

Financial Patenting in Europe

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1. Introduction

The advent and fast growth of the Internet economy has been accompanied by innovation in the traditional forms of financial payments. These changes have been propelled on the one hand by the emergence of new commercial relations conveyed through the Internet which require new and secure modes of payments – e.g. digital market places and e-commerce. On the other hand, traditional markets and industries have experienced the diffusion of such business practices within their procurement and marketing activities (Lerner 2004).

The potential benign impact of innovation in the payment and financial systems is very high and it goes well beyond the banking sector. It is worth remembering that changes in the short term payment and financial systems were at the base – among others – of the commercial revolution in Europe during the fifteenth and sixteenth centuries (Rosenberg and Birdzell 1986). More recently other scholars have suggested that innovation in payment and financial systems has some of the features of a General Purpose Technology (GPT) (Hall 2007). GPTs are technologies characterized by use in a wide range of sectors, the need for complementary investment when adopted, and scope for productivity enhancement in diverse sectors of the economy, leading to increasing returns on both the supply and demand side (Bresnahan and Trajtenberg, 1995).

Patenting in this area has increased significantly in the last two decades. According to evidence documented by Hall (2007), 5,393 patents were issued by the United States Patent and Trademark Office (USPTO) in Class 705 (Data Processing: Financial, Business Practice, Management, or Cost/Price Determination) during the decade 1995-2004, corresponding to approximately 2,918 patentees. The patenting trend in this class accelerated after the key decisions taken by the Courts of Appeals for the Federal Circuit (CAFC) in 1998 which

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removed most of the exceptions to the patentability of software and other business methods ‘as such’, that is, methods that are independent of a particular physical embodiment (State Street v. Signature Financial 1998, ATT v. Excel 1998).¹ Such patents have proved particularly contentious and subject to litigation, especially those related to financial innovations (Lerner, 2006).

At the EPO the treatment of software and intangible business methods is different, with these inventions “as such” excluded from patentable subject-matter according to the European Patent Convention (Article 52). Nevertheless, when Hall, Thoma and Torrisi (2007) analyzed a large dataset of EPO patents, they found an increasing number of what appeared to be software-related patents during the 1990s. This suggests that, despite the different legal environment, barriers to patenting on software and intangible business methods may have fallen somewhat in Europe as well. This process has been reinforced by some conflicting decisions at the various national European courts and the European Court of Justice.

Here as in most areas, the strengthening of patent coverage can have both positive and negative effects. On the one hand, it can increase the incentive to devote resources to inventive activity. On the other hand, it may discourage or raise the cost of combining and recombining of inventions to make new products and processes, in particular in cumulative innovations such as GPTs and technologies that are part of a standard setting process (see, among others, Scotchmer 1996, Cohen and Lemley, 2002; Lemley 2007). These considerations are of particular relevance for financial patents and software and business methods in general (Hall 2003).

In the USPTO context the heterogeneity of the actors involved in financial patents can be seen along a number of dimensions (Hall 2007). About 20 per cent of the patentees are alliances or R&D consortia of financial firms, suggesting the importance of the standards setting process in payment and financial systems. Other patentees are older and larger firms active in non-financial and non-software sectors such as oil and gas or machinery. Newer patentees are typically small firms and only three of them – E-Trade, eBay, and Verisign – have more than one billion dollars of revenue annually by 2005. Another dimension of heterogeneity is the importance of financial patents relatively to the overall portfolio of the

¹ Recently the CAFC decided to reconsider the question of patentable subject matter by scheduling an en banc hearing to consider this in light of the Bilski case. A decision has not yet issued, although the USPTO has already issued clarifying guidelines with respect to business methods (May 15, 2008).

patentee: only 0.7% of patents in this class are granted to firms that specialize in financial patenting, whereas the remaining patents are held by large patentees that operate in a number of other sectors such as Exxon Mobil, Chevron, NCR, Lockheed Martin, Diebold, etc. This picture is quite similar to that of software-related patents, a large proportion of which are held by non-software firms.

Following on the results for the U.S., in this paper we look at the ways in which European firms are dealing with the increase of financial patenting, given the differences they face in patentability in their home markets. Some exploratory questions that we would like to answer are the following:

1. Are financial patents issued at the EPO? How could they be defined? What definitions might be useful and robust in obtaining USPTO and EPO data on financial patents?
2. Are European firms patenting financial innovations at the USPTO? How many also succeed at the EPO? That is, what is the pattern of equivalents?
3. What are the characteristics of the firms that obtain financial patents? Sector, size, age, listed vs. non listed, the size of their patent portfolio? Do non-financial firms own a large share of these patents and why? (patent blocking, bargaining, cross-licensing etc.)?
4. What are the characteristics of the financial patents vis-à-vis other patents such as scope, citation of patent and non-patent literature, forward and backward citations, and family size?

2. Defining Financial Patents

To identify a financial patent in EPO we employ three different methods: A) EPO equivalents of USPTO patents in certain finance-related class/subclass combinations; B) EPO patents in a set of IPC/ECLA finance-related classifications; and C) EPO patents in technology classes where “pure play” financial firms patent.

The first set of financial patents (Set A) relies on Hall (2007) and Lerner (2006), who defined a financial patent based on the subclasses of the US class 705 and 902. We used a combination of those definitions obtaining a list of the following US class and subclasses: 705/14; 705/16-18; 705/21; 705/33; 705/35-45; 705/53-56; 705/61; 705/64-79; 902/1-41. For more details see Appendix 1. Then we retrieved all the documents in the USPTO assigned to at least one of those class and subclass combinations. We obtained a sample of 9,549 utility

patent documents granted in the USPTO, that correspond to about 1,350 equivalents of patent applications in EPO.² A similar approach has been followed by Wagner (2008) to find EPO patents on business methods. Note that the use of this criterion only to identify a financial patent in EPO has the limitation of excluding EPO applications with no equivalent application filed in the USPTO or with an equivalent US application which has been rejected or not yet granted.

The second method of defining a financial patent at the EPO relied on other patent classification systems, the IPC and the ECLA systems (Set B). We started by retrieving all patent documents classified in the full digit IPCs corresponding to the above US classes and subclasses according to the USPC-to-IPC Concordance Table provided by the USPTO.³ The validity of this task is hampered by the fact there is a many-to-many correspondence across the IPC and USPC. Hence, in order to check that these IPCs are appropriate for identifying financial patents, we consider how many other subclasses not identified by 705/902 end up in the same full digit IPCs. We found that no full digit IPC is related one-for-one to the US classes and subclasses of financial patents defined by Hall (2007) and Lerner (2006). The IPCs either include subclasses different from the US 705 subclasses considered by Hall and Lerner (e.g., IPC class G06F/11/34 corresponds to USPC class 705/11 which is about “job performance analysis”) or they are linked to other U.S. classes such as 235, 186, 178, 380, which are not related with financial inventions. Hence, the use of the IPC classes only for defining a financial patent could generate some false positives.

Therefore we employed an extension of the IPC – the ECLA classification - which is administrated by the EPO and is about twice as detailed as the IPC.⁴ On the one hand, we used the Concordance Table provided by the USPTO (see previous paragraph) to choose the ECLA codes related to the IPCs corresponding the USPC classes of Hall (2007) and Lerner (2006). On the other hand we identified those ECLA codes in which the EPO equivalents of the US financial patents were classified. In particular we considered the top ten groups of

² For the US patent documents the source is www.uspto.gov, visited August 16th, 2008; for the EPO equivalents we used PATSTAT version October 2007. There is a lag of approximately 1.5 years between the release of PATSTAT and the documents retrieved from the USPTO website. We plan to update these data in a later version of the paper.

³ See http://www.uspto.gov/go/classification/international/ipc/ipc8/ipc_concordance/ipcset1.htm

⁴ For more information on the ECLA classification see:

http://ep.espacenet.com/help?topic=classesqh&locale=en_EP&method=handleHelpTopic

ECLA codes which contain about 78 per cent of the EPO equivalents of the US financial patents.

So doing we identified the following ECLA codes that could be considered appropriate as financial system-related patents in EPO (for the description see Appendix 2): G06Q20/00; G06F21/00N9A2P; G07F7/02; G07F7/08; G07F7/10D; G07F7/10E; and H04L9/32. This subset of patents consists of circa 2,803 patent documents which are referred to as SET B in Table 1.

The third criterion used to define a financial patent was based on an analysis of the patenting activity of ‘pure play’ firms, that is, firms that specialize in financial services or software. To identify pure play firms we started with a list provided by Hall (2007) for the US patentees, and for the largest European patentees we considered those classified in investment banking and securities dealing (NAICS activity 523110) (see Appendix 3 for more details).⁵ We then retrieved all patent applications filed by these firms in the EPO. So doing we find about 452 patents that could be related to financial innovations, since they are filed by firms specialized in the financial services sectors. This group of EPO patents is labeled as SET C in Table 1.⁶

Table 1: Number of patents in each set and their intersection sets

	<i>SET A</i>	<i>SET B</i>	<i>SET C</i>
<i>SET A</i>	1350	217	11
<i>SET B</i>	217	2803	8
<i>SET C</i>	11	8	452

Source: Our elaborations using USPTO and EPO datasets

The results of this complex search procedure are illustrated in Figure 1. The union of the three search criteria yields 4370 patent applications in EPO, but the intersection yields only one patent.⁷ The largest similarity across methods is obtained when SET A and SET B are

⁵ For European firms we considered only NAICS 523110 because the other NAICS related to market of financial services are characterized by the presence of many holding companies of large industrial groups.

⁶ In the next version of this paper, Set C will be modified to include all the class/subclass areas where the chosen set of “pure play” firms patent, as in Graham and Mowery (2004).

⁷ The patent is EPO publication number EP1111559, issued to Checkfree Services Corporation, entitled “Securing electronic transactions over public networks,” publication date 27 June 2001.

taken together, yielding an intersection of about 217 patents (which account for 16.1% of patents in SET A and 7.7% in SET B). Moreover, there is a very small intersection between SET C and the other two sets. This evidence points to the fact that the three search methods may include patents unrelated to financial innovations, and also that most of these patents are not held by pure play firms.

Hence, to minimize the number of false positives (Type I error) at this preliminary stage of the analysis, we analyzed the text of the titles and abstracts of the selected patents and restricted our sample only to patent documents having as words or sub-words (e.g., wallet in electronic-wallet) at least one these keywords: transaction, financial, credit, payment, money, debit card, portfolio, and wallet.⁸

After this further refining of financial patent definition, our sample was reduced to about 1,225 patent applications at the EPO (see Table 2). This constitutes the final set of financial patents. Table 2 shows a greater similarity across the results obtained with the three different definitions.

Table 2: Including financial keywords in the title and abstract

	<i>SET A</i>	<i>SET B</i>	<i>SET C</i>
<i>SET A</i>	362	119	4
<i>SET B</i>	119	944	4
<i>SET C</i>	4	4	45

Source: Our elaborations using USPTO and EPO datasets

2.1 Aggregate trends

The trends of annual and cumulative patenting at the USPTO and EPO are displayed in Figures 1 and 2 respectively, with each series normalized to unity in 1991. Five series are shown in each figure: aggregate EPO and USPTO patenting, EPO and USPTO financial patenting, and USPTO business method patenting.⁹ Note that prior to 1991 the trends in all

⁸ In a revised version of this study we will conduct a deeper examination of patent text in order to fully assess the validity of the definitions suggested.

⁹ The precise definitions of the series shown are the following: All EP patents – patent applications to the EPO; all US patents: patent grants by the; EP financial patents – the union of sets A, B, and C; US financial patents - the union of the sets defined by Hall (2007) and Lerner (2006); US business methods patents – all USPTO patents having at least one US patent class equal to 705 or 902. All series are shown by priority year or application year if the priority year is not available.

patents and financial patents are very similar. The growth of EP financial patenting follows the growth of US financial patents and US business methods patents (class 705 and 902) closely, although the latter two sets accelerate more rapidly in 1999 and 2000. Relative to overall patenting activity financial patents show a very rapid acceleration in the years 1994 and 1995, which are the years of the main software patentability decisions in the U.S., and also the years during which use of the internet took off in that country. Roughly speaking both in the EPO and USPTO, by 2006, there were three times as many patents as in 1991 overall, and six times as many financial patents.¹⁰

[Figure 1 about here]

[Figure 2 about here]

Note also that at the end of the period (after about 2001), there is a substantial falling off in all types of patents, due to the lag between priority year and publication (at the EPO) or grant (at the USPTO). Nevertheless, there also appears to be real decline in the growth rate of patent applications at both offices.

3. Which firms take out financial patents?

This section describes the characteristics of the patentees who take out financial patents at the EPO, using the combined definition of sets A, B, and C described above.¹¹ We look at the following characteristics: country of origin (Table 3), business sector (Table 4), size of firm (Table 5), size and age of firm (Table 6) and sector and age of firm (Table 7). We also present a list of the 50 largest financial patenters in Table 8 and discuss their profile.

Table 3 shows that a large share of EP financial patents are filed by US applicants (48% versus 36% for European patentees and 13% for Japanese patentees). This distribution is clearly more asymmetric in favor of US applicants than overall patenting activity or even patenting in Information and Communication Technologies (ICT) at the EPO (see *Patent Compendium*, OECD 2008). The persistent large share of US assignees probably reflects the

¹⁰ It is difficult to be completely precise, as the EPO data is based on applications, and the USPTO data on granted patents by date of first priority.

¹¹ There are a total of 1174 patents in our sample after excluding those granted so recently that we do not have all the data for them yet. Of these, about 70 have more than one applicant (in a few cases more than two). In Tables 4 and 5 we have included all the applicants, so the total number of observations is 1261. In Tables 6-9 we included only those applicants that were in the business sector, excluding individuals and government applicants, for a total number of observations equal to 1090, corresponding to 1039 patent documents.

differences in the treatment of financial and business method patents between the US patent system and other systems. Another plausible explanation is the high intensity of financial innovations in the US economy vis-à-vis other economies.

The share of financial patents held by US patentees rose during the 1990s and then fell somewhat after that as European applicants increased their share. About two-thirds of European-owned financial patents come from the largest three countries, the UK, Germany, and France. It is also noteworthy that very few of these patents come from firms outside the US, EU, and Japan.

[Table 3 about here]

Table 4 depicts the distribution of financial patents by the main activity of the patentee. We used different sources to identify the main activity of the applicant, successfully obtaining this information for about 97% of the financial patents.¹² There is a very high concentration of patents in a few sectors: in particular, only six sectors account for about 65% of the financial patents overall, with four of them being services – software, financial services, telecommunications, and other business services – and the remaining computer-related hardware. This is in line with the concentration of software patents reported by Hall, Thoma and Torrisi (2007).

The concentration of patents in these six sectors is higher in the US than in the EU. Moreover, the two leading sectors in Europe differ significantly from the ones in the US: in the former case telecommunication firms and producers of communications equipment are responsible for 39% of the business sector financial patents, whereas in the US firms in the software and financial sectors hold 55% of them. In Europe, firms in the financial sector account for only 9.8% of business sector financial patents. The differences in distribution doubtless reflects the strength of the telecommunications sector relative to the software and computing sector in Europe vis-à-vis the US.

[Table 4 about here]

Figure 3 shows the time pattern of patenting for the top 6 sectors and the aggregate for the remaining business sectors. Prior to 1994/1995 there was little patenting in this area. After the U. S. Court of Appeals of the Federal Circuit (the CAFC) removed the restriction on

¹² In particular, we used Amadeus for European firms, Hoover's and Who Own Whom for US companies, Jade for Japanese firms, and company's websites for all the other firms.

patentability of software as such in 1995 and then again after the State Street decision in 1998, there were spikes in financial patent applications, the first due to computer hardware, telecommunications, and other business sectors, and the second mostly from computer hardware and finance and insurance. Between 1993 and 1998 average annual patenting in this technology jumped from 20 patents per year to 100 patents per year. However, in the period after 2000 the growth appears to have moderated somewhat and a higher share come from software and finance/insurance firms.

[Figure 3 about here]

Another important dimension of industrial dynamics is firm size.¹³ Table 5 shows that the majority of financial patents are obtained by large patentees: however their role decreased somewhat after 1999 in favor of the small-sized firms. Moreover, the small patentees are concentrated in a few sectors. Indeed, about 78% of the financial patents held by small sized firms are held by firm in three service sectors – software, financial and other business services – whereas these sectors account for less than half (40%) of patents filed by large firms.

[Table 5 about here]

The small patentees operating in the service sectors are also new firms: firms born after year 1995 account for about 75% of the financial patents by small patentees, whereas their role in the overall patenting is minimal. In contrast, the great majority of patents held by large firms are held by firms that were founded prior to 1970, as one might expect.

[Table 6 about here]

Typically the emergence of the smaller firms active in financial patenting is associated with the advent of the so-called Internet economy. Their business models often rely on licensing transactions and financial models embodied in a software application that uses non-exclusive technology contracts. This can be seen in Table 7, where firms founded after 1990 that take out financial patents are more likely to be found in the service sector. In contrast, a large share of the communication equipment and telecommunications firms that have financial patents were born during the 1981-1990 period with the advent of wireless and cell telephony.

¹³ For firm size, we used three categories that are compatible with the definition given by the European Network for SME research (ENSR) of EC SME observatory: i) small, having 1-49 employees; ii) medium, having 50-249 employees; iii) large, having more than 249 employees.

[Table 7 about here]

A higher propensity to patent is consistent with the active participation in technology markets, where IP protection of the goods being traded is important. Ongoing research has not yet reached a definitive conclusion on the sustainability in the long run of such business strategy. However, the development of specialized technology providers in the financial area could be considered a quintessential example of the vertical disintegration that takes place when ownership of innovation assets becomes available (Arora *et al.* 2007). Some examples can be found in Table 8, where we show the approximately 50 largest patenters in our sample. Although the majority of firms listed are old and large firms, a few new entrants such as Bitwallet (electronic money service provider in Japan), Orbis Patents (patent holding company in Ireland), Trintech (transaction software provider in Ireland) and Contentguard (DRM technology in the US) can be seen.

[Table 8 about here]

4. Analysis of patent documents

In this section the characteristics of financial patents are compared with other business methods patents and also with total patents at the EPO, in order to explore potential differences regarding the prior art base and possibly the economic value of the two kinds of patenting.

To identify a representative comparison set of business methods patents in EPO we adopted an approach similar to Wagner (2008). First, as described previously, we found the patents related to business methods in USPTO by including those patents having at least one technological class 705 and/or 902. So doing we found 18,244 documents, reduced to 8,695 US patents after excluding those related to financial patents as defined by Hall (2007) and Lerner (2006). Using these patents, we retrieved all the EPO equivalents obtaining a subset of 1,232 business methods patents. To form a comparison group of all patents we took a random 0.1% sample of the EPO database (excluding business method and financial patents), obtaining 1,828 patents.

Because most of the variables we consider will vary systematically over time, and because financial and business method patents are disproportionately represented in the later years, we normalized each of the variables by its overall year mean before performing the tests for differences between the two samples. Tables 9 and 10 show the results of our analysis: Table 9 contains some simple statistics on the unadjusted data for the three sets of patents, and

Table 10 some tests of equality across the distributions. We show both a conventional two-sample t-test for differences in the mean that allows the samples to have different variances, and the Kruskal-Wallis non-parametric test for differences in the distribution. Because the data are skew and can have very different variances across the three groups, occasionally the t-test accepts when the non-parametric test rejects.

The upper panels of Tables 9 and 10 reports some measures of the prior art base for the three sets of patents. The EPO financial patents differ significantly from the other business methods patents in almost all dimensions: fewer references to the non-patent literature, more backward citations to other patents as well as more X or Y backward citations.¹⁴ While non-patent references have been positively associated with indicators of patent value, contrasting evidence exists regarding backward citations. On the one hand a higher number of citations may indicate that the patent relies on a broader knowledge base and hence is more important; on the other hand, it may suggest that the patent is more derivative in its nature or that it is in a crowded technological area and so has narrow breadth. Our indicators suggest that financial patents rely to a lesser extent on non-patent prior art than business method patents but the same amount as other patents, and also that they cite more patents than either business method or other patents. They are cited more slowly than business method patents (after about 60.5 months against 53.7 months), and more quickly than patents as a whole (66.6 months). Note that in many ways financial patents are more similar to other patents than to other business method patents.

[Tables 9 and 10 about here]

The lower panel of Tables 9 and 10 shows some indicators that are commonly associated with patent value: the number of IPCs in which the patent is classified, the number of patents in the rest of the world with the same priority date (the number of equivalents), the number of countries in which coverage was requested at the EPO, the number of citations received by the patent in the first three years after grant, the number of divisionals (continuations) at the EPO associated with the patent, and the number of inventors on the patent document.

¹⁴ In the EPO the task of the examiner consists not only in the identification of patent documents that can be considered prior art for a given patent application, but also in the classification of the prior art patent(s) by degree of importance to that patent application. The categories X and Y signal that at least one claim of the patent application overlaps completely or partially with at least one claim of the prior art patent(s). Other categories are possible and this set of information is articulated in the so called “Search Report”.

The typical business method patent has slightly more inventors than the typical financial patent (2.8 versus 2.5), but financial patents are not significantly different from other patents. Family sizes do not differ much at all across the three groups and continuations differ in distribution when adjusted by the priority year, but not by mean. Other measures of private value – such as the number of designated countries and the number of citations in the first three years – show that financial patents are ranked somewhat higher than the other business method patents and very significantly higher than all other patents. However the composite index of family size, citations, and the number of IPCs does not differ across the groups, probably because it has very high variance within each group.¹⁵ Note that the higher rate at which these patents are cited may indicate higher social economic value as well as higher private value.

Financial patents are classified into significantly more IPC classes than the other business method patents and significantly fewer than all patents. This is a bit surprising, since business methods and software inventions are excluded from the patentability ‘as such’ in EPO according to art. 52 of the statute, and hence there is a lack in EPO of a clear technological classification regarding this type of patenting; nevertheless, this seems to lead the examiner to place the patent in fewer rather than more classes.

4.1 Outcomes at the EPO

Most of the analysis in this paper is based on the published patent documents on the EPO website. These documents are patent applications that may ultimately be rejected, withdrawn, or granted by the EPO. One indicator of the “quality” or eligibility of these financial inventions for patenting is their experience in the EPO examining and granting process. In Table 11, we show some simple statistics on this question for our three groups of patents.¹⁶ The first question is whether a decision has yet been rendered by the EPO. For three quarters of all patents, the answer is yes, but for financial and business method patents, there are somewhat fewer decisions, probably because their applications are somewhat newer.

¹⁵ The composite value index described in Hall, Thoma and Torrisi (2007) uses the factor analysis to build a synthetic measure from three patent indicators, such as family size, forward citations, and the number of IPC classes at 8 digits level. This composite index revealed to be predictive of the market value of the firm after controlling for several other variables in a sample representing about 1000 largest R&D doers across European publicly listed firms. The index draws on a methodology first adopted by Lanjouw and Schankerman (2004).

¹⁶ For this table, it was feasible to use all patents to compute the shares rather than a sample of patents.

The possible outcomes for an application are that it is granted, that the EPO refuses it, or that the applicant withdraws it after negotiation with the EPO. The decision to withdraw a patent application can often be considered equivalent to having received a rejection. In this way, the patentee can preempt a potential rejection decision of the examiner after the dispatch of the results of the examination process (Van Pottelsberghe de la Potterie and Lazaridis, 2007). Table 11 shows clearly that conditional on a decision having been reached, financial patents are far less likely to be granted than either business method or other patents, indicating that the EPO is finding these applications unpatentable more often than other patents, which is probably related to the subject matter restriction of art. 52.

[Table 11 about here]

The final step in the EPO process before the patent becomes a set of national patent rights that can be enforced in national courts is the 9 month post-grant window during which any third party may file an opposition against the patent showing that it should not have been granted. The overall rate at the EPO for opposition during the 1978-2005 period is about eight per cent, but financial patents have been opposed 12 per cent of the time, and business method patents 16 per cent of the time. However, when the 1978-2000 period¹⁷ is broken down into three periods corresponding roughly to changes in the patenting regime, we find that in the most recent period financial and business method patents have been opposed with roughly the same frequency as patents overall.

4.2 Exploring the determinants of EPO outcomes

In order to disentangle how the characteristics of the patentee and the invention impact on the variability of the outcomes described in the previous section, we estimated a series of probit equations for the probability of a decision conditional on an application, a grant conditional on a decision, and opposition conditional on a grant. Controlling for average differences across time, the decision variable could be considered an indicator of quality of the original application and the speed with which the patentee pursues the application. The grant is first and foremost an indicator of invention quality, and also of whether it is viewed as satisfying the subject matter restrictions. Finally, opposition has been shown repeatedly to be an

¹⁷ These periods are based on priority years, so there are too few granted patents in 2001-2005 to see much in the way of opposition. We therefore ended the detailed analysis at 2000.

indicator of the economic value and importance of the patented invention (Harhoff et al. 2003, Harhoff and Reitzig 2004).

The explanatory variables for these equations are in two sets, those associated with the patent owner, and those associated with the patent. The first group are the following:

- Log stock of EP patents of the patentee (depreciated at 15% annual rate)
- Log stock of XY backward citations by EP patents of the patentee (depreciated at 15% annual rate)
- Log stock of cite-weighted EP patents of the patentee (depreciated at 15% annual rate, first 3 years only), normalized by the stock of patents
- Size of the patentee (small, medium, large)
- Age of the patentee (3 dummies for firms that were founded prior to 1981, between 1981 and 1995, and after 1995). Preliminary explorations showed including a more detailed set of dummies lowered precision but did not change the results.
- Sector of the patentee (7 dummies for the 6 leading sectors plus the remainder)
- Country of the patentee (6 dummies for US, Japan, Germany, France, the UK, and the remainder)

The patent characteristics included are the following:

- Total backward cites in the patent document
- XY backward cites in the patent document
- Forward cites received by the patent in the first 3 years
- Log number of inventors listed on the patent, as a proxy for the intensity of R&D expenditures supporting the inventive project that has generated the patents.
- Log number of designated states for the patent at the EPO
- Priority year dummies: we used the five year time intervals discussed by Wagner (2008); preliminary explorations showed that the years 1978-1985 could be collapsed together.

163 (15 per cent) of the financial patents were taken out by individuals and governments and have been excluded from the analysis. The remaining sample consists of 1,041 patent applications corresponding to 407 patentees that have priority year 2005 or earlier. 292

patentees (70 per cent) have applied for only one financial patent at the EPO, while one (Citicorp) has applied for 40.

The results of this analysis are presented in Tables 12a (all variables included in the regressions) and 12b (only significant sets of the variables included in the regressions). Three probit regressions are presented in each table: 1) predicting the 692 decisions on the 1041 applications; 2) predicting the 320 grants that emerge from those decisions; and 3) predicting the 38 oppositions filed against the 303 grants that have priority year 2000 or earlier.¹⁸ All standard errors in these tables have been clustered by patent owner, although this makes relatively little difference to their estimates.

Turning first to the probability of obtaining a decision on patentability at the EPO, controlling for priority year the most important predictors among the owner characteristics are the quality of the firm's prior inventions as proxied by average citations per patent, whether the firm is German (positive) or Japanese (negative). A patent with more inventors or more designated states is less likely to have received a decision, which suggests that more valuable financial patents that have more resources behind them take longer to issue or be rejected, other things equal. This may reflect the applicant's willingness to extend the process at the EPO when more is at stake. Note that size, age, and sector of patentee do not seem to matter for receiving a decision, which is somewhat encouraging.

Once a decision has been reached, however, the probability of grant is more affected by the characteristics of the patent owner. Although size of firm does not matter in the presence of the size of the firm's patent portfolio, sector, country and to a lesser extent age do matter. Experience matters: a doubling of the firm's patent portfolio is associated with a 10 per cent increment in the probability that a financial patent is granted. Firms in software, telecommunications, and computing equipment experience a higher probability of receiving a financial patent grant than firms in finance, insurance, or other business sectors. This may reflect the nature of the patent applications in different sectors: those in the ICT sectors are more likely to be for the kinds of software-hardware combinations that are viewed as patentable subject matter by the EPO.

¹⁸ There are no oppositions for the grants of patents with priority year after 2000, so we excluded those years from the analysis in the last column (17 observations).

US patent owners (who presumably are more likely to have patent applications outside the art. 52 restrictions but acceptable to the USPTO) are 18 per cent less likely to receive a grant of their financial patent application. Looking at the patent characteristics themselves, more inventors and more designated states increase the likelihood of a grant once a decision has been reached, even if they delay the decision. Again, this is consistent with greater effort by the patentee when more is at stake.

The final column reports on the predictors of opposition conditional on grant. Unfortunately, the sample size is fairly small and the results therefore somewhat weaker than some of those in the literature. It is noteworthy that patent owner characteristics do not predict the probability that a particular patent is opposed, with the possible exception of the firm's stock of previous X or Y backward citations. That is, firms that have patents in a crowded space that have possibly low inventive steps are less likely to find their patents opposed. These are probably firms operating in technological areas where mutual blocking is common and where the cross-licensing solution is used, so that opposition is a less useful strategy (Hall and Ziedonis 2001, von Graevenitz *et al.* 2008). Note however, that if the patent in question has X or Y backward cites, it is more likely to be opposed, probably because there is some controversy over the extent of the inventive step above a competitor's patent. An additional X or Y cite adds 2.5 per cent to the probability that a patent will be opposed. Finally, as others have found before us, more highly cited patents are more likely to be opposed; both variables have been shown repeatedly to be value indicators and financial patents are no exceptions.

[Tables 12a and b about here]

In future research we will also analyze some further indicators of patent value, such as the presence of forward XY citations, and the composite value index developed by Hall, Thoma, and Torrisi (2007) based on work by Lanjouw and Schankerman (2004) using US data. A first look at the HTT index shows that the stock of the XY backward cites has a negative impact on the index, whereas the patent stock has a positive impact, although the two effects are small. Financial patents by small sized patentees have a higher value with a statistically confidence of 10 % level. In future research we will analyze the determinants of the HTT index more thoroughly.

5. Licensing of financial innovations

As we discussed previously the financial payment industry has seen a proliferation of specialized technology providers of payment systems and their components. In this section

we report on some individual case studies in order to explore the market for payment systems technology the business models of these firms further.

To identify the licensing strategies of the financial patentees we searched their websites, along with Google and Reuters newswires for the keyword “license” and analyzed the pages retrieved. Often these documents are very rich, including business and demographic information both for the licensor and the licensee. Table 13 shows the year of first license, major industries served and the type of technology contract for about 30 patentees randomly chosen from those that have licensed out at least once.¹⁹

[Table 13 about here]

The table shows that the participation of financial patentees in technology licensing has increased in the second half of the 1990s. This trend is associated with at least three different interrelated phenomena. First, the advent and exponential diffusion of Internet that propelled the emergence and development of digital market places and e-commerce that have been demanding secure and effective modes of payments since their inception. Secondly, in the same period we have witnessed the acceleration of financial patent applications following the decision of USPTO to allow the full patentability of business methods. Thirdly, the overall growth of markets for technology has been substantial in those years from about 50 billion USD in 1995 to about 80 billion USD in 2002 at the worldwide level, with a cumulated average growth rate of about seven per cent.²⁰

The submarkets for financial innovations are mainly twofold. First we have the producers of computers and wired and wireless communication equipment such as Infineon, NEC, Sharp, Nokia, Ericson, etc. Some estimates claim that the global mobile commerce revenue will more than double from \$24.1 billion in 2006 to \$54.6 billion in 2008. Within that figure, contactless mobile commerce revenue has been estimated to account for \$1.4 billion in 2006 and increase to \$6.0 billion in 2008.²¹ In this segment the commercialization of payment

¹⁹ Starting with the 251 patentees in the software, finance and insurance, and other business services sectors, we sampled 151 randomly and found that 30 of them had at least one technology license, for a licensing rate of 20 per cent.

So 20% say that have licensed or they are under negotiation to license.

²⁰ See Arora et al (2007) who constructed these kinds of data by integrating different sources.

²¹ Source Global research and consulting firm, Celent, LLC,
<http://ir.firstdatacorp.com/news/releasedetail.cfm?ReleaseID=234708>

technologies concern secure methods of identification technologies, such as smart cards, encryption methods, PIN codes, etc. One example is given by INNOVATRON, which offers a smartcard technology to computer equipment producers, enabling its use through a contactless communication interface, particularly suitable for public transport applications. Another example is Contentguard who has filed several hundred patents in the context of remote digital content management.

Another important market segment is financial services, which have licensed innovative payment methods such as prepaid cards, digital money, virtual wallets, electronic billing etc. Often the payment technology is embedded in a software application that can ease the implementation by the financial firms.²² One example is CyberSource, which offers software solutions of eCommerce Payment Management; in addition to software applications, CyberSource supplies customized support and services for the implementation of the payment services.

Note that the use of exclusive contracts is more widespread across the financial services segment than for the computer and communication equipment. This difference can be explained by the fact that the adoption of new forms of payment can be a competitive advantage for the financial services firms whereas the hardware is more commodity-like. In the segment of computer and communication equipment there is greater variation in technology contracts. Indeed when technologies are characterized by different level of generality, the licensor should choose the form of contract that maximizes its payoff. When the licensor holds a sufficient general technology, even a low share of royalties coming from non-exclusive contracts can ensure significant profits (see the study of Gambardella and Giarratana (2008) regarding the software encryption industry).

In our future research we will collect more detailed information on a representative sample of specialized technology providers with the aim of finding data on the price of technological deals. This would contribute to our further validate our preliminary findings on the economic (private) value of financial patents.

²² A similar pattern can be found in another sector such biotechnology, where specialized technology firms embody generic compound in a tool that can enable large pharma firms to do research in the area.

6. Conclusions

We have analyzed financial patents in the European Patent Office. To our knowledge, this is among the first studies exploring this component of business methods patents based on European data. This paper draws on earlier studies on USPTO patents and proposes a new definition of financial patents. Although in the EPO system software ‘as such’ and business methods are excluded from the patentable subject matter, we found a substantial number of such patents in the European system. Clearly, to be patented at the EPO these inventions should yield some technical effects and some financial inventions like payment technologies indeed have links with electronic (hardware) devices, such as a wireless systems. However, it is often difficult to establish a clear border between patentable inventions and business methods.

Our preliminary investigation shows that financial patents are different from other business methods on several grounds such as references to non-patent literature (NPL) and backward citations to other patents. The differences with other patents are less marked when we look at various indicators of prior art contained in financial patents. However, both financial and business method patents have higher opposition rates vis-à-vis all patents and this may be due to a higher uncertainty surrounding these subject matters especially in Europe. Moreover, compared with other patents, the average financial patent has a number of Designated Countries and receives a number of citations larger than other business method patents and very significantly higher than all other patents.

Then we have explored the characteristics of financial patentees. First, firms from few sectors (computers, telecommunication equipment, finance and insurance, and software) account for the bulk of financial patents. Second, large firms maintain a large, albeit declining share of these patents while small, young firms have a smaller, but rising share of these patents. Small firms include some specialized technology firms whose business model is largely based on technology licensing.

Finally we have also analyzed how the main characteristics of the patentee and the invention impact on the outcome of the examiner’s decision and the probability of receiving an opposition. First we find that the probability of grant for financial patent applications – rather than reject (by the EPO) or withdrawal (by the applicant) – is influenced by the owner’s stock of EPO patents and other assignees’ characteristics such as sector and country of origin, whereas indicators at the individual patent level do suggest that inventions that have required

a larger inventive effort are associated with a higher probability of grant. In the case of the opposition to a financial patent we show that patent value indicators at the invention level reveal to be predictive of the decision. At the owner's portfolio level we find that applicants operating in a crowded technological space – as proxied by counts of XY citations – reduce the probability of an opposition. This suggests that an opposition is often considered a less optimal choice when other strategies are available (e.g. cross-licensing).

In summary, the explosion of patents in this field then produces contrasting effects. On the one side, more business method and financial patents induce more oppositions (and probably a greater deal of litigations) and strategic patenting by large established firms. On the other side, financial patents opens up new windows of opportunities for specialized technology firms. This trend is similar to what happens in other sectors like security software and semiconductors. In our future research we will explore more thoroughly the differences between financial patents by different types of firms. Moreover, we will examine the differences in patent exploitation strategies between specialized technology firms and vertically integrated firms. Our preliminary analysis shows that specialized technological firms are heavily involved in licensing out of financial patents.

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Appendix on Data and Sources

In this work we based our analysis on multiple sources.

The identification of financial patents based on ECLA codes and keywords has been done using the on-line database ESPACE. Bibliographic data on EPO patents has been extracted from EPO-OECD PATSTAT database version October 2007, whereas information on oppositions from EPOLINE files.

Regarding information on patent owners we used different company directories: Amadeus for European companies; Compustat for North American firms; Jade for Japanese and Who Owns Whom for all the others. When complemented these source with information from companies' websites.

For the licensing agreements we used Reuters, Google Wires, Factiva, Lexis-Nexis, and again companies' websites.

Appendix 1 Subclasses in Class 705 and 902

Financial patent	US class	US subclass	subclass description	US patents	correspondent IPC
	705	overall	<i>DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION</i> AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE	16868	
	705	1	OR MANAGEMENT ARRANGEMENT	1815	G06Q/10/00; G06Q/30/00
	705	2	Health care management (e.g., record management, ICDA billing)	589	G06Q/10/00; G06Q/50/00
	705	3	Patient record management	495	A61B/5/00; G06F/19/00
Lerner (2006)	705	4	Insurance (e.g., computer implemented system or method for writing insurance policy, processing insurance claim, etc.)	388	G06Q/40/00
	705	5	Reservation, check-in, or booking display for reserved space	362	G06Q/10/00
	705	6	Coordination of plural reservations (e.g., plural trip segments; transportation and accommodation, etc.)	167	G01C/21/34; G01C/21/36
	705	7	Operations research	852	G06F/9/44; G06F/17/50
	705	8	Allocating resources or scheduling for an administrative function	1035	G05B/19/418; G06F/9/46
	705	9	Staff scheduling or task assignment	560	G06F/9/46; G06F/15/02
	705	10	Market analysis, demand forecasting or surveying	1058	G06F/17/30; G07G/1/00
	705	11	Job performance analysis	260	G06F/11/34; H04M/3/51
	705	12	Voting or election arrangement	109	G06F/11/00; G07C/13/00
	705	13	Transportation facility access (e.g., fare, toll, parking)	204	G07B/15/00; G07B/15/02
			Distribution or redemption of coupon, or incentive or promotion program		
Hall (2007)	705	14		1373	G06Q/30/00; G07G/1/14
	705	15	Restaurant or bar	119	G06Q/30/00; G06Q/50/00
Hall (2007)	705	16	Including point of sale terminal or electronic cash register	491	G06Q/20/00; G06G/1/12
			Having interface for record bearing medium or carrier for electronic funds		
Hall (2007)	705	17	transfer or payment credit	213	G06Q/20/00; G06G/1/12
Hall (2007)	705	18	Having security or user identification provision (password entry, etc.)	163	G06Q/20/00; G06G/1/12
	705	19	Tax processing	50	G06Q/20/00; G06G/1/12
	705	20	Price look-up processing (e.g., updating)	207	G06Q/20/00; G06G/1/12
			Interconnection or interaction of plural electronic cash registers (ECRs) or to host computer (e.g., network detail, transfer of information from host to		
Hall (2007)	705	21	ECR or from ECR to ECR, etc.)	243	G06G/1/12; G06Q/20/00
	705	22	Inventory monitoring	292	G06G/1/14; G06Q/20/00
	705	23	Input by product or record sensing (weighing, scanner processing)	146	G06Q/20/00; G07G/1/12
			Specified transaction journal output feature (e.g., printed receipt, voice		
	705	24	output, etc.)	133	G07G/1/12; G07G/5/00
	705	25	Specified keyboard feature	52	G07G/1/10; G07G/1/12
	705	26	Electronic shopping (e.g., remote ordering)	2446	G06Q/30/00; G06F/17/30

			Presentation of image or description of sales item (e.g., electronic catalog browsing)	1149	G06F/17/30; G07F/7/00
	705	27			
	705	28	Inventory management	813	G06Q/10/00; A01K/5/02
	705	29	Itemization of parts, supplies, or services (e.g., bill of materials)	267	A01K/5/02; G06F/17/50
	705	30	Accounting	417	G07B/17/00; G07F/19/00
	705	31	Tax preparation or submission	90	G06F/17/22; G07F/19/00
	705	32	Time accounting (time and attendance, monitoring billable hours)	132	G06F/15/02; G07C/1/10
Hall (2007)	705	33	Checkbook balancing, updating or printing arrangement	51	G07F/7/10; G07F/19/00
	705	34	Bill preparation	255	G07F/19/00; H04M/15/00
Lerner (2006)	705	35	Finance (e.g., banking, investment or credit)	1264	G06Q/40/00; H04K/1/00
Lerner (2006)	705	36R	Portfolio selection, planning or analysis	524	G06Q/40/00; H04K/1/00
Lerner (2006)	705	36T	Tax strategies	68	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	37	Trading, matching, or bidding	1022	G06Q/40/00; H04K/1/00
Lerner (2006)	705	38	Credit (risk) processing or loan processing (e.g., mortgage)	514	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	39	Including funds transfer or credit transaction	782	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	40	Bill distribution or payment	572	G06Q/40/00; H04K/1/00
			Having programming of a portable memory device (e.g., IC card, "electronic purse")	349	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	41			
Hall (2007); Lerner (2006)	705	42	Remote banking (e.g., home banking)	256	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	43	Including Automatic Teller Machine (i.e., ATM)	310	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	44	Requiring authorization or authentication	464	G06Q/40/00; H04K/1/00
Hall (2007); Lerner (2006)	705	45	With paper check handling	184	G06Q/40/00; H04K/1/00
	705	50	BUSINESS PROCESSING USING CRYPTOGRAPHY	363	H04K/1/00; H04L/9/00
	705	51	Usage protection of distributed data files	931	H04K/1/00; H04L/9/00
	705	52	Usage or charge determination	425	H04K/1/00; H04L/9/00
			Including third party for collecting or distributing payment (e.g., clearinghouse)	205	H04K/1/00; H04L/9/00
Hall (2007)	705	53			
			Adding plural layers of rights or limitations by other than the original producer	228	H04K/1/00; H04L/9/00
Hall (2007)	705	54			
Hall (2007)	705	55	Requiring a supplemental attachment or input (e.g., dongle) to open	153	H04K/1/00; H04L/9/00
Hall (2007)	705	56	Specific computer ID (e.g., serial number, configuration, etc.)	187	H04K/1/00; H04L/9/00
	705	57	Copy protection or prevention	669	H04K/1/00; H04L/9/00
	705	58	Having origin or program ID	242	H04K/1/00; H04L/9/00
	705	59	Licensing	447	H04K/1/00; H04L/9/00
	705	60	Postage metering system	174	H04K/1/00; H04L/9/00
Hall (2007)	705	61	Reloading/recharging	45	H04K/1/00; H04L/9/00
	705	62	Having printing detail (e.g., verification of mark)	108	H04K/1/00; H04L/9/00
	705	63	Utility metering system	36	H04K/1/00; H04L/9/00
Hall (2007)	705	64	Secure transaction (e.g., EFT/POS)	445	H04K/1/00; H04L/9/00
Hall (2007)	705	65	Including intelligent token (e.g., electronic purse)	293	H04K/1/00; H04L/9/00

Hall (2007)	705	66	Intelligent token initializing or reloading	118	H04K/1/00; H04L/9/00
Hall (2007)	705	67	Including authentication	407	H04K/1/00; H04L/9/00
Hall (2007)	705	68	Balancing account	55	H04K/1/00; H04L/9/00
Hall (2007)	705	69	Electronic cash detail (e.g., blinded, divisible, or detecting double spending)	93	H04K/1/00; H04L/9/00
Hall (2007)	705	70	Home banking	51	H04K/1/00; H04L/9/00
Hall (2007)	705	71	Including key management	150	H04K/1/00; H04L/9/00
Hall (2007)	705	72	Verifying PIN	157	H04K/1/00; H04L/9/00
Hall (2007)	705	73	Terminal detail (e.g., initializing)	51	H04K/1/00; H04L/9/00
Hall (2007)	705	74	Anonymous user system	112	H04K/1/00; H04L/9/00
Hall (2007)	705	75	Transaction verification	410	H04K/1/00; H04L/9/00
Hall (2007)	705	76	Electronic credential	239	H04K/1/00; H04L/9/00
Hall (2007)	705	77	Including remote charge determination or related payment system	145	H04K/1/00; H04L/9/00
Hall (2007)	705	78	Including third party	166	H04K/1/00; H04L/9/00
Hall (2007)	705	79	Including a payment switch or gateway	79	H04K/1/00; H04L/9/00
	705	80	ELECTRONIC NEGOTIATION	175	H04K/1/00; H04L/9/00
	705	400	FOR COST/PRICE	453	G06F/17/00; G06G/7/00
	705	401	Postage meter system	290	G06F/17/00; G07B/17/02
	705	402	Special service or fee (e.g., discount, surcharge, adjustment, etc.)	84	G06F/17/00; G07B/17/02
	705	403	Recharging	87	G06F/17/00; G07B/17/02
	705	404	Record keeping	101	G06F/17/00; G07B/17/02
	705	405	Data protection	99	G06F/12/14; G06F/12/16
	705	406	With specific mail handling means	137	B65B/35/00; G06F/17/00
	705	407	Including mailed item weight	163	G01G/19/413; G06F/17/00
	705	408	Specific printing	296	G06F/17/00; G07B/17/02
	705	409	Rate updating	39	G06F/17/00; G07B/17/02
	705	410	Specialized function performed	319	G06F/9/00; G06F/17/00
	705	411	Display controlling	36	G07B/17/02; G01R/11/56
	705	412	Utility usage	219	G01R/11/56; G01R/21/133
	705	413	Fluid	87	B67D/5/00; G06F/17/00
	705	414	Weight	60	G01G/19/413; G06F/17/00
	705	415	Correcting or compensating	38	G01G/19/413; G06F/17/00
	705	416	Specific input and output device	50	G01G/19/413; G06F/17/00
	705	417	Distance (e.g., taximeter)	64	G06F/17/00; G07B/13/04
	705	418	Time (e.g., parking meter)	91	G06F/17/00; G07B/15/02
	705	500	MISCELLANEOUS	71	G06F/17/00; G06Q/90/00

Financial patent

US class

subclass

subclass description

US patents

correspondent IPC

902

overall

ELECTRONIC FUNDS TRANSFER

1659

not defined

Lerner (2006)	902	1	WITH ELECTRONIC MEANS PROVIDING SECURITY	49	not defined
Lerner (2006)	902	2	Protects transmitted data (e.g., encryption or decryption)	93	not defined
Lerner (2006)	902	3	Evaluates biometrics	88	not defined
Lerner (2006)	902	4	Means to read data stored on identifier*	124	not defined
Lerner (2006)	902	5	And to verify identity of user*	131	not defined
Lerner (2006)	902	6	Image processor (e.g., video camera)	19	not defined
Lerner (2006)	902	7	Means to identify counterfeit money	61	not defined
			TERMINAL* WITH MEANS PERMITTING DEPOSIT OR		
Lerner (2006)	902	8	WITHDRAWAL (E.G., ATM)	114	not defined
Lerner (2006)	902	9	With secure receptacle (e.g., safe, depository)	90	not defined
Lerner (2006)	902	10	Remote from terminal	28	not defined
Lerner (2006)	902	11	And value discriminator	40	not defined
			Serving as both depository and source for (e.g., note dispensing recycling)		
Lerner (2006)	902	12		77	not defined
Lerner (2006)	902	13	Dispensing (e.g., money cassette)	80	not defined
Lerner (2006)	902	14	With cash dispenser	71	not defined
Lerner (2006)	902	15	Including currency feeder	82	not defined
Lerner (2006)	902	16	Sensitive to erroneous passage of plural bills	50	not defined
Lerner (2006)	902	17	With particular feeder or counter feature	70	not defined
Lerner (2006)	902	18	With printer	57	not defined
Lerner (2006)	902	19	And page turner	8	not defined
Lerner (2006)	902	20	With specific data input means (e.g., keyboard)	46	not defined
Lerner (2006)	902	21	With specific data output means or indicator	43	not defined
			TERMINAL* REGISTERS TRANSACTION* (E.G., POINT OF SALE		
Lerner (2006)	902	22	TERMINAL*)	157	not defined
Lerner (2006)	902	23	FOR ENTERTAINMENT, AMUSEMENT, OR GAMBLING	70	not defined
			FOR USE WITH GENERAL PURPOSE TERMINAL* (E.G., HOME		
Lerner (2006)	902	24	BANKING)	44	not defined
Lerner (2006)	902	25	SPECIFIC IDENTIFIER* (E.G., BANK CARD)	69	not defined
Lerner (2006)	902	26	Including semiconductor chip (e.g., smart card)	175	not defined
Lerner (2006)	902	27	Magnetically encoded	40	not defined
Lerner (2006)	902	28	Designed to resist counterfeiting	17	not defined
Lerner (2006)	902	29	Specific process of manufacture	24	not defined
Lerner (2006)	902	30	SUPPORT OR ENCLOSURE (E.G., KIOSK)	80	not defined
Lerner (2006)	902	31	Selectively prevents access to terminal*	43	not defined
Lerner (2006)	902	32	For plurality of terminals*	13	not defined
Lerner (2006)	902	33	For drive-in installation	18	not defined
Lerner (2006)	902	34	Collapsible	11	not defined
Lerner (2006)	902	35	Accommodates user (i.e., walk-in enclosure)	19	not defined
Lerner (2006)	902	36	PAPER SUPPLY (E.G., RECEIPT)	23	not defined

Lerner (2006)	902	37	SYSTEM*	20	not defined
Lerner (2006)	902	38	Error or fault recovery	27	not defined
Lerner (2006)	902	39	Particular communication feature	85	not defined
Lerner (2006)	902	40	Transaction* processing	75	not defined
Lerner (2006)	902	41	MISCELLANEOUS	6	not defined

Source: <http://www.uspto.gov/go/classification/index.htm>

Notes

Query to retrieve financial patents on the USPTO website

(ccl/705/14 OR ccl/705/16 OR ccl/705/17 OR ccl/705/18 OR ccl/705/21 OR ccl/705/33 OR ccl/705/53 OR ccl/705/54 OR ccl/705/55 OR ccl/705/56 OR ccl/705/61 OR ccl/705/64 OR ccl/705/65 OR ccl/705/66 OR ccl/705/67 OR ccl/705/68 OR ccl/705/69 OR ccl/705/70 OR ccl/705/7\$ OR ccl/705/37 OR ccl/705/39 OR ccl/705/40 OR ccl/705/41 OR ccl/705/42 OR ccl/705/43 OR ccl/705/44 OR ccl/705/45 OR ccl/705/4 OR ccl/705/35 OR ccl/705/36R OR ccl/705/36T OR ccl/705/38 OR ccl/902/\$)

Appendix 2 ECLA codes linked to financial patents in the USPTO

ECLA & Subclass	Description
G06Q20/00 -	Payment schemes, architectures or protocols (apparatus for performing or posting payment transactions)
G06Q20/00K	further characterised by the type of neutral party arbitrating, type of payment circuit used, architecture used, payment model or scheme applied, or details of specific step in the protocol
G06Q20/00K1	involving a neutral party, e.g. certification authority, notary or trusted third party (TTP)
G06Q20/00K2	characterised by the type of payment circuit
G06Q20/00K2B	in a public payment circuit, e.g. standard banking accounts
G06Q20/00K2C	in a private payment circuit, e.g. electronic cash used only among participants of a common payment scheme or inside a defined community, money generated by private organizations
G06Q20/00K3	characterised by the architecture used
G06Q20/00K3A	Electronic funds transfer (EFT) systems; Home banking systems
G06Q20/00K3B	Electronic shopping systems
G06Q20/00K3C	Billing systems
G06Q20/00K3D	Payments settled via telephone service provider
G06Q20/00K3E	Payments for services accessed through systems involving a self- service terminal (SST), a vending machine or a multimedia terminal
G06Q20/00K3F	point-of-sale (POS) network systems (POS per se G07F or G07G)
G06Q20/00K4	characterised by the payment model or scheme
G06Q20/00K4C	Credit card scheme, e.g. pay after
G06Q20/00K4D	Debit scheme, e.g. pay now
G06Q20/00K4P	Pre-payment scheme, e.g. pay before
G06Q20/00K5	characterised by the use of a wireless device
G06Q20/00K6	characterised by details of the protocol
G06Q20/00K6A	Authorisation
G06Q20/00K6C	Confirmation
G06F21/00N9A2P	protecting personal data, e.g. for financial or medical purposes
G07F7/02	by keys or other credit registering devices (for producing a coded signal for use together with coded identity cards G07F7/10)
G07F7/02B	by active credit-registering devices, e.g. counters, memories
G07F7/02C	by means, e.g. cards, comprising cases representing monetary value (for cancelling tickets, see G07B11/11)
G07F7/02D	by cards with numerical value (G07F7/08 takes precedence)
G07F7/02E	by means, e.g. cards, providing billing information at the time of purchase, e.g. identification of seller or purchaser, quantity of goods delivered or to be delivered
G07F7/08	by coded identity card or credit card or other personal identification means (without personal verification means G07F7/02)
G07F7/08B	by passive credit-cards adapted therefore : constructive particularities to avoid counterfeiting, e.g. by inclusion of a physical or chemical security-layer (for security documents see G07D7/00; for the reading of record-carriers in general see G06K7/00; for the design of coded credit-cards see G06K19/10)
G07F7/08C	by active credit-cards adapted therefor (G07F7/10D takes precedence)
G07F7/08C2	Electronic wallets suitable to be connected to similar devices for mutual funds transfer, either with or without a terminal
G07F7/08C2B	with central accounting to keep track of the electronic money in circulation
G07F7/08C2C	the wallets having several accounts
G07F7/08C4	the value being automatically decremented in function of a variable, e.g. time, distance

G07F7/08C6	Systems wherein such cards are used for payment
G07F7/08C8	Separate devices accepting such cards for payment
G07F7/08D	Details or accessories, e.g. reading, decoding, printing of data from the cards (G06K takes precedence)
G07F7/08E	Verification of the card, i.e. checking validity to avoid misuse, e.g. checking expiry date
G07F7/08E2	by comparing with other document or pass, e.g. with a bank-cheque
G07F7/08E4	by mutual comparing codes on the card
G07F7/08F	Account status verification, e.g. checking solvency of the holder (computers adapted for financial accounting G06Q40/00A)
G07F7/08F2	Local credit-checking, e.g. with black-list on tape
G07F7/08F4	Central credit-checking via terminal (G07F7/10 takes precedence)
G07F7/10D	Active credit-cards provided with means to personalise their use, e.g. with PIN-introduction/comparison system
G07F7/10D2	Personalisation or initialisation of card
G07F7/10D2K	with securisation during issuing/transport phase
G07F7/10D2M	for several users, e.g. hierarchical
G07F7/10D2P	by application program downloading (G07F7/10D10M2 takes precedence)
G07F7/10D4	Mutual authentication of card and transaction partner, e.g. terminal, host, other card
G07F7/10D4E	the card having encyphering/decyphering capabilities
G07F7/10D4E2	used for an authentication protocol (means for verifying the identity or authority of the user of a communication system per se H04L9/32)
G07F7/10D4T	with transaction monitoring means, e.g. deriving transaction authentication number; with registration of transaction
G07F7/10D6	Identification of card user
G07F7/10D6F	with means to protect against fraudulent identification attempts, e.g. counter for erroneous PIN-attempts
G07F7/10D6K	by comparing other identifying data with reference data stored in the card chip (G07C9/00B6 takes precedence)
G07F7/10D6P	by PIN check
G07F7/10D8	Independent cards, capable to authorise a transaction without the intervention of a terminal, e.g. by self-checking of user identity or solvency
G07F7/10D8C	Cards only used as intermediate carriers for identification data of user and for transaction data
G07F7/10D8P	Cards combined with portable reader/writer to constitute an independent assembly
G07F7/10D10	Multiple service cards, e.g. for several accounts, applications of the same person, the card to be processed by different terminals/issuers
G07F7/10D10M	with protecting memory zones, assigned to one service, against access (read/write/delete) by terminals of other services (protection against unauthorised access of computer memory areas in general G06F12/14; circuits for protecting data, e.g. PIN, in card G06K19/073)
G07F7/10D10M2	Zone-allocation and setting access conditions of zones
G07F7/10D12	Means to guarantee integrity of card data, not provided for in G07F7/10D2 to G07F7/10D10, e.g. digital signatures, check numbers
G07F7/10D14	Details or accessories concerning data transfer and storing, e.g. error detection, self diagnosis (G06K19/07 takes precedence)
G07F7/10D16	Multiple-card systems, the cards having either different or identical functions
G07F7/10E	Devices and methods for securing the PIN and other transaction-data, e.g. by encryption (arrangements for secret communication, see H04L9/00)

H04L9/32	including means for verifying the identity or authority of a user of the system (computer systems G06F; coin-freed or like apparatus with coded identity card or credit card G07F7/08)
H04L9/32A	involving a third party or a trusted authority
H04L9/32B	using a non-public key algorithm
H04L9/32C	using a zero-knowledge proof
H04L9/32H	using hash functions
H04L9/32M	for message authentication (H04L9/32S takes precedence)
H04L9/32P	involving the concurrent use of a plurality of channels of different nature
H04L9/32R	using challenge-response
H04L9/32R2	for mutual authentication
H04L9/32R4	involving splitting up or repeating the challenge and/or response
H04L9/32S	using electronic signatures
H04L9/32S1	using blind signatures
H04L9/32S3	involving a plurality or a group of signers
H04L9/32S5	with message recovery
H04L9/32S5P	with partial message recovery
H04L9/32T	using time stamps or public key certificates

Appendix 3 Top 15 US and European Pure Play Firms

Company Name	Country	NAICS	US fin pats	EP pats
AUTOMATIC DATA PROCESSING	US	518210	2	0
CERIDIAN CORP	US	541214	8	9
ELECTRONIC DATA SYSTEMS COF	US	541513	197	135
TOTAL SYSTEM SERVICES INC	US	522320	1	0
IDENTIX INC	US	541512	11	11
FIRST DATA CORP	US	518210	55	69
CHECKFREE CORP	US	561990	8	19
VIEWPOINT CORP	US	511210	8	2
STERLING COMMERCE INC	US	511210	18	9
VERISIGN INC	US	511210	10	20
EBAY INC	US	518111	8	37*
BOTTOMLINE TECHNOLOGIES INC	US	511210	2	0
S1 CORP	US	541512	na	0
EFUNDS CORP	US	518210	3	6
METAVANTE CORP	US	514210	1	14
KAPMAN	SE	523110	na	62
ASSA ABLOY IDENTIFICATION	SE	523110	na	24
HBS	FR	523110	na	15
AB CARL MUNTERS	SE	523110	na	9
SOLARONICS	FR	523110	na	8
DE LA RUE INTER	SE	523110	na	6
REBROSKENAN AKTIEBOLAG	SE	523110	na	6
RIOKS PATENTER	SE	523110	na	3
THIBAUT	FR	523110	na	3
LEIGH INTERESTS	GB	523110	na	3
BEHEERS BELEGGINGSMAATSCH.	NL	523110	na	2
MEDIAMETRIE	FR	523110	na	2
GARBAGE GENIE CONCEPT 2000	IE	523110	na	2
NORAM INTERNATIONAL	IE	523110	na	2
DURLIN FRANCE	FR	523110	na	2

Notes: * It includes one patent (EP1366601) reassigned to Ebay 2007/06/20

Figure 1: Aggregate patenting trends by priority year at the EPO and USPTO (base year 1991)

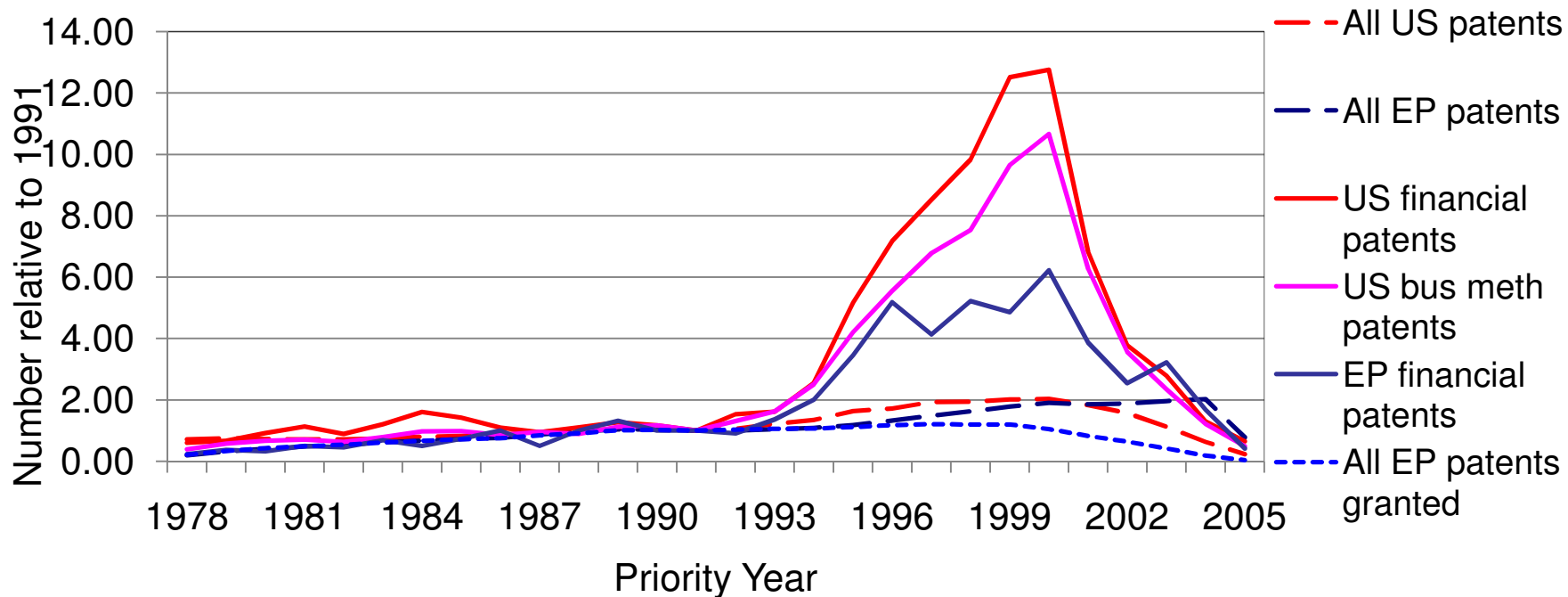


Figure 2: Cumulative EP and US patenting by year
(base year 1991)

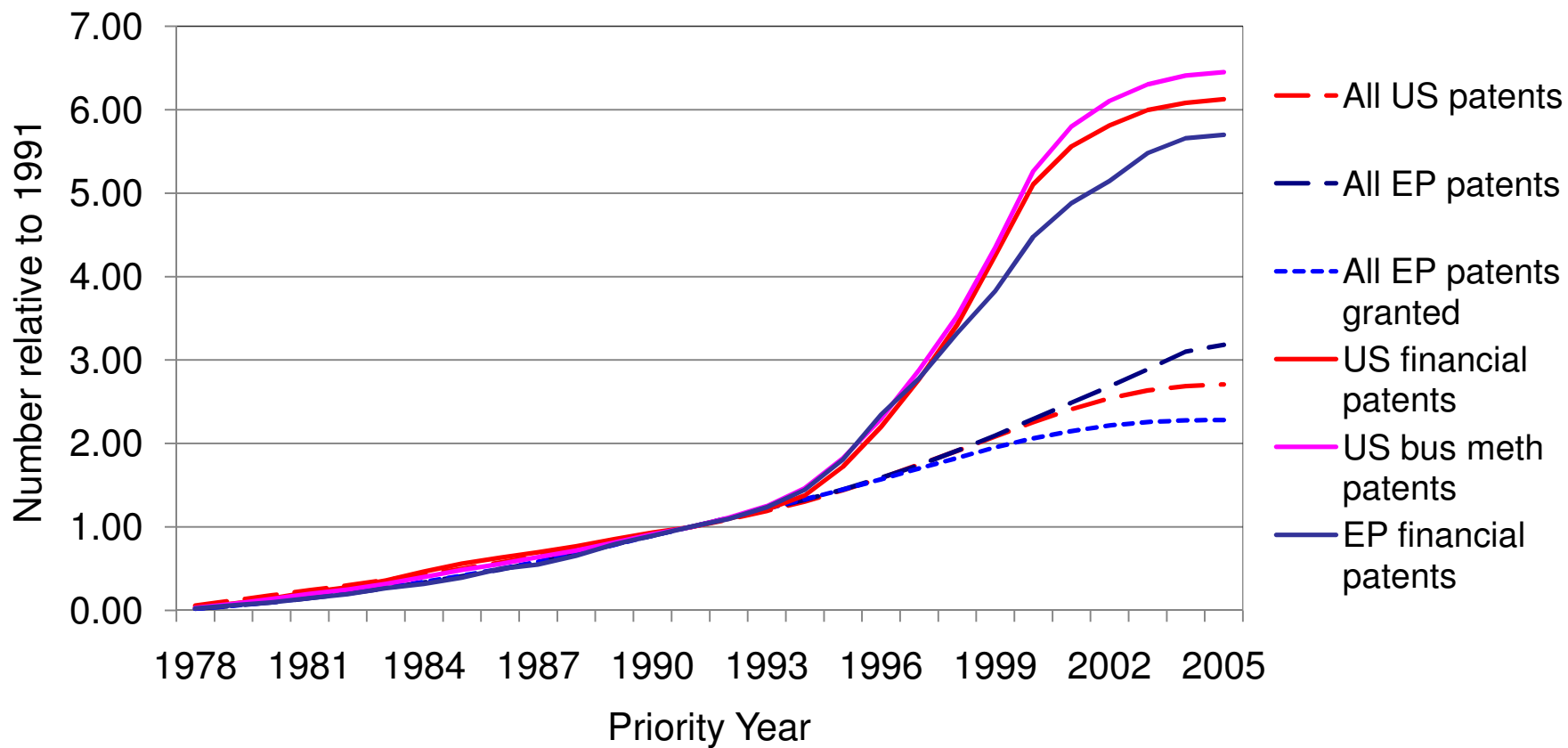


Figure 3: Financial patenting by sector

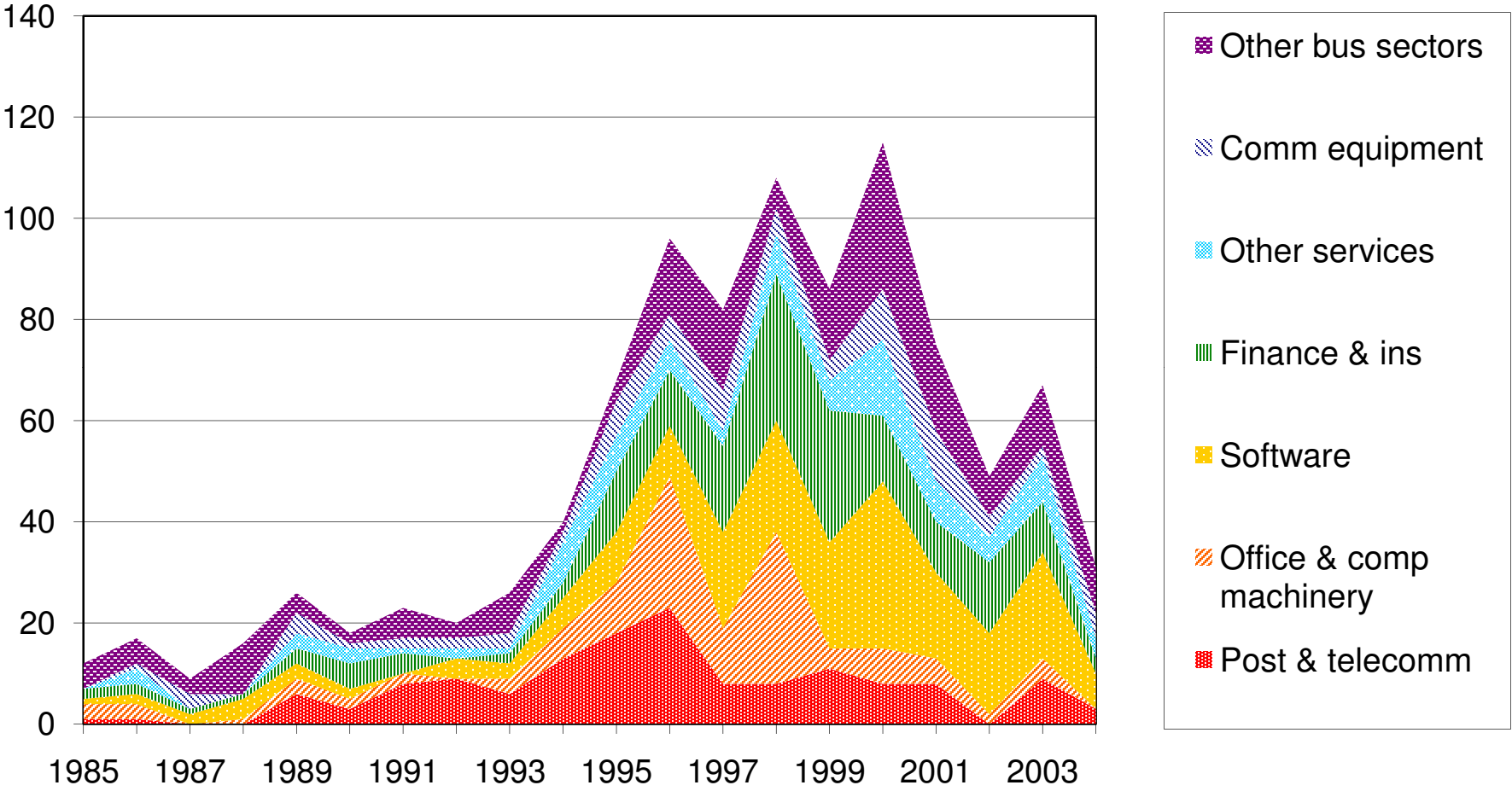


Table 3: Time evolution of financial patents by region of the patentee
1,174 EPO patent documents*

Country	Number with priority year equal to				Total
	before 1990	1990-1994	1995-99	after 2000	
US	64	71	258	175	568
<i>Germany</i>	15	8	26	34	83
<i>France</i>	27	18	30	45	120
<i>UK</i>	16	6	14	18	54
<i>Other EU countries</i>	17	16	71	58	162
EU27 total	75	48	141	155	419
JP	16	14	77	47	154
Rest of world	7	3	12	11	33
Overall	162	136	488	388	1174

Country	Shares with priority year equal to				Total
	before 1990	1990-1994	1995-99	after 2000	
US	39.5%	52.2%	52.9%	45.1%	48.4%
<i>Germany</i>	9.3%	5.9%	5.3%	8.8%	7.1%
<i>France</i>	16.7%	13.2%	6.1%	11.6%	10.2%
<i>UK</i>	9.9%	4.4%	2.9%	4.6%	4.6%
<i>Other EU countries</i>	10.5%	11.8%	14.5%	14.9%	13.8%
EU27 total	46.3%	35.3%	28.9%	39.9%	35.7%
JP	9.9%	10.3%	15.8%	12.1%	13.1%
Rest of world	4.3%	2.2%	2.5%	2.8%	2.8%

*70 documents have more than one applicant but in almost all cases the applicants are from the same country.

Table 4: Patents by the country and sector of the patentee

1,174 EPO patent documents, includes double counting in case of copatenting

Code	Sector Description	Overall		EU 27		US	
		N	Share*	N	Share*	N	Share*
41	Software & computer related activities	217	20.8%	38	10.6%	150	29.4%
38	Finance & insurance	172	16.5%	35	9.8%	128	25.1%
37	Post & telecommunications	145	13.9%	89	24.9%	36	7.1%
17	Office, accounting & computing machinery	130	12.5%	5	1.4%	85	16.7%
43	Other Business Activities	94	9.0%	37	10.4%	49	9.6%
19	Radio, television & communication equip.	82	7.9%	52	14.6%	22	4.3%
18	Electrical machinery & apparatus, nec	67	6.4%	31	8.7%	1	0.2%
20	Medical, precision & optical instruments	42	4.0%	23	6.4%	10	2.0%
31	Wholesale & retail trade repairs	26	2.5%	15	4.2%	9	1.8%
16	Machinery & equipment, nec	23	2.2%	12	3.4%	6	1.2%
7	Pulp, paper, paper products, printing	6	0.6%	5	1.4%	0	0.0%
25	Manufacturing nec recycling	5	0.5%	0	0.0%	5	1.0%
47	Other services	4	0.4%	3	0.8%	0	0.0%
4	Food products, beverages and tobacco	4	0.4%	1	0.3%	3	0.6%
8	Coke, petroleum products & nuclear	4	0.4%	0	0.0%	1	0.2%
33	Land transport transport via pipelines	3	0.3%	0	0.0%	1	0.2%
35	Air transport	3	0.3%	1	0.3%	1	0.2%
42	Research & development	3	0.3%	3	0.8%	0	0.0%
9	Chemicals excluding pharmaceuticals	2	0.2%	1	0.3%	1	0.2%
15	Fabricated metal products	2	0.2%	2	0.6%	0	0.0%
21	Motor vehicles, trailers & semi-trailers	2	0.2%	1	0.3%	1	0.2%
2	Mining and quarrying (energy)	1	0.1%	0	0.0%	0	0.0%
3	Mining and quarrying (non-energy)	1	0.1%	1	0.3%	0	0.0%
11	Rubber & plastics products	1	0.1%	0	0.0%	1	0.2%
26	Production & distribution of electricity	1	0.1%	1	0.3%	0	0.0%
39	Real estate activities	1	0.1%	1	0.3%	0	0.0%
Top 6 business sectors		840	80.7%	256	71.7%	470	92.2%
Total for all business sectors		1041	82.6%	357	76.1%	510	86.9%
Individuals & non-business organizations		171	13.6%	89	19.0%	62	10.6%
Patents held by non-classified business firms		49	3.9%	23	4.9%	15	2.6%
Total, including double counting for co-patent		1261		469		587	

*The share of business sector financial patents is shown in these columns, with the exception of the last 3 rows, where the share of all financial patents is shown.

Table 5: Time evolution of financial patents by size of the patentee

1,039 EPO patent documents*

With priority year equal to

Size of firm	before 1990	1990-1994	1995-99	after 2000	Overall
Number of patents					
Large (>249 employees)	99	98	361	249	807
Medium (50-249 employees)	9	8	29	26	72
Small (<50 employees)	16	18	47	71	152
Size class not available	11	7	21	20	59
Total	135	131	458	366	1090

Share of patents by size of firm

Large (>249 employees)	73.3%	74.8%	78.8%	68.0%	74.0%
Medium (50-249 employees)	6.7%	6.1%	6.3%	7.1%	6.6%
Small (<50 employees)	11.9%	13.7%	10.3%	19.4%	13.9%
Size class not available	8.1%	5.3%	4.6%	5.5%	5.4%

*The sample includes double counting in case of copatenting and excludes patents held by individuals and governments.

Table 6: Patents by the size and age of the patenting firm

1,039 EPO patent documents*

Founding Year	Size of firm				Total
	Large	Medium	Small	Size unknown	
Number of patents					
pre-1970	534	3	4	5	546
1971-1980	28	3	2	0	33
1981-1990	126	13	14	0	153
1991-1995	65	18	18	0	101
1996-2000	40	25	42	0	107
post-2000	10	10	70	0	90
Not known	4	0	2	54	60
Total	807	72	152	59	1090
Shares					
pre-1970	97.8%	0.5%	0.7%	0.9%	100.0%
1971-1980	84.8%	9.1%	6.1%	0.0%	100.0%
1981-1990	82.4%	8.5%	9.2%	0.0%	100.0%
1991-1995	64.4%	17.8%	17.8%	0.0%	100.0%
1996-2000	37.4%	23.4%	39.3%	0.0%	100.0%
post-2000	11.1%	11.1%	77.8%	0.0%	100.0%
Not known	6.7%	0.0%	3.3%	90.0%	100.0%

*The sample includes double counting in case of copatenting and excludes patents held by individuals and governments.

Table 7: Patents by the sector and age of the patentee

1,039 EPO patent documents*

Stan Code	Sector Description	Founding year of firm						Unknow n
		pre-1970	1971- 1980	1981- 1990	1991- 1995	1996- 2000	post-2000	
17	Office, accounting & computing machir	97	11	12	5	1	4	0
19	Radio, television & comm. equipment	45	2	29	2	3	1	0
	<i>Equipment</i>	142	13	41	7	4	5	0
38	Finance & insurance	109	1	15	20	17	8	2
41	Software & computer related activities	95	4	16	38	32	31	1
37	Post & telecommunications	52	0	57	15	18	3	0
43	Other Business Activities	24	2	9	10	19	28	2
	<i>Services</i>	280	7	97	83	86	70	5
-	Other business sectors	124	13	15	11	17	14	7
	Sector unknown	0	0	0	0	0	1	48
	Total	546	33	153	101	107	90	60

Within-sector shares of financial-patenting firms founded in each period

17	Office, accounting & computing machir	74.6%	8.5%	9.2%	3.8%	0.8%	3.1%	0.0%
19	Radio, television & comm. equipment	54.9%	2.4%	35.4%	2.4%	3.7%	1.2%	0.0%
	<i>Equipment</i>	67.0%	6.1%	19.3%	3.3%	1.9%	2.4%	0.0%
38	Finance & insurance	63.4%	0.6%	8.7%	11.6%	9.9%	4.7%	1.2%
41	Software & computer related activities	43.8%	1.8%	7.4%	17.5%	14.7%	14.3%	0.5%
37	Post & telecommunications	35.9%	0.0%	39.3%	10.3%	12.4%	2.1%	0.0%
43	Other Business Activities	25.5%	2.1%	9.6%	10.6%	20.2%	29.8%	2.1%
	<i>Services</i>	44.6%	1.1%	15.4%	13.2%	13.7%	11.1%	0.8%
-	Other business sectors	61.7%	6.5%	7.5%	5.5%	8.5%	7.0%	3.5%
	Sector unknown	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	98.0%

*The sample includes double counting in case of copatenting and excludes patents held by individuals and governments.

Table 8: Top financial patentees and the relative importance of financial patenting in their portfolio

Firms with more than 3 financial patents; 594 patents, 53.8% of the financial patents by business firms

Rank	Company	Country	Size	Industry	Entry	Fin Pats	All Pats	% Fin Pats	Tech specialist
1	IBM	US	large	Comp serv	pre 1970	37	14433	0.3%	no
2	CITIBANK NA	US	large	Fin & ins	pre 1970	35	149	23.5%	no
3	AT&T	US	large	Post & tele	pre 1970	30	5505	0.5%	no
4	FUJITSU	JP	large	Comp serv	pre 1970	28	8782	0.3%	no
5	HITACHI	JP	large	Comp mach	pre 1970	28	11875	0.2%	no
6	NCR INTERNATIONAL	US	large	Machinery	pre 1970	23	451	5.1%	no
7	FRANCE TELECOM	FR	large	Post & tele	1981-1990	23	1915	1.2%	no
8	VISA	US	large	Fin & ins	pre 1970	20	50	40.0%	no
9	SIEMENS	DE	large	Elec. Eq.	pre 1970	17	25672	0.1%	no
10	PITNEY BOWES	US	large	Comp mach	pre 1970	17	984	1.7%	no
11	DIEBOLD	US	large	Comp mach	pre 1970	17	80	21.3%	no
12	KONINKLIJKE KPN	NL	large	Post & tele	1981-1990	15	557	2.7%	no
13	MATSUSHITA ELECTRIC	JP	large	Elec. Eq.	pre 1970	12	17584	0.1%	no
14	ERICSSON	SE	large	Comm. Eq.	1981-1990	12	5384	0.2%	no
15	SONY	JP	large	Comm. Eq.	pre 1970	11	14402	0.1%	no
16	NOKIA	FI	large	Comm. Eq.	pre 1970	11	7541	0.1%	no
17	DEUTSCHE TELEKOM	DE	large	Post & tele	1981-1990	11	624	1.8%	no
18	MASTERCARD INT.	US	large	Oth bus	pre 1970	11	44	25.0%	no
19	SWISSCOM MOBILE	CH	large	Post & tele	1996-2000	11	271	4.1%	no
20	MOTOROLA	US	large	Comm. Eq.	pre 1970	11	5414	0.2%	no
21	SUN MICROSYSTEM	US	large	Comp mach	pre 1970	10	2202	0.5%	no
22	METAVANTE	US	large	Comp serv	pre 1970	10	14	71.4%	no
23	ELEC. DATA SYS	US	large	Comp serv	pre 1970	10	135	7.4%	no
24	GEMPLUS	FR	large	Comm. Eq.	1981-1990	10	63	15.9%	no
25	LA POSTE	FR	large	Post & tele	1991-1995	9	70	12.9%	no
26	NTT	JP	large	Post & tele	pre 1970	9	1395	0.6%	no
27	FIRST DATA	US	large	Fin & ins	1991-1995	9	69	13.0%	no
28	CHECKFREE	US	large	Comp serv	1991-1995	9	19	47.4%	no
29	EBAY	US	large	Comp serv	1991-1995	9	37	24.3%	no
30	OMRON ELECTRONIC	JP	large	Instruments	pre 1970	7	671	1.0%	no
31	OKI ELECTRIC	JP	large	Elec. Eq.	pre 1970	7	888	0.8%	no
32	AMERICAN EXPRESS	US	large	Fin & ins	pre 1970	6	40	15.0%	no
33	HEWLETT PACKARD	US	large	Comp mach	pre 1970	6	7319	0.1%	no
34	ALCATEL ALSTHOM	FR	large	Fin & ins	pre 1970	6	3042	0.2%	no
35	EASTMAN KODAK	US	large	Instruments	pre 1970	6	10102	0.1%	no
36	BITWALLET	JP	small	Oth bus	post 2000	6	7	85.7%	yes
37	LUCENT	US	large	Comp serv	1985-1990	6	3802	0.2%	no
38	AXALTO	FR	large	Comm. Eq.	pre 1970	5	318	1.6%	no
39	NTT DOCOMO	JP	large	Post & tele	pre 1970	5	1507	0.3%	no
40	ORBIS PATENTS	IE	small	Oth bus	1996-2000	5	7	71.4%	yes
41	SCHLUMBERGER UK	GB	large	Instruments	pre 1970	5	55	9.1%	no
42	FINANCIAL ENGINES	US	large	Fin & ins	1996-2000	5	6	83.3%	no
43	REUTERS	GB	large	Oth bus	pre 1970	5	14	35.7%	no
44	TOSHIBA	JP	large	Comp mach	pre 1970	5	10596	0.0%	no
45	IGT	US	large	Oth services	pre 1970	4	260	1.5%	no
47	TRINTECH	IE	small	Machinery	1996-2000	4	8	50.0%	no
48	CONTENTGUARD	US	small	Comp serv	post 2000	4	33	12.1%	yes
49	SCHLUMBERGER FR	FR	large	Instruments	1971-1980	4	219	1.8%	no
50	GIESECKE DEVRIENT	DE	large	Printing	pre 1970	4	641	0.6%	no
51	PHILIPS ELECTRONIC	NL	large	Elec. Eq.	pre 1970	4	25221	0.0%	no
52	THE WESTERN UNION	US	large	Fin & ins	pre 1970	4	20	20.0%	no
53	VERISIGN	US	large	Comp serv	1991-1995	4	20	20.0%	yes
54	ATALLA	US	large	Comp mach	1971-1980	4	156	2.6%	no
55	SANDEN	JP	large	Machinery	pre 1970	4	644	0.6%	no
56	CAPITAL ONE	US	large	Fin & ins	1991-1995	4	23	17.4%	no

Table 9: Prior Art Base and Patent Value Indicators: Comparison of financial and other business methods patents

	Financial patents <i>1202 observations</i>			Other business methods <i>1232 observations</i>			All patents <i>0.1% sample of 1828 patents</i>		
	mean	sd	median	mean	sd	median	mean	sd	median
Indicators of Prior Art Base									
Inventors	2.46	2.07	2.0	2.81	2.22	2.0	2.41	1.69	2.0
Non-patent literature references	0.44	1.09	0.0	0.72	1.54	0.0	0.46	1.29	0.0
Backward Citations to Patents	4.72	3.57	4.0	3.95	3.14	4.0	3.81	3.00	4.0
Backward Citations per Inventor	2.94	2.78	2.0	2.15	2.31	1.5	2.34	2.39	1.7
XY Type Backward Citations	1.00	1.49	0.0	0.86	1.35	0.0	0.92	1.63	0.0
XY Type Backward Citations per Inventor	0.62	1.08	0.0	0.48	0.96	0.0	0.54	1.12	0.0
Citation Lag in Months @	60.49	36.72	52.0	53.73	33.12	45.0	66.63	45.05	56.0
Indicators of Patent Value									
Technological classes	1.92	1.07	2.0	1.66	1.04	1.0	2.27	1.90	2.0
Family size	2.32	0.93	2.0	2.37	1.08	2.0	2.21	0.78	2.0
Designated countries	12.80	8.53	14.0	11.93	8.28	10.0	11.78	9.05	8.0
Forward citations after 3 years	1.14	2.36	0.0	1.01	2.01	0.0	0.40	0.94	0.0
Continuations rate	0.07	0.25	0.0	0.10	0.30	0.0	0.05	0.22	0.0
HTT Composite Index	0.26	0.51	0.2	0.19	0.49	0.1	0.00	0.43	-0.1
Valuation from Patval survey (1000s euros) #	1,523	2,791	200	2,438	2,798	650	11,083	65,580	650

Notes:

@ Computed for nonzero lags only. Numbers of observations are 437, 360, and 539 respectively.

Computed for patents that were covered by the PATVAL survey only. Numbers of observations are 5, 20 and 8,281 respectively.

Table 10: Tests of differences between financial, business method and other patents

	Difference between financial and other business method patents				Difference between financial and all patents			
	T-test #		Wallis test		T-test #		Wallis test	
	Sign.+	@	Sign.+	@	Sign.+	@	Sign.+	
Indicators of Prior Art Base								
Inventors	4.11	***	37.8	***	0.03		10.0	***
Non-patent literature references	5.14	***	28.6	***	0.61		2.1	
Backward Citations to Patents	-6.00	***	38.8	***	-6.90	***	48.5	***
Backward Citations per Inventor	-7.90	***	58.9	***	-0.18		37.5	***
XY Type Backward Citations	-2.42	**	2.8	*	1.00		3.8	*
XY Type Backward Citations per Inventor	-3.45	***	5.6	**	0.98		6.9	***
Citation Lag in Months	-2.62	***	7.6	***	3.62	***	11.0	***
Indicators of Patent Value								
Technological classes	-6.09	***	73.0	***	7.04	***	38.1	***
Family size	1.27		0.7		0.95		165.9	***
Designated countries	-2.60	***	3.6	*	-5.95	***	38.1	***
Forward citations after 3 years	-1.53		0.5		-6.95	***	129.4	***
Continuations rate	1.88	*	8.4	***	-0.48		4.9	***
HTT Composite Index	-0.98		2.4		0.52		0.3	

All variables have been normalized by dividing by the overall year mean, to control for changing year effects.

Notes:

+ Significant at 1% (***), 5% (**), or 10% (*) level.

Test for equality of means, with unequal variances.

@ Non-parametric test for difference in distributions.

Table 11: Outcomes of the EPO Process

	Financial	Business method	All
Number of patent applications 1978-2005	1,204	1,232	1,846,138
Decision reached	68.4%	58.2%	74.4%
Applications failed	39.1%	27.5%	27.7%
withdrawn	34.7%	23.9%	25.3%
refused by EPO	4.6%	3.7%	2.6%
Applications granted	29.6%	31.4%	47.6%
<i>Conditional on a decision being reached</i>			
Applications failed	57.2%	47.4%	37.2%
withdrawn	50.7%	41.1%	34.0%
refused by EPO	6.7%	6.4%	3.5%
Applications granted	43.3%	54.0%	64.0%
<i>Conditional on grant</i>			
Opposition	12.4%	21.4%	7.8%
<i>Opposition by period</i>			
1978-1985	14.3%	64.5%	9.0%
1986-1994	21.5%	16.1%	6.2%
1995-2000	5.6%	6.5%	3.7%

Table 12a: Probability of decision, grant, and opposition conditional on grant 1978-2005

1041 observations for 407 patentees (692 decisions, 320 grants, 38 oppositions out of 303 pre-2001 grants)

<i>Dependent variable</i>	<i>Decision</i>		<i>Grant conditional on decision</i>		<i>Opposition conditional on grant</i>				
	<i>Marginal</i>	<i>s.e.</i>	<i>Marginal</i>	<i>s.e.</i>	<i>Marginal</i>	<i>s.e.</i>			
<i>Owner characteristics</i>									
Log (stock of EP patents) +	0.022	0.028		0.103	0.050	**	0.022	0.018	
Log (stock of XY backward cites) +	-0.009	0.029		-0.083	0.051		-0.044	0.020	**
Log (stock of forward cites per patent) +	0.075	0.023	***	0.015	0.066		-0.010	0.031	
D (small firm)	-0.012	0.039		-0.046	0.094		0.017	0.053	
D (medium firm)	0.057	0.027	*	-0.004	0.107		0.152	0.132	
Founded 1981-1995	0.031	0.029		-0.096	0.066		-0.054	0.032	
Founded after 1995	0.010	0.035		0.100	0.086		-0.013	0.038	
Software sector	0.020	0.031		0.198	0.068	***	-0.028	0.038	
Other business services	0.003	0.042		0.086	0.109		-0.025	0.037	
Post & telecommunications	-0.002	0.037		0.203	0.081	**	0.026	0.051	
Finance & insurance	0.061	0.027	*	0.003	0.107		0.046	0.070	
Computing equipment	0.013	0.056		0.156	0.096	*	0.087	0.087	
Communication equipment	-0.083	0.067		0.144	0.099		0.014	0.059	
US owner	-0.061	0.035	*	-0.182	0.102	**	-0.047	0.037	
Japanese owner	-0.177	0.094	**	-0.068	0.100		0.004	0.055	
German owner	0.094	0.017	***	0.017	0.104		0.024	0.061	
French owner	0.014	0.037		0.172	0.111		0.041	0.064	
UK owner	-0.008	0.055		0.017	0.124		-0.003	0.056	
Chi-squared (2) size	4.5	0.105		0.3	0.861		2.7	0.263	
Chi-squared (2) founding year	1.2	0.635		5.7	0.057	*	1.9	0.390	
Chi-squared (6) sector dummies	10.4	0.108		13.9	0.031	**	5.0	0.541	
Chi-squared (5) region	33.4	0.000	***	18.4	0.002	***	4.8	0.444	
Chi-squared (18) firm characteristics	78.9	0.000	***	46.6	0.000	***	23.0	0.189	
<i>Patent characteristics</i>									
Total backward cites	0.003	0.004		0.014	0.008		0.002	0.005	
XY backward cites	-0.003	0.007		-0.017	0.017		0.028	0.008	***
Forward patent cites received in 3 years	-0.003	0.003		0.017	0.010	*	0.016	0.005	***
Log (inventors)	-0.061	0.017	***	0.075	0.039	*	0.014	0.024	
Log (N of designated states at EPO)	-0.044	0.013	***	0.056	0.028	**	-0.005	0.024	
Priority year 1986-1990	<i>combined with pre-1986</i>			0.101	0.106		0.127	0.104	
Priority year 1991-1995	-0.986	0.004	***	-0.016	0.112		-0.010	0.054	
Priority year 1996-2000	-0.983	0.007	***	-0.230	0.106	**	-0.072	0.055	
Priority year post-2000	-0.998	0.001	***	-0.300	0.091	***	<i>no oppositions</i>		
Chi-squared (2) priority year	436.4	0.000	***	21.9	0.000	***	21.0	0.000	***
Chi-squared (5) patent characteristics#	34.1	0.000	***	13.5	0.019	**	22.2	0.001	***
Pseudo R-squared	0.325		0.159		0.257				

The left out category is a patent owned by a large firm in the rest of the world that was founded before 1981, and that operates in one of the remaining business sectors, with priority year prior to 1986 (prior to 1991 in the first set of columns).

Marginal effects and their standard errors clustered on patentee are shown. Significance at 1% *** 5% ** 10% *.

+ These variables are stocks for all the firm's patents as of the priority year of the current patent, constructed using a 15% depreciation rate.

All patent characteristics excluding the priority year dummies, which control for selection over time.

Table 12b: Probability of decision, grant, and opposition conditional on grant 1978-2005

1041 observations for 407 patentees (692 decisions, 320 grants, 38 oppositions out of 303 pre-2001 grants)

<i>Dependent variable</i>	<i>Decision</i>		<i>Grant conditional on decision</i>			<i>Opposition conditional on grant</i>		
	<i>Marginal</i>	<i>s.e.</i>	<i>Marginal</i>	<i>s.e.</i>		<i>Marginal</i>	<i>s.e.</i>	
<i>Owner characteristics</i>								
Log (stock of EP patents) +	0.008	0.004	**	0.102	0.046	**	0.005	0.016
Log (stock of XY backward cites) +				-0.083	0.048	*	-0.025	0.017
Log (stock of forward cites per patent) +	0.079	0.026	***					
D (small firm)								
D (medium firm)								
Founded 1981-1995				-0.106	0.068			
Founded after 1995				0.072	0.076			
Software sector				0.195	0.066	***		
Other business services				0.078	0.108			
Post & telecommunications				0.203	0.078	**		
Finance & insurance				0.008	0.104			
Computing equipment				0.153	0.085	*		
Communication equipment				0.155	0.096			
US owner	-0.047	0.038		-0.175	0.083	**		
Japanese owner	-0.162	0.087	**	-0.053	0.103			
German owner	0.100	0.019	***	0.015	0.096			
French owner	0.024	0.041		0.184	0.108	*		
UK owner	-0.010	0.059		0.033	0.122			
<i>Patent characteristics</i>								
Total backward cites	0.003	0.005		0.014	0.009		0.005	0.006
XY backward cites	-0.002	0.007		-0.018	0.017		0.025	0.009
Forward patent cites received in 3 years	-0.003	0.003		0.017	0.009	*	0.015	0.006
Log (inventors)	-0.057	0.019	***	0.076	0.039	**	0.010	0.027
Log (N of designated states at EPO)	-0.042	0.013	***	0.056	0.028	**	0.006	0.021
Priority year 1986-1990				<i>combined with pre-1986</i>			0.112	0.080
Priority year 1991-1995	-0.985	0.003	***				-0.024	0.049
Priority year 1996-2000	-0.981	0.007	***	-0.244	0.056	***	-0.099	0.049
Priority year post-2000	-0.998	0.001	***	-0.311	0.060	***	<i>no oppositions</i>	
Pseudo R-squared	0.310			0.155			0.214	

The left out category is a patent owned by a large firm in the rest of the world that was founded before 1981, and that operates in one of the remaining business sectors, with priority year prior to 1986.

Marginal effects and their standard errors clustered on patentee are shown. Significance at 1% *** 5% ** 10% *.

+ These variables are stocks for all the firm's patents as of the priority year of the current patent, constructed using a 15% depreciation

All patent characteristics excluding the priority year dummies, which control for selection over time.

Table 13: Participation of Financial Patentees in Technology Markets: major industry served and type of technology contracts

Patentee		listed	Fin. Pats	Founding Year	Stan	Size	Spin-Off	First License	Principal industries	Type of technology contracts
BITWALLET	(JP)	no	6	post-2000	other bus	small	SONY	2003	Wireless Equipment	Joint-Venture
INNOVATRON	(FR)	no	2	1991-1995	other bus	small	Start-up	1992	Comp. Equipment	Flexible by market segment
TELCORDIA TECHNOLOGY	(US)	no	2	1981-1990	other bus	large	Start-up	1999	Wireless Equipment	Flexible by market segment
PACIFIC PAYMENT SYSTEM	(US)	no	1	post-2000	other bus	small	Start-up	pending	Financial services	none
NAVIO SYSTEM	(US)	no	1	post-2000	other bus	small	Start-up	2006	Wireless Equipment	Exclusive Licensing
ARITAS	(US)	no	1	post-2000	other bus	small	Start-up	pending	Wireless Equipment	none
E DDUCTION	(US)	no	1	post-2000	other bus	small	Start-up	2001	Financial services	Exclusive Licensing
EVERY PENNY COUNTS	(US)	no	1	post-2000	other bus	small	Start-up	pending	Financial services	Exclusive Licensing
FINANCIAL ENG. ASSOC.	(US)	no	1	post-2000	other bus	small	Start-up	1996	Financial services	Exclusive Licensing
US ENCODE	(US)	no	1	post-2000	other bus	small	Start-up	pending	Comp. Equipment	none
INTERNATIONAL BARCODE	(US)	no	1	post-2000	other bus	small	Start-up	2001	Embedded Software	General Purpose
CONTENTGUARD HOLDING	(US)	no	3	post-2000	software	small	XEROX	2006	Wireless Equipment	Flexible by market segment
CYBERFONE TECHNOLOGY	(US)	no	2	post-2000	software	small	Start-up	2008	Comp. Equipment	Technology Granting
CYBERSOURCE	(US)	yes	2	1991-1995	software	large	Start-up	1997	Financial services	Exclusive Licensing
WELCOME REAL TIME	(FR)	no	2	1996-2000	software	small	Start-up	2003	Financial services	Cross-licensing
RSA SECURITY	(US)	yes	2	1981-1990	software	large	Start-up	1999	Comp. Equipment	Flexible by market segment
BRIZA TECHNOLOGY	(US)	no	1	post-2000	software	small	Start-up	pending	Embedded Software	none
MTREX	(US)	no	1	post-2000	software	small	Start-up	pending	Retail industry	none
SMART VOUCHER	(GB)	no	1	post-2000	software	small	Start-up	pending	Financial services	none
SERVERSIDE GROUP	(GB)	no	1	post-2000	software	small	Start-up	pending	Financial services	Exclusive Licensing
PROPRIETARY FINANCIAL PRO	(US)	no	1	post-2000	software	small	Start-up	1995	Financial services	
BCE EMERGIS TECHNOLOGY	(US)	no	1	1981-1990	software	large	Start-up	1999	Comp. Equipment	Exclusive Licensing
HNC SOFTWARE	(US)	yes	1	1981-1990	software	large	Start-up	1996	Retail industry	Flexible by market segment
IDENTIX	(US)	yes	1	post-2000	software	large	Start-up	2003	Comp. Equipment	Flexible by market segment
CERTICOM	(CA)	yes	1	1981-1990	software	medium	Start-up	1997	Comp. Equipment	Flexible by market segment
FINANCIAL ENGINES	(US)	no	5	1996-2000	fin & ins	medium	Start-up	1996	Financial services	Technology Granting
MONDEX INTERNATIONAL	(GB)	no	2	1991-1995	fin & ins	small	Start-up	1997	Financial services	Vertical Integration - Mastercard
KEYCORP	(AU)	no	1	1981-1990	fin & ins	medium	Start-up	1997	Wireless Equipment	Joint-Venture
FEXCO	(IE)	no	1	1981-1990	fin & ins	large	Start-up	2005	Financial services	Exclusive Licensing
FIRST FINANCIAL INTERNET	(US)	no	1	1981-1990	fin & ins	large	Start-up	2000	Comp. Equipment	Flexible by market segment