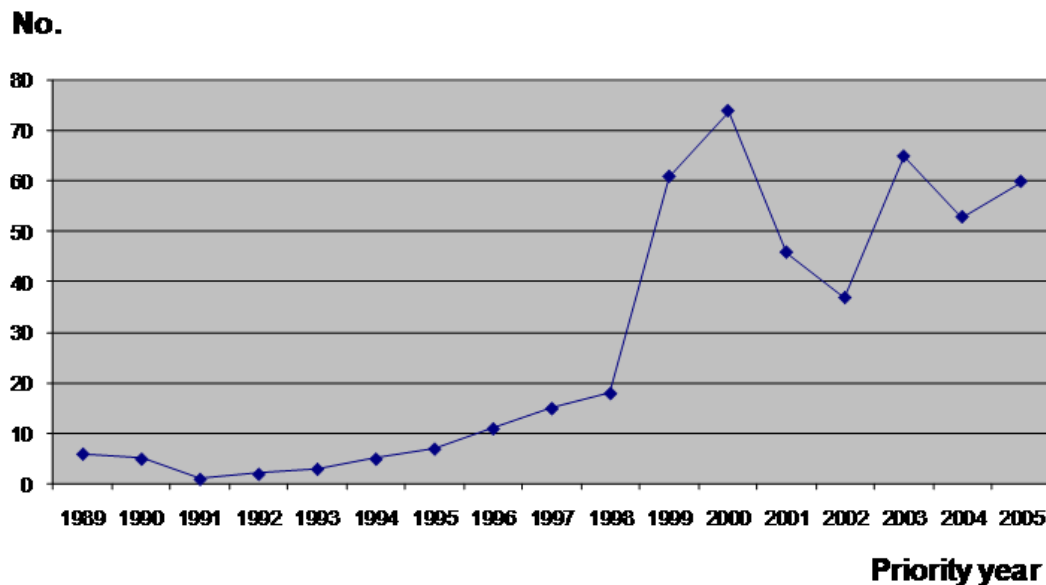
As Figure 2 shows, the first priorities date back to the end of the 1980s, and their amount was under 20 applications annually during the first ten years. After the *State Street* decision in 1998, the volume of exchange-related applications at the EPO first increased dramatically. However, the volume of applications has decreased over the recent years. The decline in applications appears to take place after the EPO introduced its ‘no search’ policy but is also consistent with the drop in the Class 705 applications in the U.S. (see Figure 1). The time trend of European financial patent applications uncovered by Hall et al (2009b) is fairly similar.

¹⁹ All of the three clearly misclassified applications had also led to a patent, which is problematic given the low number of issued patents in our data. While we tried carefully read all applications to inspect misclassifications, it is clearly conceivable that exceptional cases such as those that had resulted in a patent attracted more careful scrutiny than the bulk of the applications that were pending. We have hence reported some key figures including the misclassified patents.

²⁰ In the U.S. patent system a corresponding, but not necessary an identical, non-provisional application must be filed within 12 months after the provisional application filing date.

Figure 2.

G06Q 40/00B EP-applications by priority year



4.1.2 Geographical origins

We investigate the geographical origins of applications by two means. First, we use priority country information, which tells the country or the authority where an application was first filed. Typically applicants begin the process of patenting from their home countries so the priority country can also be used as a proxy for the home region of an application. But the proxy is imperfect, especially in our case. For example, the U.S. with its large financial markets and a favourable regime towards finance patents might constitute a sensible first choice for non-U.S. applicants, too. Moreover, some innovators may proceed to European or international patenting directly and claim priority rights in a European or in an international (PCT) patent application.

Second, we have read the patent documents to uncover the applicants' home countries. While this method does reveal the country where an application is coming from, some multinational companies may file applications from different countries (say, tax havens) than where their activities creating underlying intellectual property are taking place.

We report the division of priority between countries and authorities in the first column of Table 1a, which is then pooled into four main regions (U.S., Europe, Japan and the rest of the world (ROW)) in the second column. Not surprisingly, the largest amount of priority applications came from the U.S., but the gap between it and other countries is huge. The EPO and Japan are also relatively popular origins of priority applications. Recall that financial methods are patentable also in Japan, which is with the U.S. only country outside Europe

among the most popular priority countries. Of the European countries appearing in this priority data, U.K., Germany and France are not only the largest countries in Europe in terms of GDP but also in terms of market capitalization and trading volumes of their financial exchanges. Sweden in turn is the home country of OMX, a pan-Nordic exchange, which is known for its advanced technology among industry practitioners.

Table 1a. **G06Q 40/00B EP-applications by priority country or authority²¹**

Priority country			
US	358	US	358
EP	24	Europe	77
Japan	24	Japan	24
UK	17	ROW	20
Germany	12		
WO	9		
France	8		
Sweden	6		
ROW	21		

In Table 1b we give an overview of the applicants' home regions. While this confirms the basic message of Table 1a, it suggests less applications originating from the U.S. and, correspondingly, more from Europe than what is implied by the priority country information. It seems that priority country numbers overestimate the importance of the U.S. whereas the numbers based on the applicants' country of origin underestimate it. Not surprisingly, the comparison of Tables 1a and 1b also suggests that priority country information underestimates the importance of relatively small open economies (eg, Sweden and Switzerland), whose applicants are prone to find international procedures or larger regions more appealing points of departure for patenting than their home countries.

²¹ In the cases of multiple priorities we use the country or the authority of the first priority application. EP and WO indicate that priority rights were claimed directly in an European or in an international (PCT) patent application, respectively. Category 'Europe' includes Norway and Switzerland besides EP applications and the EU countries.

Table 1b.

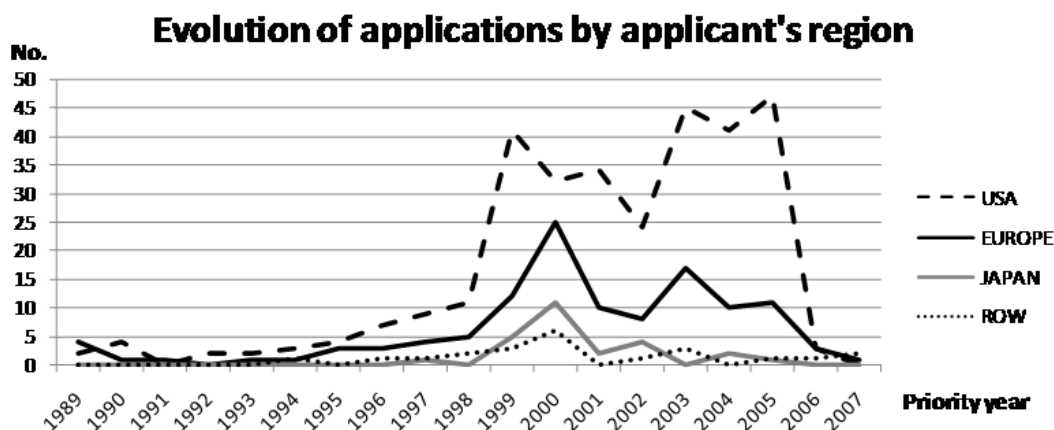
G06Q 40/00B EP-applications by applicants' country of origin²²

Applicant's country of origin			
US	311	US	311
UK	45	Europe	120
Germany	30	Japan	26
Japan	26	ROW	22
Sweden	16		
France	11		
Switzerland	6		
ROW	34		

Figure 3 shows that the share of the U.S. applicants is increasing over time: the U.S. applicants accounted for 60% of applications before 1998 but their share between 1998–2005 rose to over 66%. While Hall et al (2009b) also find the U.S. as the most important home country of European finance patent applicants (the share of the U.S. applicants is 49% in their sample), they report the relative importance of the U.S. declining over time. One potential reason for the difference is, as Hall et al (2009b) hint, that the dotcom bust in the U.S. probably had a smaller impact on the innovative activity in the financial exchange sector than in the sectors focused by Hall et al (2009b). Similarly, Wagner (2008) also documents that the majority (56%) of European business method patent applications originates from the U.S.

Figure 3.

Time evolution of G06Q 40/00B EP-applications by applicants' regions and priority year



²² In the case of multiple countries of origin we use the one which corresponds with the priority country. Category 'Europe' includes Norway and Switzerland besides the EU countries.

4.1.3 Applicants

The most active innovators according to patent filing statistics are presented in Table 2. Cantor Fitzgerald, a leading financial service provider in the equity and fixed income capital markets, with its NASDAQ-listed trading technology subsidiary, eSpeed, and with its patent holding company, CFPH, is clearly the most active patent applicant. Like eSpeed, Trading Technologies International, and EBS Group are financial software and technology vendors. Reuters is also a well-known provider of financial information and software. Some financial exchanges and their subsidiaries such as Chicago Mercantile Exchange, Deutsche Börse, NASDAQ and OMX also file patents frequently.²³ Goldman Sachs (like Cantor) in turn represents investment bankers in Table 2. FX Alliance provides foreign exchange and treasury products. Seven of the eleven most active companies were U.S. based, the rest four were from Europe.

It thus seems that the traditional sources of financial exchange innovations are also currently actively seeking patent protection to their innovations. The list of top applicants also differs from the one in Hall et al (2009a) where payment media and non-financial ICT firms dominate, but this is probably due to the different emphases of the studies. However, taking a closer look at Table 2 reveals that only Cantor and Trading Technologies International had over 20 applications in this dataset. Deutsche Börse and FX Alliance LLC managed to be in the top eleven list only with six applications. The diversity of applicants was large, other applicants than previously mentioned, including dozens of industry outsiders, totalled 315 applications.

Table 2. **The most filed applicants of G06Q 40/00B EP-applications**

1. eSpeed, Inc. (US)	50
2. Trading Technologies International, Inc. (US)	24
3. EBS Group, Ltd (GB)	19
4. Chicago Mercantile Exchange, Inc. (US)	15
5. Reuters, Ltd (CH), (GB)	12
6. Goldman Sachs & Co. (US)	9
7. OMX Technology AB (SE)	9
8. The NASDAQ Stock Market, Inc. (US)	9
9. CFPH LLC (US)	8
10. Deutsche Börse AG (DE)	6
11. FX Alliance LLC (US)	6
Others	315

²³ NASDAQ and OMX merged in 2007.

4.1.4 International applications

Since the most patent applications to the EPO seem to originate from the U.S. (Tables 1–2, and Figure 3), it makes sense to look at international (PCT) patent applications within our data. As explained briefly in Section 2.3, a major goal of the PCT system is to allow an applicant aiming at patenting in multiple patent offices to secure her rights for all desired countries with a single application and procedure (cf. Appendix 2). But the system becomes complicated and exposed to strategic behavior when patentability criteria substantially differ across jurisdictions. *A priori*, one could envision that a U.S. based innovator seeking patent protection for a financial method in Europe would choose as the USPTO as an ISA, since this is more likely to result in a favorable opinion of patentability. Alternatively, one could think that by choosing the EPO as an ISA would allow the innovator to learn the EPO’s patentability criteria and subsequently to modify the application to raise the probability of obtaining a European patent eventually.²⁴

In our dataset, 72% of applications had also a PCT application. As shown in Table 3 the most popular ISA is the USPTO, where 66% of the PCT applications (48% of all applications) obtained an ISR. Only three applications have other priority than the U.S. among the PCT applications where the USPTO acted as an ISA. Nevertheless, 64 applications with the EPO as the ISA had a U.S. priority application. Swedish, Japanese, and Australian patent offices also received multiple international filings (recall that besides the U.S., Australia and Japan have relatively lenient approach towards patenting of financial methods).

Table 3. **G06Q 40/00B EP-applications with a PCT application divided by ISA²⁵**

ISA	No.	% of all applications
USPTO	229	48%
EPO	92	19%
PRV (Sweden)	9	2%
JPO	9	2%
IP Australia	5	1%
Rospatent (Russia)	1	0%
TOTAL	346	72%

²⁴ When filing an international patent application, a U.S. based innovator can choose whether international search (and preliminary examination) is carried out by the USPTO, the EPO or the Korean Intellectual Property Office.

²⁵ Table 3 is based on the ISA of the PCT applications. In most (but not in all) of the cases where an applicant also requested an international preliminary examination, the ISA is also the IPEA.

4.2 Outcomes

4.2.1 Application outcomes

The status of exchange-related European patent applications by applicants' home region is presented in Table 4. The last column shows that the majority of the applications (55%) were still pending, which is not surprising given the lengthy examination process.²⁶ A high percentage (42%) of applications were rejected; they were either deemed to be withdrawn (30%), withdrawn (7%), refused (4%) or revoked in opposition (1%).²⁷ Only 3% of applications had resulted in an undisputed patent. The average examination duration of granted patents was 5.2 years, which is considerably longer than the usual examination duration at the EPO.²⁸ Although the number of granted patents in our sample is too low for definite conclusions, the examination time we report is in accordance with Wagner (2008) and Hall et al (2009b), but our granting rate is much lower.²⁹

Table 4 also indicates that applications from the U.S. have smaller prospects to survive to the later stages of the examination process than applications originating from Europe. To formally assess the difference between the U.S. and European applicants, we compute Pearson's χ^2 -test, which obtains a value of 15.59 (d.f. 3). This allows us to firmly reject the null hypothesis at 1% significance level.³⁰

Table 4. **The status of G06Q 40/00B EP-applications by applicants' home region**

	Applicant's region of origin								Total	
	USA		Europe		Japan		ROW			
Status	No.	%	No.	%	No.	%	No.	%	No.	%
Pending	185	59,5%	56	46,7%	10	38,5%	11	50,0%	262	54,7%
Withdrawal	110	35,4%	45	37,5%	12	46,2%	10	45,5%	177	37,0%
Refused or revoked	8	2,6%	12	10,0%	3	11,5%	1	4,5%	24	5,0%
Granted	8	2,6%	7	5,8%	1	3,8%	0	0,0%	16	3,3%
Total	311	100%	120	100%	26	100%	22	100%	479	100%

²⁶ The EPO had reached no decision in 255 (53%) of applications and in eight cases (making some 1% of applications) an appeal or an opposition process concerning an EPO's decision was pending.

²⁷ An applicant must promptly answer the EPO communications. If the applicant fails to respond by the dead line, the application is deemed to be withdrawn. In Table 4, category 'withdrawal' includes both withdrawn and deemed to be withdrawn applications.

²⁸ For example, EPO (2008) reports a 44 month average examination duration for granted patents.

²⁹ From 25 patents (constituting 5% of the applications) that were initially granted, three are clearly misclassified as explained in Section 3, four were indisputably revoked, and two were in pending opposition and appeal processes. The highest granting rate we can report is 11% which is calculated by using all 25 initial grants and excluding applications without any decision. The granting rates reported by Wagner (2008) and Hall et al (2009) are 68% and 34%, respectively.

³⁰ The conclusion is unchanged (at least at 5% significance level) when we make robustness checks, eg exclude pending applications or include the misclassified patents.

4.2.2 Examination outcomes

The results of the examination are presented in Table 5. A majority of the applications received a preliminary rejection from the outset: The EPO or another ISA found that the invention described by an application did not belong to patentable subject matter in 55% of cases.³¹ We find that 195 applications encountered a more thorough search treatment. Nonetheless, most of these applications with a more substantial search report were judged to lack novelty or an inventive step.³² Only 21% of substantial searches found the invention novel and inventive, providing a necessary condition for the granting of a patent. This is quite remarkable since, as described in Section 4.1.4, many applications only have an ISR from the USPTO (or from another ISA with a softer approach to financial method patents). Such searches may not be accepted by the EPO and hence the search outcomes can experience changes during the EPO examination procedure.

Tables 4 and 5 indicate that it is hard to obtain patent protection over an exchange related financial invention in Europe. The results suggest that the major reasons for the failure of obtaining patent protection arise not only from the subject matter exclusions but also from the novelty and inventive step criteria.

Table 5. **The statement of G06Q 40/00B EP-applications**

Statement	No.	%
not a patentable subject matter	265	55%
ISR or EPO SR X (no novelty or inventive step)	110	23%
ISR or EPO SR Y (no inventive step)	44	9%
ISR or EPO SR A (novel and inventive step)	25	5%
patentable	16	3%
report not made or published	19	4%

³¹ More precisely, the EPO (or another ISA) refused to search the application thoroughly on the grounds that the invention is not patentable under Article 52(2) and 52(3) of the EPC (under Article 17(2)(a)(i) and Rule 39 of the PCT).

³² A prior art publication marked with 'X' in a search report means that all or most features of a claimed invention under examination were found from the publication (ie, the claimed invention is not new) and the remaining features were obvious to a person skilled in the technology area of the invention (ie, the claimed invention involves no inventive step). Mark 'Y' in turn indicates that the publication has features that combined with other Y-type publication(s) cover the (non-obvious) features of a claimed invention under examination. Since X-type publications constitute a stronger bar to patentability, the search reports containing both X and Y publications are subsumed in the X-category of Table 5.

4.2.3 Oppositions and appeals

Table 6 shows that the applications in our sample received nine post-grant oppositions and thirteen appeals. Four applications had both an opposition and an appeal. Benchmarking opposition rates with granted patents reveals that 41% of the granted patents in our sample encounter opposition.³³ Again, while one should keep in mind that our numbers are very small, this is a much higher percentage than the EPO average (5%). Although Wagner (2008) and Hall et al (2009b) also report higher-than-average opposition rates (16% and 9%, respectively), they remain lower than in our case. However, Wagner (2008) reports even slightly higher opposition rate (44%) in his case study of business method patenting in the franking device industry.

One opposition was rejected, two were withdrawn and one was pending. Five of the nine oppositions (55%) ended up with a revocation of the patent, either because of lack of inventiveness or novelty or both. Four of the five patent invalidations were appealed (two of these appeals were unsuccessful and two still pending). The rest of the 13 appeals contested the refusals of applications or other unfavourable search and examination results.

Table 6. **Oppositions and appeals of G06Q 40/00B EP-applications³⁴**

Oppositions		Appeals	
pending	1	pending	7
rejected	1	rejected	5
withdrawal	2	withdrawal	1
patent revoked	5		

4.3 Robustness: secondary classifications

To check the robustness of our findings we consider potential secondary classification within the ECLA and potential U.S patent classifications. An application can belong to several ECLA classes, if it includes features going beyond the main class of the invention. If the secondary classifications would not be related to financial services or business methods generally, this would cast a doubt to our interpretations. But as Table 7 shows, only 95 or 20% of applications

³³ The opposition rate drops to 36% if we include the three misclassified grants that were not opposed.

³⁴ In Table 6, category ‘rejected’ includes inadmissible and dismissed oppositions and appeals. In the case of appeals it includes the two cases in which the decision to revoke the patent made in the opposition procedure was maintained.

had another ECLA class besides G06Q 40/00B and most popular secondary classes were clearly related to finance.

Table 7. **Secondary ECLA classes of G06Q 40/00B EP-applications**

ECLA class	No.
G06Q30/00C4 Data processing for auctions, matching or brokerage	27
G06Q40/00C Investment	26
H04L12/18B Data swithing networks for stock exchange	7
Total	95

Class G06Q 40/00C is another subclass of finance (G06Q 40/00), and even G06Q 30/00C4 belongs to the general class of business methods (G06Q) (see Appendix 3). The third most popular class is a subclass of H04L (Data transmission) but this subclass deals with data transmission for stock exchanges.

Only 35 (7%) of applications have a secondary class within the ‘technical’ classes (including the aforementioned H04L12/18B). This indicates that according to the patent classification used by the EPO, at most 7% of applications are considered to have technical features in addition of financial or business method features.

Since the U.S. is the overwhelmingly most important priority country in our data, it also makes sense to consider the U.S. patent classes of the dataset applications. We found a U.S. patent class for 340 applications (71%), ie, they either have a corresponding U.S. application (or the USPTO as an ISA). Of these U.S. classified applications, 296 (87%) were in class 705, indicating that many of them are dealing with business methods according to the U.S. classification, too.

5 Summary of the cases

In this section we present the conclusions from the case study of six applications, which are described in detail according to their priority dates in Appendix 4. The six cases, summarized in Table 8, are not representative of the sample; rather they consist of successful applications or applications with oppositions or appeals. Studying such applications that endure the whole application process should shed light on the EPO’s criteria regarding patentability of financial innovations, and the intellectual property management strategies used by applicants (see the illustration of the patenting process at the EPO in Appendix 1.) Accordingly the cases focus on the patentability on the independent claims of a patent application, and

strategic interaction among the patent applicant, the EPO and the applicant's competitors.³⁵

The cases support the results found in Section 4. The applicants seek to test the boundaries of the EPC. In various communications with the applicants, the EPO emphasizes that a European patent should contain technical features which solve a technical problem and which as such involve an inventive step. In their response, the applicants modify the claims of their application and use supporting argumentation to convince the EPO that their inventions have a technical character, which is novel and inventive. The cases hence provide support for the notion that European patent applications on financial and business methods are drafted so as to emphasize their technical character and contribution, which reminds the way that software patents were drafted during the 1980s and early 1990s in the U.S.

There is also an indication that the European patenting process changes over time. The issue of patentable subject matter becomes to the fore only after the *State Street* decision had increased the awareness of the scope for patenting financial methods. In the subject matter debate between the applicants and the EPO the case law of the Boards of Appeal of the EPO becomes one of the key guidelines to determine whether and how the invention described by an application has a technical character and a technical contribution. In particular, it seems that following the Boards of Appeal's decision T641/00 ('Two Identities/Comvik') the non-technical aspects are set aside at the EPO when assessing whether the invention passes the inventive step requirement. But as our examples show, the consistency of the case law over time is in doubt.

In the three latest cases (see A4.4–A4.6) the EPO first argues that the applications are not patentable because they involve business methods as such but the applicant always managed to convince the EPO that their inventions have a technical character. In all cases (A4.3–A4.5) in which the patent was ultimately denied, the decisive reason was the absence of an inventive step. It seems that it is easier for the EPO to use the lack of inventive step as a bar to patenting rather than the lack of a technical character or the subject matter exclusion: Persistent applicants are able to draft and modify the claims to look technical so that at least some technical features can be found even if the technical problem to be solved may be questionable.

Even in the two earliest and relatively smooth cases (A4.1–A4.2) where a patent was granted without opposition, bars to novelty or inventive step were

³⁵ Independent claims of a patent application define the scope of the protection of the invention. An application can contain several independent claims, eg, apparatus and method claims. However, the first independent claim usually defines the essential features of the invention, the other independent claims being in consistency with the first one. An independent claim is typically followed by one or several dependent claims, which refine the features of the invention suggested by the independent claim.

found in the search stage. The applicant managed to overcome these objections by revising the claims, but the revisions rendered the independent claims more precise, creating more clearly defined but probably narrower property rights over the invention.

Five of the six European applications (see cases A4.1–A4.2 and A4.4–A4.6) have at least one corresponding U.S. patent. In four cases (A4.1–A4.2, and A4.5–A4.6) also continuing applications were successfully filed. The cases suggest that a key difference between the USPTO and the EPO is in inventive step requirements rather than subject matter exclusions. The cases also indicate that the U.S. patent system allows for continuing the original patent applications, the European system has a disclosure requirement rooted in an application as originally filed, which at least to some extent restricts the scope for extending the application over the course of the patenting process.

Table 8.

Summary of the cases

Application	Key technical features (according to the applicant)	Outcome; the main reason for a refusal	U.S. equivalents
EP0776505: 'Negotiated Matching System and Method'	<ul style="list-style-type: none"> The matching station uses information from users to match potential counterparties to a transaction. 	Patent granted.	Patents No. 5924082 and No. 7505915, a continuing application pending.
EP0847561: 'Anonymous Trading System with Improved Quote Input Capabilities'	<ul style="list-style-type: none"> The system determines if a quote is about to be accepted by a substantial number of trading partners, and if so, notifies the trader originating the quote. 	Patent granted.	Patents No. 6282521 and No. 7383221
EP1016014: 'Order Processing Apparatus and Method'	<ul style="list-style-type: none"> Optimization of data processing Efficient matching of orders reduces the quantity of data traffic. 	Patent revoked after opposition; no inventive step. Appeal dismissed; no inventive step.	None
EP1080438: 'Index Rebalancing for a Capitalization Weighted Stock Index'	<ul style="list-style-type: none"> An apparatus which receives data pertaining to a complex system, and processes the data to provide a more accurate physical description of the system. 	Application refused; not a patentable subject matter. Appeal dismissed; no inventive step.	Patent No. 6061663.
EP1114384: 'Method and System for Conducting Electronic Auctions'	<ul style="list-style-type: none"> Collisions of lot closing times are prevented. Distribution of the network traffic. 	Application refused; no inventive step.	Patent No. 6199050.
EP1319211: 'Click Based Trading with Intuitive Grid Display of Market Depth'	<ul style="list-style-type: none"> User interface areas that increases the speed and precision with which orders can be entered. 	Patent granted. Five oppositions pending.	Patents No. 6772132 and No. 6766304.

6 Conclusions

We examine whether and how financial methods are patented in Europe by analyzing European patent applications on inventions related to financial exchange infrastructures. We go through all applications in ECLA class G06Q 40/00B Exchange and closely examine their fate in the examination process. We find that financial exchange-related applications first increased significantly after

the State Street decision, but decreased subsequently. The majority (65–75%, depending on the method of calculation) of applications came from the U.S., investments banks and exchanges themselves being among the most active innovators. But patents were not granted easily to these applications. Only few applications (3–11% depending on the method of calculation) had resulted in a patent grant by the end of our sample period and over 40% of applications were either rejected. The few granted patents were opposed vigorously (41% of the awarded patents were opposed) and successfully (55% of the oppositions led to the revocation of the patent), suggesting that competitors monitored each other's patents carefully.

Our analysis of technical characters and contributions of patent applications show that most applications encountered preliminary rejection from the EPO because of containing non-patentable subject matter. Even when the subject matter exclusion could be overcome, the applications ultimately failed to show a sufficient technical contribution to pass the inventive step requirement. Our case studies confirm that when challenged by persistent applicants, the EPO views the lack of an inventive step as a more robust bar to patenting rather than the lack of a technical character or the subject matter exclusion.

Our findings suggest that the State Street decision created a period of uncertainty where the boundaries of the European patent system were tested by the U.S. firms with more experienced intellectual property management organizations. But contrary to what has been speculated, we find that the patentability standards for financial innovations have not weakened in Europe in the aftermath of the State Street decision. This shows that law matters, albeit the link from the law on the books to the actual enforcement might be complicated. Hence if raising the patentability standards for business and financial methods is desirable in the U.S., emphasizing technical contribution with respect to prior art and introducing the European-style post-grant opposition procedures could be efficient tools to that end. In contrast, reassessing restrictions against finance patents in Europe might be necessary, if the current financial market crisis warrants greater transparency of new financial instruments or drug-industry type regulation and supervision emphasising product-safety guarantees.

The results also indicate that the risk of patent hold up in the integration of European financial exchange infrastructures should be limited, but not eliminated. It would hence be important to pay adequate attention to intellectual property policies in the standard setting for European financial exchange infrastructures.

Looking ahead, it is expected that the propensity to file finance patent applications will fall but granting rates will increase, as the applicants learn the patentability standards and do not waste resources to unnecessary applications. However, since there is economies of scale in filing patent applications, since application process takes considerable time (the average examination duration of granted patents is 5.2 years in our sample), and since merely having a pending

application is valuable, some firms filing financial method patent applications to the USPTO will continue to file similar applications to the EPO even if they put a much smaller probability on obtaining a grant in Europe. The patent statistics in future may also look different because there is a potential selection bias in the applications that reach decision in our data. For example, they might be relatively easy to evaluate (eg, reject) with the more tedious cases being buried in the pending cases.

Our findings suggest that the State Street decision opened up a unique policy experiment where major financial markets operate(d) in drastically different intellectual property environments. Since well-function financial markets and innovation infrastructures are crucial for economic growth, future research should assess the impacts of the experiment on financial market innovation and performance.

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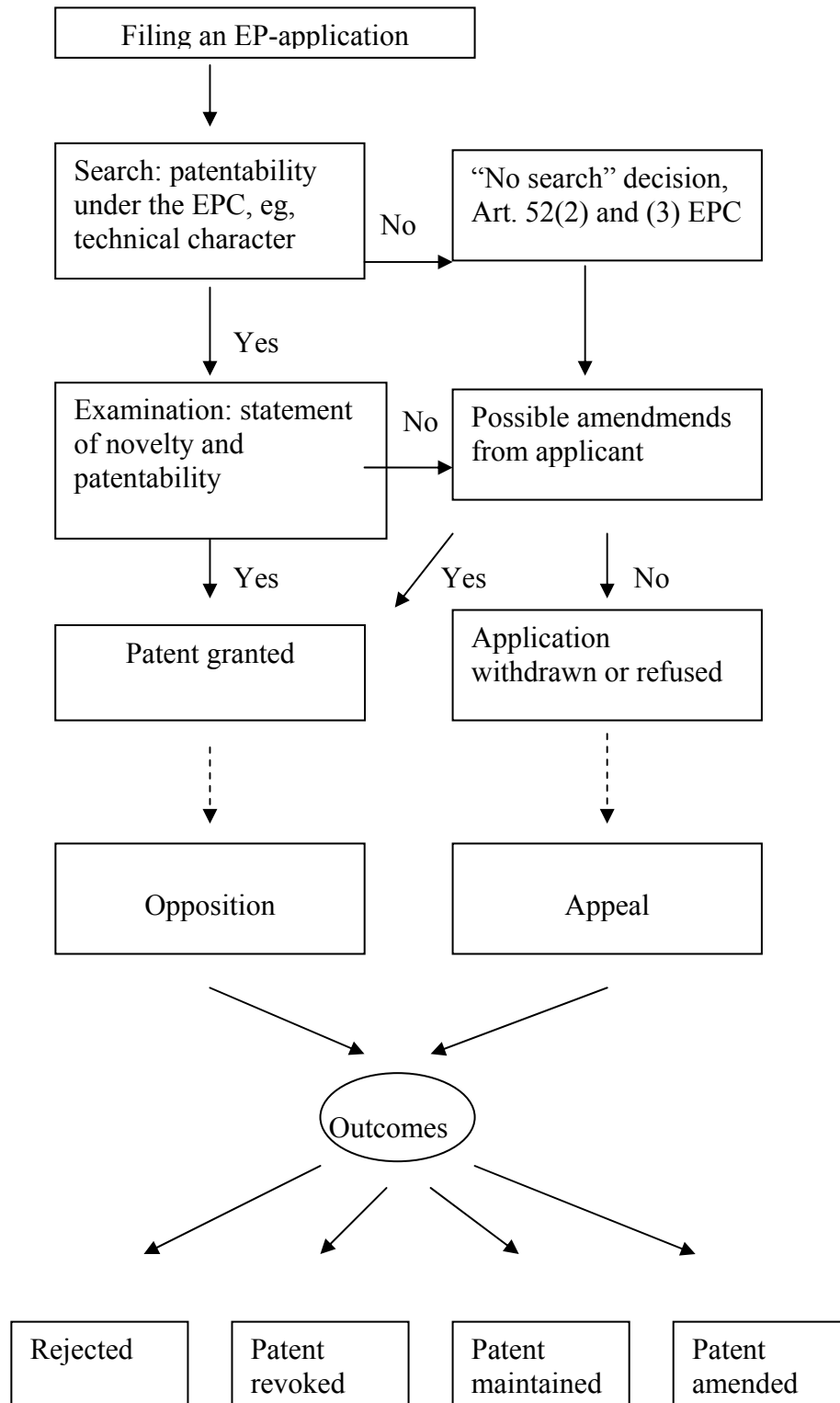
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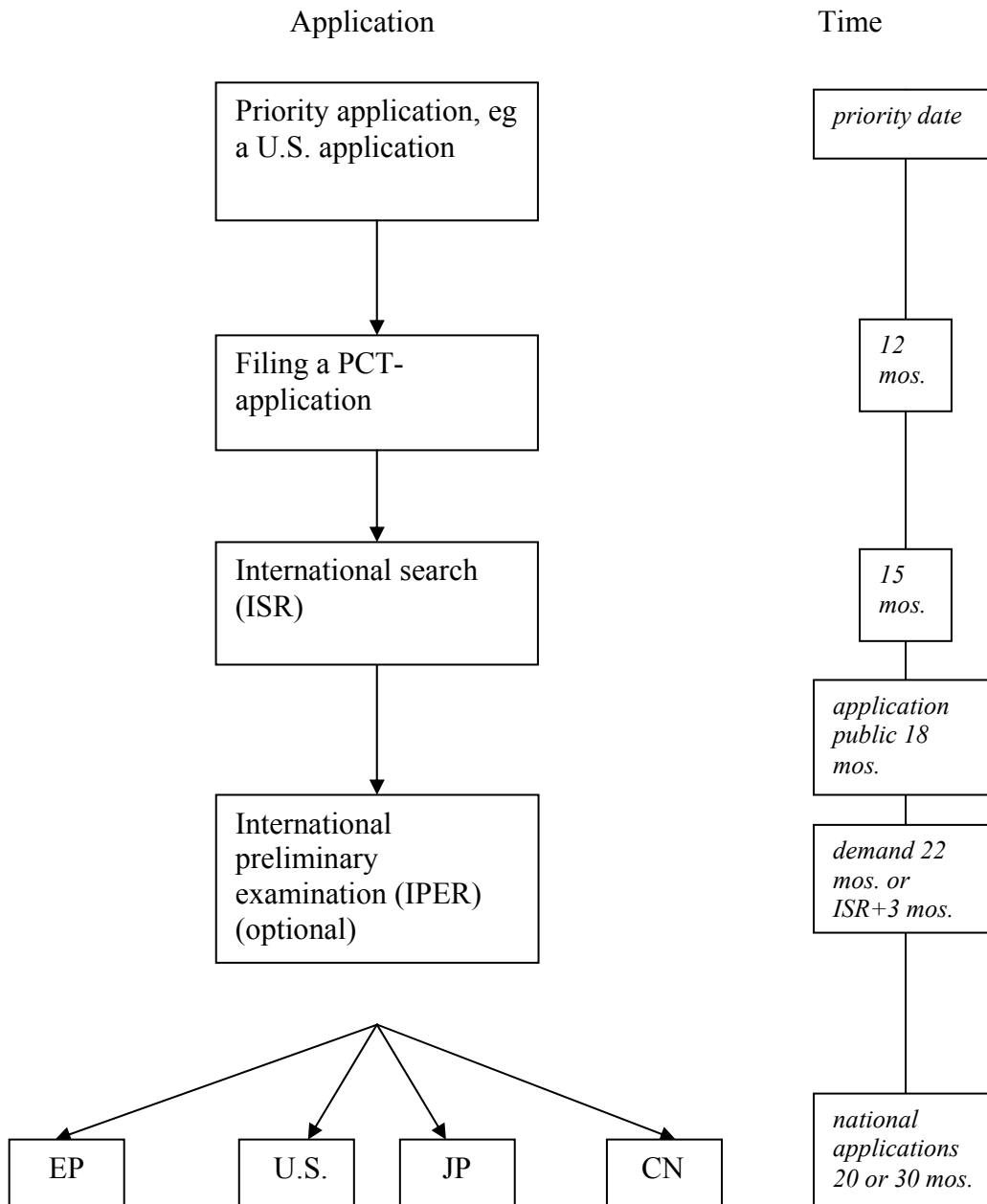
Appendix 1

A simplified presentation of the European patenting system at the EPO



Appendix 2

A simplified presentation of the international patenting system



Appendix 3

European Patent Classification for Financial Methods (ECLA 2007)

G06Q	Data processing systems or methods, specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes; Systems or methods specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes, not otherwise provided for.
G06Q40/00	Finance, eg banking, investment or tax processing; Insurance, eg risk analysis or pensions.
G06Q40/00A	Banking, eg interest calculation, credit approval, mortgages, home or on-line banking; Financial accounting; Tax processing.
G06Q40/00B	Exchange, eg stocks, commodities, derivatives, foreign exchange.
G06Q40/00C	Investment, eg financial instruments, portfolio management, fund management.
G06Q40/00D	Insurance, eg risk analysis; Pensions.

Appendix 4

Cases

In this Appendix we study six applications in detail. In describing each invention we use our own words. In a couple of cases we also use the language of an original patent application to illustrate the way applicants try to confer their invention a technical character on the one hand and to hide the content of the application from outsiders on the other hand. We present the cases according to their priority dates.

A4.1 European Patent No. 0776505: ‘Negotiated Matching System and Method’ (Reuters Transaction Services, UK)

The matching system described in the application consists of a communications network between remote terminals and a centralized matching station. The matching station collects information that trading parties enter into their remote terminals, seeks to identify mutually acceptable trading opportunities, and match potential counterparties to a transaction. If a match occurs, the potential trading parties can use the system to negotiate some or all terms of the transaction. Clearly, the system of matching traders is reminiscent of, eg, online dating schemes trying to form mutually beneficial matches in marriage market.

There are two priority applications, UK patent application GB19940016673 of August 17, 1994 and U.S. patent application US19950475499 of June 7, 1995. The corresponding PCT application (WO9605563) containing 11 claims was filed on August 17, 1995, with the EPO as the ISA. The EPO’s ISR cites two prior European patent applications as novelty bars. The applicant responded by defining independent claims more precisely than in the original PCT application, and reducing number of claims from 11 to eight. The subsequent IPER by the EPO regards the invention as novel, but independent claims 1 and 8 were seen to lack inventive step over the prior art. The applicant nonetheless continued to the regional phase of the EPO on February 27, 1997 without further modifying the application.

Not surprisingly, the conclusion of the EPO’s examination report on November 28, 1997, was consistent with the IPER. The applicant replied on May 11, 1998 by filing a new set of claims but without changing the content of the independent claims. The applicant explained how the application differs from the cited prior art, maintaining that the independent claims constitute a novel and inventive invention. The EPO was apparently satisfied with explanations, since the application was only slightly modified before the decision to grant a European patent (EP077650) was made on March 2, 2000.

U.S. Patent No. 5924082 was issued on the U.S priority application on July 13, 1999. The claim 1 of the U.S. patent is the same as the claim 1 of the original PCT application, which had to later be specified in the European patenting process. The European patent has two independent and six dependent claims, whereas the U.S. patent has 39 claims including eight independent claims. The original U.S. application has two ‘continuing’

applications.³⁶ The U.S. Patent No. 7505915 with 42 claims was issued on the first of them on March 17, 2009. The latest U.S. application (US20060059082) had a non-final rejection and is still pending. The first claim of this application includes aspects from the final form of the European patent.

A4.2 European Patent No. 0847561: ‘Anonymous Trading System with Improved Quote Input Capabilities’

(EBS Dealing Resources, U.S.)

The application discloses a trading system that determines whether a quote entered into the system by a market maker or a trader ‘is waiting to be hit’ by ‘a substantial number of trading floors’, and if so, notifies the market maker or the trader originating the quote. The system also includes a graphical display showing the market maker how many trading floors are poised to hit her quote, and a numeric display showing a price that would be hittable by a substantial number of trading floors. In other words, the invention tells a trader or a market maker how many of available trading partners are willing to accept her quote and how the quote should be changed to make it acceptable by a given threshold of available trading partners.

The priority application is provisional U.S. application US19950002856P of August 28, 1995. The PCT application (WO9708640) containing eight claims was submitted to the EPO exactly 12 months later on August 28, 1996.³⁷ The EPO’s ISR suggests two previous U.S. patent applications which taken together render the invention obvious to a person skilled in the art. The applicant renewed the claims of the application after the ISR. In particular, new independent claim 1 was drafted more precisely to reduce the relevance of the documents cited in the ISR. As a result, the EPO’s IPER views the invention as novel and inventive enough to pass the inventive step hurdle.

The application entered into regional phase at the EPO on March 16, 1998. The EPO signalled an intention to grant the patent on March 23, 2001, suggesting some minor amendments to the description and claims. After the application was amended accordingly, the decision to grant a European patent was made on September 11, 2003.³⁸

Corresponding U.S. Patent No. 6282521 of August 28, 2001 has one independent claim and seven dependent claims. The independent claim 1 of the U.S. patent is close to the claim 1 in the European patent. A continuing application (US20020082976) was filed just before the U.S. patent was issued on August 10, 2001. This application resulted in U.S. Patent No. 7383221 with 10 claims on June 3, 2008.

³⁶ The U.S. patent system allows, after an original application is filed, one or more continuing applications based on the same invention with the same priority date. This property of the U.S. patent system has been heavily criticized since it not only increases the number of patents over one invention but also allows applicants to hide and strategically modify claims (see, eg, Bessen and Meurer, 2008)

³⁷ As mentioned in Section 2.3 (see also Appendix 2) the international application must be filed within one year from the priority date.

³⁸ Interestingly, the last revision round increased the number of claims from eight to 27. We find no evident reason why the increase was made or why it was allowed; the modifications required by the EPO’s Examining Division clearly do not warrant such an increase.

A4.3 European Patent (revoked) No. 1016014: ‘Order Processing Apparatus and Method’

(Advanced Transaction Systems, UK)

The application deals with a system of processing trading orders comprising a central server connectable to several user terminals. The central server includes communication means and optimization procedure for transmitting user orders between the server and the terminals.

There is UK priority application GB19970019829 of September 17, 1997. Exactly a year later the PCT application (WO9914695) with 58 claims was filed with the EPO as the ISA. The priority application was modified slightly for the PCT application, eg, one independent claim was added. The ISR from the EPO cites one prior PCT application originating from the U.S. as a novelty bar. However, the subsequent IPER by the EPO disregards the prior art document, and considers the invention novel and involving an inventive step. The PCT application entered into the regional phase at the EPO on April 14, 2000. The patenting process progressed fairly smoothly, resulting in the publication of an European patent (No. 1016014) on November 27, 2002.

Deutsche Börse filed a notice of opposition on August, 27, 2003, just within the nine month time limit of opposition. The notice presents six new patent documents to show that the invention lacks novelty and inventive step. As a response to the opposition the patent holder amended independent claims 1 and 28, and argued that the documents cited by the opponent were unrelated to the patent.

The summons to oral proceedings show that the EPO’s Opposition Division disagreed with the opponent about the lack of novelty but agreed about the lack of an inventive step. According to the EPO the purpose of the invention is to optimize the allocation of trading orders and that such invention lies primarily in the field of business methods. It was clear that the data processing affects neither the physical nor technical functioning of the system of the computers, nor does the data contribute to the solution of a technical problem. Furthermore, the optimization scheme could only be seen as a numerical algorithm and hence not technical. While claims 1 and 28 were seen to involve a mix of technical and non-technical features, the claimed technical solution was considered obvious to a skilled person.

In the oral proceedings on November 14, 2005 the patentee argued that the field of optimization was a technical area independently of its application, and that technical considerations were involved in optimizing data. The optimization engine allowed efficient data matching and the server and terminal system, and it was a new technical solution. The patentee stressed that the claimed subject matter was not concerned with a solution of a business problem. The opponent in turn indicated that in the arguments by the EPO’s Opposition Division seemed to be valid, and that the optimization techniques disclosed by the invention were standard and used to achieve a business effect. At the end of the oral proceedings, the EPO’s Opposition Division announced that the patent was revoked because of the failure to meet the inventive step requirement of Article 56 of the EPC.

The applicant filed an appeal on May 15, 2006 with the request of reversing the decision to revoke the patent. The applicant re-emphasized that the optimization produces a technical effect by enabling an efficient matching of trading orders, by reducing data traffic, by rendering the optimization problem more tractable, and thereby reducing the computational burden on the server apparatus. The applicant also argued that the invention must be considered as a whole according to Article 52(3) of the EPC, excluding the partitioning of the claimed subject matter to non-technical and technical features. The applicant nonetheless argued that particularly the features of ‘processing the orders to calculate a set of coefficients’ and ‘optimizing the values of said coefficients’ of the invention should be considered technical in itself, since they lead to the optimization of

the flow of the orders through a physical and technical device. Thus the processing is technical and achieves a technical effect, being analogous to the control of the flow and routing of data through a telecommunications network. Inventions in the field of telecommunications are not excluded from patentability even if the data being transmitted is non-technical, eg, human conversation.

The Board of Appeal on its decision (T0331/06) on October 7, 2008 held the decision of the Opposition Division to revoke the patent. The Board of Appeal stated that optimisation methods employing mathematical algorithms are considered to be excluded from patentability under Articles 52(2) and (3) of the EPC, if no technical applications are apparent. The calculation of the coefficients is not a solution to a technical problem. Thus, the invention did not involve an inventive step.

A4.4 European Patent Application No. 1080438: ‘Index Rebalancing for a Capitalization Weighted Stock Index’

(The Nasdaq Stock Market, U.S.)

This application describes ‘a computer system including a processor and a storage device storing a computer program product for rebalancing a capitalization weighted stock index’. The computer program further ‘includes instructions for causing a computer to classify stocks in the index’ to large and small stocks. ‘The computer program causes the computer to scale down’ the large stocks ‘by an excess capitalization weight’ and ‘distribute an aggregated excess capitalization weight of the large stocks ‘over the capitalization weights’ of the small stocks. ‘An iterative redistribution of excess capitalization...can be used to provide less than proportional distribution of excess capitalization to very small capitalized stocks’. ‘The index rebalancing software retains a capitalization weighting characteristic while permitting the index to conform to generally accepted accounting, economic and tax standards. Index rebalancing is accomplished while maintaining the original relative position of stocks and reducing the market impact of rebalancing’ on the smallest stocks.

Our reading is that the core of the invention consists of a computer program or a method for weighting components of a stock index in a novel way. Especially many smaller stock exchanges suffer from the problem that a stock index weighted by market capitalization may give a too high weight to one or a few large companies and equally or price weighted index may in turn give a too high weight to the smallest companies. Hence, various amalgams of the market capitalization weighting and equal weighting have been developed over the past decades. The invention described in the application is part of that development.

The priority application is US19980063535 of April 21, 1998. The applicant revised the application (eg, reduced the number of claims from 35 to 29) before filing the international application with the USPTO as the ISA one year later. The ISR for the PCT application (WO9954838) cites one U.S. patent application as a novelty bar. However, the IPER from the USPTO considers the claims novel and inventive.

The PCT application with the same 29 claims entered into the regional phase in the EPO on November 3, 2000. In spite of the examination made by the USPTO, the EPO’s Search Division found the application incompatible with the provisions of the EPC and hence a prior art search non-meaningful. Consequently, a ‘no-search’ declaration (Communication under Rule 45 of the EPC) was sent to the applicant on April 7, 2001. The declaration points out that the subject matter of claims 16–28 relates to a method of doing business as such and is hence not patentable under Articles 52(2) and (3) of the EPC, and that although claims 1–15 and 29 do not literally belong to the business method category, they essentially claimed protection for the same commercial effect as the method claims.

The applicant nonetheless proceeded further with the European patent application, pushing the EPO to examine the application. The EPO's examination report on November 19, 2001, concludes that claims 1–15 concern only with a computer program as such with no further technical effect. Therefore, they do not comply with the subject matter requirements of Articles 52(2) and (3) of the EPC. Even if the feature of 'computer readable medium' of claims 1–15 conferred a technical character to the claims, they would lack novelty because such computer readable media are well known. In addition, claims 1–15 were not considered to involve an inventive step according to Article 56 of the EPC because they solve no technical problem. The difference to the prior art (eg a CDROM) is the computer program for rebalancing a capitalization weighted stock index. The problem associated with this difference can be formulated as 'How can an imbalance in capitalization weights in a stock index be corrected?' The EPO emphasized that this is not technical problem but an economic or a mathematical problem. Claims 16–28 were considered to have a non-technical character as already mentioned in the Declaration under Rule 45. While claim 29 were seen to involve technical aspects, it was not considered novel in the sense of Articles 52(1) and 54 of the EPC, because its technical features are present in all stored program computers.³⁹ The EPO further argued that even if the non-technical features of claim 29 were considered novel, they would not involve an inventive step because no technical problem is solved.

The applicant responded on May 21, 2002 by sending a revised set of claims 1–29 and by emphasizing that the invention relates to a technical apparatus which receives a raw data from a complex system, and processes that data to provide a user with a more accurate and relevant physical description of the system. The data on stocks in an index derives from a number of variables that relate to many physical entities and organizations besides financial and business data. Thus the data processing method also involves non-technical matters.

In the summons to attend oral proceedings August 4, 2003 the EPO stated that replacing the word 'computer program product' with 'apparatus' in the application does not render the invention technical. The core of the invention is the method or the algorithm used to compute a stock index value. Therefore, the objections regarding claims 1–29 were maintained. The EPO also reminded the applicant that the mere computer environment is not enough to lend a technical character to a method claim. Moreover, even if a technical effect were present in claim 1, it would be considered neither novel nor inventive, because an anonymous document filed by a third party on February 26, 2003 discloses a non-patent prior art literature where a very similar modified capitalization weighted stock index is computed. The EPO also viewed that some additional features in the revised claims extend the subject matter beyond the original filing, being in contrast with Article 123(2) of the EPC.⁴⁰

The applicant responded with a letter of November 10, 2003 restating her view that the invention deals with a technical tool receiving and processing data from physical entities and organisations whose shares are part of a stock index. The applicant argued that there is no difference between the use of such a tool and a tool receiving and processing data from physical sensors, eg, to construct an image of a human body using magnetic resonance signals or to determine global weather patterns. The applicant also resorted to the definition of a word 'technical' in English Dictionaries to argue that the present invention is consistent with the normal dictionary definition of 'technical'. The

³⁹ Article 54 of the EPC gives the novelty criterion for patentable inventions: 'An invention shall be considered to be new if it does not form part of the state of the art...'

⁴⁰ According to Article 123(2) of the EPC, 'A European patent application...may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed'. One of its main functions is to augment the Article 83 of the EPC governing the adequate disclosure of the invention in a patent application.

applicant considered the claims compatible with the requirements of Article 123(2) of the EPC, and dismissed the document of February 26, 2003 as irrelevant with an unclear origin. Nevertheless, the applicant amended some claims and presenting them as auxiliary requests.⁴¹

In the oral proceedings on December 9, 2003, the EPO's Examining Division accepted the applicant's arguments with regard to Article 123(2) of the EPC, but noted that the subject matter of claim 15 is primarily related to a mathematical method excluded from patentability by Articles 52(2) and (3) of the EPC. The few technical features present were not considered to lend a sufficient technical character to make the application an invention under Article 52(1) of the EPC. The argumentation using the dictionary definition of 'technical' was found unconvincing. The previously held objections concerning the absence of novelty and inventive step were maintained. The application was then refused on the grounds of Articles 52(1-3) of the EPC.

The applicant appealed on July 19, 2004. The applicant's reasoning was unchanged except that the applicant now also noted that the Board of Appeal's decisions T115/85 ('Computer-Related Invention/IBM') and T362/90 ('WABCO Westinghouse') establish the principle that the automatic visual display of conditions prevailing in an apparatus is basically a technical problem. Thus since the present invention suggests the automatic computation of output data necessary to provide such an automatic visual display, it also contributes to solving a technical problem.

In the summons to oral proceedings on May 15, 2006, the EPO referred to the approach defined in T641/00 ('Two Identities/Comvik') by which only those features contributing to a technical character can support the presence of an inventive step. As to claim 1, only the input, output and processing means can be seen as technical whereas the functions they perform belong to the financial domain. Similarly, the only technical feature of claim 15 appears to be in the indication that a non-technical method is executed on a computer. The EPO also noted that the decision T115/85 ('Computer-Related Invention/IBM') cited by the applicant concerns an event occurring in a technical device. The index calculation of the present invention is based on the stock prices of companies, which is determined by the market participants, ie, by human beings. The index can thus be said to be indicative of an opinion. Collecting, processing and displaying data about a financial system does not affect the technical functioning of the system.

In her response on November 3, 2006, the applicant restated her old argument that the system described by a stock index is a complex physical system comprising real physical attitudes. The applicant also underlined that claim 15 is 'a method executed on a computer for automatically rebalancing...' and therefore unambiguously falls exclusively within the scope of a method involving technical means. The applicant also argued by referring to the Board of Appeal's decision T258/03 ('Auction Method/Hitachi') that claims 1 and 15 involve such technical features that cannot be excluded from patentability under Article 52(2) of the EPC. The apparatus features of claim 1, and the method steps of claim 15 serve to perform input, output, and data processing steps necessary to solve the problem of providing an accurate indication of conditions prevailing in a complex system. The applicant also reminded that computer systems typically generate output to a human agent through automatic means. The applicant further maintained that there is no requirement for a patentable data collection and processing device monitoring a physical entity (eg, a magnetic resonance imaging device monitoring a human body) to have a direct effect on the technical functioning of the entity.

Oral proceedings on December 6, 2006, the EPO now considered the claim 1 inventive within the meaning of Article 52(1) of the EPC, because the apparatus of claim

⁴¹ The patent applicant may send to the EPO a main request and auxiliary requests, which consist of different claim sets. Only one of these requests can be accepted.

1 comprises input, data processing, and output means. However, since the computer implementation of processing data on the shares of a stock index is straightforward, an inventive step can only be involved if the data processing features form a solution to a technical problem. The Board of Appeal did not agree with the applicant that the present invention provides automatic visual indications about conditions prevailing in a system in the sense of decision T115/85 ('Computer-Related Invention/IBM') because the conditions are not detected by the claimed system but they are entered into it in the form of descriptive data, and the system in which the conditions prevail is of a commercial rather than technical nature. The descriptive information concerning financial stocks entered into the system has exclusively 'cognitive content' in the sense of decision T1194/97 ('Data Structure Product/Philips'). Applying the test proposed in this decision for cognitive information as opposed to 'functional data' suggests that if stock information were lost, the claimed apparatus would still function. Consequently, the appeal was dismissed.

A notification of the Board of Appeal's decision, sent to the applicant on January 12, 2007, adds to the arguments presented in the oral proceedings that the data input into the claimed apparatus have no technical function. The data processing in turn comprises classification, scaling and redistribution, which exclusively concern with the cognitive content of the data. Such pure information processing is a mental act and excluded from patentability by Article 52(2) of the EPC. The remaining technical features of the invention involve no inventive step. The additional features in auxiliary requests serve to define the mental act underlying the invention, and their technical implementation is obvious. The subject matter of the auxiliary requests hence has no inventive step either.

U.S. Patent No. 6061663 was granted to the priority patent application on May 9, 2000. The U.S. patent is similar to the PCT application as originally filed but, in accordance with the initial U.S. patent application, includes dependent claims 30–35 referring to the computer system of claim 29.

A4.5 European Patent Application No. 1114384: 'Method and System for Conducting Electronic Auctions' (Freemarkets, U.S.)

This application describes an auction conducting method which seems fairly complicated from the outset. The described method involves 'a dynamic lot closing extension feature', which 'avoids collisions in closing times of multiple lots by dynamically extending the closing time of a subsequent lot if a preceding lot's closing time is extended to be too close to the subsequent lot's then-currently scheduled closing time'. There is also 'a flexible overtime feature in which the properties of the event triggering the extension and the duration of the overtime period(s) can be tailored to a particular auction'. The method also allows for alerting 'the auction coordinator of technical problems in submission of bids'.

Another way to describe the application is that it involves an online auction method with a staggered closing scheme to maintain a minimum time interval between the closing times of different lots of the auction. Consider, for example, two auctions with closing times T_1 and T_2 . If the closing time of the first auction is for some reason postponed to, say, T_1' , a problem may arise if T_1' is too close to T_2 , since there is not enough time to bid in the second auction. The auction method involves a mechanism which automatically extends T_2 to T_2' , keeping the difference $T_2' - T_1'$ large enough. While financial products are sold in an auction, this innovation clearly deals with a more general business method with applications beyond financial sector.

There are three U.S. priority applications, two provisional applications (US19980101141P and US19980110846P) and application US19990252790. The first

priority date is September 18, 1998. A year later the PCT application (WO0017797) with 88 claims was filed to the EPO as the ISA. In the EPO's ISR (of March 20, 2000) no novelty or inventive step bars are cited. However, the IPER (of January 5, 2001) states that the application contains six different business method inventions, all of which are excluded from International Preliminary Examination according to Article 34(4)(a)(i) and Rule 67.1 of the PCT.

A few months later the applicant requested entry into the regional phase at the EPO but sent renewed claims 1–35 for the European examination process. The EPO's examination report of July 11, 2001 considers that the claims relate to methods of doing business, being excluded from patentability under Article 52(2) of the EPC. The EPO reminded the applicant that the claims should include technical features which solve a technical problem and which as such involve an inventive step. Indications of a business-related activity may be included for clarity. The EPO also complained that the claims lack clarity, rendering their full examination overly difficult, and invited the applicant to revise the claims.

The applicant responded on November 6, 2001, and sent amended claims 1–35. In her response, the applicant referred to the case law of the Board of Appeal to argue that the claims have a technical character. Decision T0769/92 ('General-Purpose Management System/Sohei') establishes that if technical considerations are required to carry out an invention, they imply a technical solution to a technical problem. According to the applicant, the technical problem underlying the invention is to enhance the operational security of a computer network. This technical problem is solved by the technical features of claim 1, which concern with the automatic measurement, monitoring and control of closing times, ie, of physical parameters which can only be measured, monitored and controlled by technical means.

The EPO's second examination report of November 30, 2001 acknowledge that the general objective of enhancing the operational security of a network is technical. But claim 1 misses the essential technical features for solving the problem. Moreover, the technical problem should be defined over the prior art and be more specific. The applicant was asked to provide her own formulation of the technical problem over the prior art.

The applicant again sent a modified application on March 4, 2002 where the independent claims are more concise than in the previous versions. In the third examination report (October 10, 2002) the EPO considered that delaying the closing time of an auction in a way specified in the application is not explicitly disclosed in the prior art. However, when the closing time of a lot is delayed to extend the bidding time, it is an obvious solution to the problem of maintaining a minimum time interval between closing times of different lots. Thus no inventive step was observed in the claims of the application. The EPO's Examination Division also indicated its intention to refuse the application.

The applicant responded on February 20, 2003 by referring to the discussion with the EPO's examiner of the application who had indicated that the application would involve some technical aspects. The applicant also described the invention in more technical terms, and argued that the claims involve a specific technical realization preventing the collisions of lot closing times. Thus the invention solves the technical problem of distributing network traffic and data more evenly over time.

In the summons to attend oral proceedings on February 12, 2004 the EPO viewed the claimed subject matter as being excluded from patentability under Article 52(2) of the EPC. The EPO noted that the technical problem of distributing network traffic over time to reduce traffic peaks and data processing requirements cannot be derived from the application as originally filed (and is hence in contrast with the 123(2) of the EPC)). Even if the problem were accepted as technical, the solution provided by independent claims 1 and 29 would be obvious and, therefore, they would not include an inventive step.

The applicant responded on May 6, 2004 and sent new claims 1–14 in an auxiliary request. The applicant continued to maintain that the invention described by claims 1–35 filed on March 4, 2002 deals with patentable subject matter and involves an inventive step over the prior art. The independent claims of the auxiliary request described the cooperation of the individual network components and the timing control mechanism in more technical terms including receipt, evaluation and broadcasting of electronic bids by the server component, and the provision and evaluation of a trigger time interval.

Oral proceedings were held on June 17, 2004. The applicant's objections concerning the exclusion from patentability did not receive support. The Examining Division's opinion continued to be that the inventive step requirement given by Article 56 of the EPC is not fulfilled. The automatic extension of the closing times of different auctions was considered primarily a solution to a business problem, and even if it were viewed as a solution to a technical problem of reducing network traffic, it would be obvious. The claims 1–14 of the auxiliary request were considered to be more technical since they disclose the functioning and the implementation of the timing control mechanism with a trigger time interval. However, Examining Division considered that the timing control mechanism solves no technical problem but only a business one. As a conclusion, the EPO refused the application because of the lack of an inventive step of the independent claims of the main and auxiliary requests.

U.S. Patent No. 6199050 was granted to a continuing application of the original priority application US19990252790 on November 6, 2001. The claims 1–49 of the U.S. patent do not mention closing times and their extension even if they are presented in the abstract and in the description.

A4.6 European Patent No. 1319211: 'Click Based Trading with Intuitive Grid Display of Market Depth'

(Trading Technologies International, U.S.)

The original application discloses a method to speed up the placing of an order in electronic trading on an exchange, thus increasing the probability that the trader will have orders filled at desirable prices and quantities. The method in essence consists of a novel way of presenting market depth data of a traded commodity on a computer screen by displaying simultaneously bid and ask quantities and corresponding prices.

The application has two priorities: US20000186322P (March 3, 2000) and US20000590692 (June 6, 2000). One year from the first priority date, the PCT application WO0165403 with 40 claims was submitted with the EPO as the ISA. The EPO's ISR of January 25, 2002 is a 'no-search' declaration, stating that a meaningful search of the prior art is impossible because the subject matter of the application (methods of doing business) is excluded from patentability under the Article 52(2) and (3) of the EPC.

Nonetheless, the applicant pushed the application into the regional phase at the EPO on August 19, 2002, with 31 modified claims. New independent claim 1 defines a method, which not only displays data but also updates it, and connects user terminal to a gateway server.

The EPO's examination report on July 15, 2003 argues that the amended claim 1 extends, contrary to Article 123(2) of the EPC, the subject matter beyond the content of the original application. Moreover, claims 1–16 were not regarded as new considering another PCT application. The subject matter of claims 17–31 in turn was considered to be excluded from patentability under Articles 52(2) and (3) of the EPC, because they involve a method of doing business without no technical character. Even if some features of the claims such as graphical user interface would be technical, their use for purely economic means would not confer technical character to the method as a whole. The Examining

Division further argued that the conclusion is in line with the Board of Appeal's decisions T1173/97 ('Computer-Program Product/IBM') according to which the presence of a concrete product does not automatically confer technical character to an invention, and T769/92 ('General-Purpose Management System/Sohei') according to which the evaluation of the patentability can be based on the joint effect of method and other claims. The EPO also pointed out that even if the claimed subject matter had a technical character within the meaning of Article 52(2) of the EPC, the claims would not make a technical contribution to the state of the art to satisfy the requirement for an inventive step.

The applicant responded on October 30, 2003 by sending redrafted claims 1–25. There were no essential changes to the independent claims, but their support from the original content of the application and their novelty and inventive step were more thoroughly explained. The dependent claims were more heavily modified.

The summons to attend oral proceedings on March 23, 2004 suggests a reversal of the EPO's opinion concerning with Article 123(2) of the EPC and the associated subject matter extension. However, the EPO still considered claims 1–25 problematic under Article 52(2) and (3) of the EPC, and considered the subject matter of claims 1–25 lacking an inventive step in the sense of Article 56 of the EPC. The EPO suggested that while the proposed method might facilitate viewing trading data on a screen, it cannot be considered technical in terms of improved data processing. Even if the data displaying method solved a technical problem, the solution would be obvious to anyone who has ever used a computer screen: it should not require undue experimentation to realize that it is more convenient to have related values such as quantities and prices viewable at the same time within the same window.

The applicant responded May 28, 2004, and enclosed new claims 1–58 to replace all of the claims currently on file. The new independent claim 1 consisted of an interface for receiving data, means for displaying and updating data, and multiple order entry regions. The applicant now referred to the case law of the Board of Appeal, pointing out that decision T931/95 ('Pension Benefit System Partnership') and T769/92 ('General-Purpose Management System/Sohei') establish that a concrete product performing an economic activity is an invention under the Article 52(1) of the EPC, and that a technical invention cannot lose its technical character when used for a non-technical purpose, like financial management. Therefore, if the technical character of an invention is demonstrated, its particular purpose cannot affect its patentability. According to the applicant, a technical contribution of its invention arises from the arrangement and relationship of multiple user interface areas. The applicant argued that the invention also marks a substantial improvement over the prior art by increasing the speed and precision at which trading opportunities can be recognized and orders entered.

Oral proceedings were held on August 27, 2004. The EPO reversed its opinion concerning with Articles 52(2) and (3), ie, the EPO considered that the invention belongs to patentable subject matter. The subject matter of claim 1 was considered to solve a technical problem, which is independent from the business aspects of the claims. A trader, who is confronted with correlated changing measures (prices, and bid and ask quantities) in a real-time environment, has to place order on prices at a guaranteed level. The solution is to create a field of prices and let bids and asks move relative to the price field. This assures both speed and accuracy. As a result, the EPO viewed the solution as involving an inventive step, and announced the intention to grant a patent. The patent was issued on April 13, 2005.

Oppositions were filed nine months later by Anitra Medienprojecte, Deutsche Börse, Eccoware, Rosenthal Collins Group, and Tick Trading Software. Using a common strategy in oppositions, the opponents argued for the revocation of the patent based on multiple grounds. They suggested that the invention deals only with the presentation of information, and is hence excluded from patentability under Article 52(2) of the EPC.

The invention was also seen to lack novelty and to be obvious with respect to the prior art. Some of the claims were considered to be outside the original application. Furthermore, some claims were considered to be so opaque that they could not be understood by a person skilled in the art. The opposition procedure was still pending at the moment of writing this paper.

We find two equivalent U.S. patents for the European patent: No. 6772132 (August 3, 2004) and No. 6766304 (July 7, 2004). The latter patent arises from a continuing application of priority application US20000590692. The independent claim 1 of U.S. Patent No. 6766304 is more detailed than its predecessor U.S. Patent No. 6772132, and our reading is that it comes closer to the European patent.

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