

# ALTERNATIVE MOTIVES TO FILE FOR PATENTS: PROFITING FROM PENDENCY AND PUBLICATION

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Many patent applications lapse before they are reviewed by patent examiners. In this paper we analyze how even a lapsed patent application yields benefits to the applicant. We argue that these benefits are attributable to pendency and publication of patent applications. Based on an analysis of all direct first filings at the German patent office between 1986 and 2000 we find that more than 20% of all applications are left pending for the maximum of seven years before examination is requested or the application is deemed to be withdrawn. Our findings, which are supported by 25 interviews with inventors, indicate that firms keep patents pending in order to gain time for evaluating if an exclusion right is worth its cost and to create insecurity for competitors. Further 2% of all applications could turn out to have defensive publishing as their sole purpose, that is, the publication of inventions with the purpose of creating prior art. In this way, firms secure freedom to operate (FTO), which is a central precondition for appropriating profits from own-used inventions. This finding gives an indication that, for all other applications, the share of their value attributable to creating FTO might be considerable.

*Keywords: Defensive publishing, motives to patent, intellectual property, freedom to operate, patents, patent pending*

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# 1 Introduction

Innovators must be able to appropriate a sufficient share of the value that their innovations create, lest they lack economic incentives to innovate. For such incentives to exist, the ability to exclude others from using the underlying invention is often stated as a precondition (Arrow, 1962).

Addressing the importance of excludability, surveys consistently found that, in most industries, aspects such as lead time advantages and complementary assets (Teece, 1986) are considered more effective than patents in enabling firms to profit from their innovations (Levin et al., 1987; Harabi, 1995; Cohen et al., 2000; Arundel, 2001; Sattler, 2003).

Attempting to unravel why firms patent excessively anyway (Kortum and Lerner, 1998; Hall and Ziedonis, 2001; Hall, 2005) scholars have investigated various “strategic” functions of patents beyond the traditional function to allow exclusive use or licensing of an invention (Granstrand, 1999; Kash and Kingston, 2001; Arundel and Patel, 2003; Macdonald, 2004; Blind et al., 2006, Blind et al., 2009). Cohen et al. (2000) summarize such motives as blocking competitors, enabling cross-licensing, and forearming against infringement suits.

Regardless of the effectiveness of patents in a “traditional” or “strategic” sense, all of these functions require, trivial as it may sound, obtaining a patent grant. Yet, many patent applications lapse even before the patent office decides on grant or refusal.<sup>1</sup> A simple explanation might be that many of those applications turned out not to be worth further cost of patenting. However, it is possible, yet likely, that even a lapsed patent application yields benefits to the applicant. From a procedural perspective, there are two sources where those benefits could originate from. The first is the simple fact that the patent application has been *pending for a certain period of time* – and, potentially, could have become a patent someday. The second is that nearly all *patent applications are published* and the underlying invention becomes state of the art.

## 1.1. The role of pendency

Literature on *patent pendency* suggests that, in certain cases, applicants benefit from pending patents. Popp et al. (2003: 1) investigating “grant lags” of US patents note that a “[...] shorter lag is not always preferable [...]”. Guellec and van Pottelsberghe de la Potterie (2007: 180) even remark that in some cases the patent process at the European Patent Office (EPO) was willfully delayed by applicants. Creating insecurity for competitors seems to be an important

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<sup>1</sup> Note that we do not refer to rejected patents. We refer to patent applications that are withdrawn or deemed to be withdrawn before examination.

motive here. The relevance of this phenomenon is well known to patent authorities. As Alison Brimelow, president of the EPO put it: “*If you spend several years waiting for a decision, you and others can play “rich man’s poker”, taking a bet on what your rights are going to be and discussing your commercial relationships in the shadow of that pending set of applications.*”<sup>2</sup> In that context, it is surprising that only little empirical research on the subject exists (Popp et al., 2003). Our article is a contribution to filling this gap. A further contribution is our detailed analysis of the components of patent pendency. At many patent offices (such as in Germany or at the EPO) the lag between filing and grant or refusal effectively consists of two lags: One between the filing of the application and examination (“examination lag”), a second one between start of examination and grant or refusal (“grant/refusal lag”). In Germany for example, examination does not start until it is requested by the applicant.<sup>3</sup> Thus, the applicant controls the examination lag solely (whereas grant/refusal lag also depends on the office’s performance). By that means applicants can achieve a very long, and cost-efficient, period of patent pending. Since no examination takes place, there are no prosecution costs (e.g. no patent attorney to communicate with the examiners is needed), and no “risk” of too early termination of the process through grant or refusal. However, the patent application can not be ignored by competitors since the applicant could file the request for examination at any point in time and, later, potentially secure a patent right. This leverage for delaying examination makes the German patent process a magnifying glass for applicants’ benefits from patent pendency. Later in the article we will use German patent applications to analyze various aspects of this value component.

### ***1.2. The role of publication***

With respect to the *publication of patents*, extant literature has discussed the effects of disclosed information on the ability of competitors to imitate an innovation or invent around the patent (e.g. Horstmann et al., 1985; Johnson and Popp, 2003; Anton and Yao, 2004; Aoki and Spiegel, forthcoming). However, one further effect of published patent applications is scarcely analyzed: They secure *freedom to operate* (FTO), that is, the right to practice the invention in the first place. As we noted at the beginning of the article the ability to exclude others was often stated as a precondition for the ability to appropriate value created by an innovation (Arrow, 1962). However, if the focal firm aims to profit from its inventions by embodying them into its own products and processes, FTO is a much more fundamental precon-

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<sup>2</sup> Interview with Alison Brimelow, president of the EPO, published on the website of the EPO. ([http://www.epo.org/about-us/press/backgrounders/interview\\_de.html](http://www.epo.org/about-us/press/backgrounders/interview_de.html), accessed 12.02.2009).

<sup>3</sup> There is a statutory maximum lag of seven years (see below).

dition. Even if the focal firm does not require exclusivity on its invention, patents are of crucial importance: the innovator might be denied its FTO when a patent on the same invention is granted to some other party.<sup>4</sup> To avert such a situation, the focal firm might disclose its invention in a *defensive publication* (DP), which creates prior art and thus precludes, at least in theory, any subsequent patent grant (e.g., Parchomovsky, 2000; Johnson, 2004; Henkel and Pangerl, 2008). Or it might file for a patent. Since nearly all patent applications are published 18 months after filing,<sup>5</sup> they become part of the state of the art typically long before their examination is completed or even started, and irrespective of the application being withdrawn or pursued to the end. We argue that many patent applications are filed *inter alia*, and some even solely, to maintain FTO. In the latter case, the patent application effectively amounts to a DP.

Somewhat surprisingly, this motive to patent has received little attention in the literature. Empirical research on the practice of filing patents for the purpose of maintaining FTO is scarce. Henkel and Pangerl (2008) conducted a qualitative study of DP, focusing on German corporations and in particular the leading German stock index, DAX 30. Out of 37 firms they interviewed, 26 would practice DP, and 11 would do so systematically by filing patent applications (Henkel and Pangerl, 2008: 28). More precisely, the firms would file for a national patent, and let the application lapse after publication. Hence, the patent system appears to be a rather common means for creating DPs. The only pertaining large-scale study that we are aware of is that of Lazaridis and van Pottelsberghe de la Potterie (2007). The authors analyze withdrawn patent applications at the EPO, focusing on withdrawals that are induced by examiners signaling to the applicant a low probability of grant. However, they also identify a share of applications, between 6% and 14%, that are withdrawn even before completion of the search report by the EPO and might thus turn out to be DPs.

We adopt a similar approach in the present study. However, based on the findings by Henkel and Pangerl (2008), we work on the hypothesis that inventors who file a patent application as a DP would do so at a *national* patent office rather than at the EPO, the most promi-

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<sup>4</sup> While in principle it is possible in to maintain FTO for inventions that were kept secret through a “prior use” defense, this procedure very often is not effective (cf. Henkel and Pangerl, 2008, p.1).

<sup>5</sup> An exception is the US patent system. It allows applicants to keep their patent applications confidential until grant provided that they do not file subsequent applications in other countries in which the 18 months rule applies (Aoki and Spiegel, forthcoming). According to USPTO statistics approximately 10% of applicants opt-out of publication (<http://www.ftc.gov/opp/intellect/050601summarytownmtg.pdf>, p.11, accessed February 24, 2009).

ment reason being cost advantages.<sup>6</sup> Therefore we analyze data from the German Patent and Trademark Office (GPTO).

### ***1.3. Further proceeding and main results***

We present a detailed analysis of timing and occurrence of requests for examination, withdrawals, deemed withdrawals, payment of annual fees, and the existence of patent families of patent applications at the GPTO. Doing so allows us to identify patterns in the patenting process that we relate to potential motives for filing patents. They comprise: (1) Obtaining an exclusion right as fast as possible; (2) delaying the patent process in order to gain time for evaluating the invention or to create insecurity for competitors; and (3) effectuating a defensive publication in order to secure FTO. Our findings are backed up by 25 interviews with inventors of patent applications that exhibit process patterns relevant to our analysis.

Our main findings are the following. First, a surprisingly large share of applications is kept pending without request for examination, in 20% of all filings even for the maximum period of seven years. For applications with low value or low probability of grant, this creates insecurity for competitors and is thus preferable to an early withdrawal or an early, and likely negative, decision by the examiner. Second, a longer pendency period gives the applicant more time to assess the value of requesting examination. We find that for 17% of all GPTO direct filings, a request for examination is made with delay, that is, after publication of the application.

Evidence from interviews suggests that firms strongly benefit from maintaining pendency of patent applications that cover rather abstract technologies whose market is considered strategically important as a whole, but which are not yet embodied in concrete products. It seems that in such cases a pending patent application offers enough protection while at the same time involving lower cost (e.g. no examination fee, no prosecution cost). As soon as “full” protection is required (e.g. when a product will be launched soon), the applicant can easily induce examination of the patent. Our data shows that this strategy is mostly used by firms (in contrast to individuals): 90.4% of all patents that were pending for seven years before examination started were filed for by corporations or institutions.<sup>7</sup>

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<sup>6</sup> Applicants at the EPO have to pay a filing fee (100 € if patent is filed electronically, otherwise 180 €) and a search fee (1050 €); cf. Article 78 (2) EPC. In contrast, an application at the GPTO entails a fee of only 50 € for an electronic filing, 60 € otherwise.

<sup>7</sup> 9.6% have been filed by individual inventors. The average share of all GPTO applications filed by individual inventors is 14.6% for the period between 1986 and 2000 (cf. Annual reports of the GPTO, <http://dpma.de/service/veroeffentlichungen/jahresberichte/index.html>, accessed 25.02.2009).

Our interviews further suggest that individual applicants who keep their filings pending do so in order to save examination cost while searching for licensees. A majority of 54.8% (which is far above average; cf. footnote 7) of all early lapsed patent applications is filed by individuals suggesting low commercial value of the underlying inventions. The remaining 41.6% (more than 2 % of all filings) are early lapsed corporate or institutional filings. They are strong candidates for being DPs, or in any case for having a large value component related to creating FTO.<sup>8</sup> While we can currently not exclude that the applicants did file initially with the intention of obtaining a patent grant, and within two years realized that a request for examination would be of little value (because of a low probability of grant, or a low value of the resulting patent, if granted), interpreting these filings as DPs is very plausible. First, this interpretation is suggested by qualitative evidence (Henkel and Pangerl, 2008). Second, a survey among EPO applicants found that preserving FTO, after preventing imitation, is the second most important motive for patenting (de Rassenfosse et al., 2008).

As the “tip of the tip” of the iceberg, we identify some hundred early-lapsed GPTO direct filings in total, for which early disclosure is requested by corporate or institutional applicants. Such behavior only makes sense when the applicant’s goal is to guarantee, as soon as possible, its FTO. Evidence from interviews with applicants of such patents confirms this assumption and demonstrates the existence of pure DP in the patent system.

When securing FTO is not the only motive for filing, it will still almost always be *one* of the motives. Except for cases in which the prospective patentee solely intends to block others’ use of the technology, an exclusion right is valuable only in conjunction with FTO. And arguable, the more valuable the exclusion right on an invention, the more valuable will also the related FTO be.

The remainder of this paper proceeds as follows. Section 2 summarizes prior research that used patent process information of the kind that we use. Section 3 provides background information about the patenting process at the GPTO. Section 4 identifies characteristic process patterns and derives motives to file an application for a patent. Section 5 describes our dataset. Section 6 presents our empirical results. Section 7 concludes.

## **2 Existing research using patent process data**

Studying pendency and the FTO-maintaining function of patent applications requires a detailed analysis of the early phases of the patenting process, i.e., of all those events that take

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<sup>8</sup> We assume that individual applicants do not profit from securing FTO since they normally do not operate own production.

place before examination. As we will describe below, the relevant events are the payment of annual fees, the request for examination, and the filing of applications at other patent offices which refer to the priority of the focal German patent applications (leading, if successful, to a patent family).

Our review of extant literature reveals that this early phase is only scarcely investigated. While many authors have used legal status data of patents (such as renewals, outcome or duration of examination), not much empirical findings on the pre-examination phase exist.

Most authors have derived their findings mainly from the examination and post-examination phase (e.g. Harhoff and Reitzig, 2004; Harhoff and Wagner, 2005). Typically, legal status data is combined with bibliographic data, such as citations (cf. Hall et al., 2005), in order to estimate the value of patents. Reitzig (2004) provides an overview of patent value indicators. Guellec and van Pottelsberghe de la Potterie (2000) use legal status data of patent applications as a dependent variable. They argue that a grant decision *reflects* the value of the underlying invention (because it was found by the examiner to be novel and non-obvious), and that it *generates* value (because returns can be higher due to the exclusion right). We argue that not only a granted, but also a rejected or withdrawn application generates value—since it secures FTO and since it was pending for a certain period of time.

Harhoff et al. (2003) provide an analysis of the patenting process at the German Patent and Trademark Office (GPTO). The authors use legal information on grant, refusal and withdrawal of patent applications as well as on the outcome of opposition proceedings and payment of renewal fees, citations and family size for a sample of GPTO patents in order to explain the value of these patents. Our study is further “upstream” since it focuses on applications *before* they are examined. Furthermore, our study differs since we do not explicitly investigate correlates of patent value.

The usage of data on patent renewals was introduced by Pakes and Schankerman (1984). Lanjouw et al. (1998) use data on patent age (i.e. annual fees) and patent family size in order to improve the valuation of patents. Our analysis extends the usage of such data to the pre-examination phase of the patent process. This kind of data is helpful for analyzing that early phase since patent families are typically founded before or during examination and first annual fees are due during (or even before) examination.

### **3 Background information on GPTO patent applications**

A German patent application (and, in largely the same way, *any* patent application) creates value for the applicant in three different ways. In temporal order, these are:

*Securing FTO:* Virtually all patent applications are published not later than 18 months after their filing date (unless they cover state secrets or are withdrawn before publication, see § 50 and §32(4) PatG). With publication, the invention described in the application becomes part of the state of the art, and is thus novelty destroying for all further applications covering the same invention.<sup>9</sup> Thus, a patent application is a means of securing FTO. How *valuable* the FTO thus gained is to the applicant depends on how the respective invention shall be used. FTO is valuable to innovators using their inventions in own products and processes, but is of no value to firms that merely seek to block others' use of the invention. Patent sharks, or trolls, are a case in point. They have no need for FTO, however, their profits from an exclusion right can be extremely high (cf. Reitzig et al., 2007; Henkel and Reitzig, 2008).

*Family option:* Under the Paris convention each patent applicant has the right to file subsequent applications covering the same invention at other patent offices within 12 months after the initial filing. Thus, a patent application provides an option to file further patents covering the same invention and thus to extend the size of the patent family.

*Examination option:* Filing an application does not automatically induce its examination. Rather, an application is pending until the applicant, or a third party, formally requests examination. In Germany it may be requested at the latest in the seventh year after the application date, otherwise the application is deemed to be withdrawn.<sup>10</sup> Thus, a German patent application gives an option to enter the examination process. The examination process ends with the grant or refusal of a patent, or a withdrawal during examination.

These three value components are related to events in the early phases of the GPTO patenting process, which we illustrate in

Figure 1 (see Harhoff et al. (2003) for a description of the entire process). The encircled numbers in Figure 1 mark points of intervention that the applicant has during the early phase of the patenting process.

--- *Insert Figure 1 about here* ---

*Subsequent applications (1):* Filing an application for a national patent generates a priority right. It lasts for one year and entitles the applicant to a patent application covering the same invention at other patent authorities. A set of patent rights in different countries which

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<sup>9</sup> Before, it is novelty destroying only in Germany.

<sup>10</sup> At the EPO, examination may be requested up to six months after the date on which the European Patent Bulletin mentions the publication of the European search report (Rule 70 (EPC)).

are based on the same priority application (and thus, on the same invention) constitutes a patent family. Thus, a patent application is a one-year option to create a patent family (1).

*Request for examination (2), (3) and (4):* In order to induce the central phase of the patent process, namely examination, applicants have to formally request it. The patenting process is put on hold until the patent office receives the request. Without the request, no grant or refusal decision is taken by the office. The request currently entails a fee of 350 €. Many applicants file the request for examination together with the patent application (by ticking a box on the application form). In that case the examination option is exercised at the beginning and the patenting process proceeds most rapidly (2). Nonetheless, there are applicants who do not request examination immediately. German patent law allows for a period of up to seven years to lapse between a patent application and the request for examination (3). Furthermore, German patent law allows applicants to modify their patent application until the date of grant, provided the subject-matter of the initial application is not expanded (cf. §38 PatG). If no request for examination is filed before the seventh year ends, the patent application is deemed to be withdrawn (4). Thus the maximum lifetime of the examination option is seven years.

*Annual fees (5):* After the second year, maintaining the examination option entails the same annual fees as maintaining a granted patent. If these fees are not paid in a timely manner, the patent application is deemed to be withdrawn.<sup>11</sup>

## **4 Motives to file an application for a patent**

Subsequent applications, the request for examination, and the payment of annual fees allow the applicant to influence the application process. How a firm utilizes them depends on the beliefs that the firm has concerning the patentability of its invention and the estimated value of the potential exclusion rights. It further depends on the importance of FTO. Thus, by analyzing from patent data how and when an applicant has used the above means we can derive conclusions on its motives for filing the patent. Furthermore, we can assess the kind of value that the firm has realized upon completion of the patent process. We identify four different application process patterns, which are summarized in Table 1 and discussed in the following.

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<sup>11</sup> The annual fees are payable in advance. For the third year, the fee is due on the last day of the 24th month after the filing date. In case of payment delays, there is a grace period of six months which may lead to additional charges. The fees increase over time, with 70€ for the 3rd year, 70€ for the 4th year, 90€ for the 5th year, 130€ for the 6th year, and 180€ for the 7th year (<http://dpma.de/english/patent/fees/index.html>, accessed 13.02.2009).

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#### **4.1. Obtain a (fast) patent grant / accelerate process**

Assume that a firm believes that its invention satisfies all criteria of patentability. Assume further that the firm believes that a patent on the invention would be worth the cost of a fully carried out patenting process (including procedural fees, cost of patent attorneys, and cost internal to the firm)<sup>12</sup>. Then, this firm would likely take the necessary steps to accelerate the patent process rather than keep it pending. Consequently, the firm will file the request for examination at the filing day of the patent application or immediately after.

In general, the earlier an applicant requests examination the less it profits from the examination option. Thus, we suggest that an immediate request for examination indicates the applicant's confidence in the patentability of the invention. Furthermore, it reveals that the applicant expects the patent's value to exceed the cost of patenting. Hence, in such a case obtaining an exclusion right as soon as possible is among the motives for filing.

Whether or not the applicant will file subsequent applications depends on if the value of geographically extended exclusion rights is high enough to justify the cost of carrying out multiple patent processes. It is beyond the scope of this paper to investigate the outcomes of patenting processes at other patent authorities, so we limit our analysis to the simple existence of subsequent filings.

Regardless of subsequent filings or the request for examination, any patent application is published. This publication maintains FTO for an invention exactly in the way it is described in the application form.

The amount and kind of information that a firm discloses in the patent application will result from a trade-off between the loss of secrecy on the one hand, gains from sufficient maintenance of FTO and broad patent protection on the other.

We draw two conclusions. First, an immediate request for examination indicates that obtaining exclusion rights was among the motives for filing the patent application. Second, securing FTO can, but need not, be among the motives.

#### **4.2. Extend pendency / gain time**

Accelerating the patenting process seems to be rational in many cases. However, there are situations in which applicants benefit more from delaying it. Consider a firm that is uncertain

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<sup>12</sup> Cf. van Pottelsberghe de la Potterie and François (2006) for an analysis of the cost of patenting at the EPO, the US Patent Office and the Japanese Patent Office.

about the patentability of an invention or that does not know whether a potential patent is worth the cost of a full patenting process. Such a firm will file a patent “just in case,” but will not file the request for examination immediately.

The applicant thus gains time, and can benefit in two ways from doing so. First, assume the applicant considers it likely that its application, or at least some of the claims, will be rejected (a “deliberately deficient” filing, cf. Guellec and van Pottelsberghe de la Potterie, 2007, p.180). In that case, by delaying the request for examination the applicant keeps its application in the state of “patent pending,” which is more favorable than a rejected application. Faced with such insecurity, competitors (in particular those unable to assess the quality of the application) might want to avoid the risk of infringement and thus incur expenses to adapt their business accordingly (e.g. try to invent around).<sup>13</sup> Analyzing its backlog of pending applications, the EPO has recently pointed to the strategic motives behind delaying the office’s decisions (cf. Section 1.1.).

Second, firms might benefit from the delay to make a more informed decision about the private value of an examination, by collecting and evaluating additional information about technology and market. Furthermore, they can modify the application (see Section 3), which may lead to a more valuable patent than the initial application.

The discussion of the value of the family option again depends on the value of geographical extension. It is not unrealistic that an applicant—although seeking patent protection in other jurisdictions—is benefiting more from a pending application in the German market. It could expect that the GPTO will reject the patent while it is being granted by a foreign office—say, the US Patent Office. As already mentioned we do not analyze foreign patent processes. Thus, it is possible (but unobserved) that a firm delays the process at other patent authorities as well.

As pointed out earlier, the value of securing FTO is determined by what the applicant plans to do with the invention. For use in its own operations, FTO constitutes a “basic value” that is realized in any case, even if the applicant later decides that the invention is not worth an examination or if it is rejected. If the applicant willfully filed a non-patentable invention (or indefensible claims) and profited from the patent’s pendency in the process, then securing FTO is of little or no value: since the invention was not patentable anyway, there should be no risk that some other party receives a patent on it. However, if we assume that the GPTO rejects such a patent to one firm, but would (wrongfully) grant it to another, or some other pat-

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<sup>13</sup> Note that also third parties can request examination. This measure will likely be taken by competitors that do have the ability to identify non-patentability of the invention.

ent authority would grant it, then again the FTO-securing function of the application is valuable.

We conclude that patents with long delay before examination or (deemed) withdrawal can have two motives: First, the applicant wants to hold an option to enter the regular process of obtaining exclusion rights. Second, it wants to create insecurity through a pending patent.

#### ***4.3. Secure priority***

We argue that some national patents are filed just in order to secure an international priority right as guaranteed by the Paris convention (and the European Patent Convention). In that case it might not be rational for an applicant to pay any annual fees or file a request for examination for the initial application at the GPTO. Imagine a German firm that has made an invention and seeks patent protection as fast as possible. In order to secure priority, it files a patent at the office that they are most familiar with and where they have the lowest cost, namely, the GPTO. By doing so, the applicant gains one year to assess whether it is worthwhile to extend patent protection. For Europe, it may prefer the centralized patenting process at the EPO over filing multiple national patents separately, and choose Germany as one of the designated states in the EPO application. This supersedes the previous filing at the GPTO, so that there is no need to request examination nor to pay annual fees at the GPTO. Consequently, the GPTO application will be deemed to be withdrawn.<sup>14, 15</sup>

For the discussion of the value of securing FTO the same argument as for the “accelerate process” pattern applies. It depends on if the applicant seeks international patents for blocking competitors only or if it does so in order to protect own operations. In the latter case, the publication of the German patent application would secure FTO for the invention as it was published by the GPTO.

#### ***4.4. Securing FTO as sole potential motive: Defensive publishing in the patent system***

There are inventions for which the incremental value of an exclusion right over FTO is too low to justify the cost of patenting, and/or for which patentability is uncertain. Nonetheless, FTO might be crucial. If secrecy is not important, then publishing the invention in a defensive publication (DP) is an appropriate strategy to maintain FTO. Henkel and Pangerl (2008) re-

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<sup>14</sup> Application DE000004000507A1 provides an example: 10.01.1990: application filed at GPTO; 18.12.1990: application filed at EPO (designated states: Germany, France, Great Britain); 01.10.1992: application deemed to be withdrawn by GPTO; 26.01.1993: request for examination at EPO; 20.11.1997: patent granted by EPO (EP000000436986B1)

<sup>15</sup> The only case in which it would make sense to maintain the GPTO application is, if the applicant fears rejection of the EPO patent. In that case, it could file a request for examination for the national GPTO application after the EPO has rejected the European patent application. If the GPTO grants the patent, although the EPO has already rejected it, then the applicant has at least national protection in Germany.

port that about one third of the firms in their sample would create DPs through the patent system. Applicants would typically file for national patents, since these carry lower fees than those at the EPO. The authors quote one of their interviewees as follows (Henkel and Pangerl, 2008: 15): *“You just send the whole junk to the patent office, and when you are in a good mood you add one or two patent claims. And this will be published some time, and then you effectively have the state of the art.”* Attractive features of this approach are the clear and indisputable time stamp, and the fact that patent applications are easy to find for examiners searching for prior art. This alleviates the concern of Arundel and Patel (2003: 3) who state that DPs might be ineffective due to patent examiners’ inability to find them.

Since obtaining exclusion rights is not among the motives for filing such applications, there is neither a rational ground for filing the request for examination, nor for paying any annual fees, nor for filing any subsequent applications at other patent authorities. One positive side effect of this method of creating prior art is that such DPs are counted in patent statistics, which may help a firm to create an image of innovativeness.

We highlight one feature of the patent system which is a further strong indicator for the FTO-maintaining function of patent applications. Upon a (costless) request by the applicant the GPTO publishes patent applications earlier than 18 months after filing. This early publication shifts the point in time where worldwide FTO is ultimately secured closer to the filing date. Firms that do not take measures for obtaining an exclusion right (i.e. pay annual fees and file request for examination) but at the same time request early publication seem to have securing FTO as their sole motive for filing an application for a patent. We take this pattern as the strongest indicator for DP in the patent system.

We finally remark that applicants can change their intentions during the patent process. They may have intended securing FTO only at the filing day, and then realized that an exclusion right would be more valuable than expected. It is important that such change takes place before the first annual fees are due. By paying the fees, the applicant “buys” time in order to evaluate whether it is worthwhile to file the request for examination. Such (unobservable) events lead to an undercounting, and hence to a conservative estimate, of the number of applications initially filed for FTO purposes only.

As already mentioned above, intention may also change from obtaining an exclusion right to securing FTO only. Such change is possible in any case since any patent application has a FTO-maintaining effect (may it be valuable to the applicant or not). The value from securing FTO depends on the amount and kind of information that was disclosed. If obtaining an exclusion right was the main driver for patenting *ex ante*, then the disclosed information

might differ from information disclosed in an application that was filed for maintaining FTO only.

## 5 Dataset

### 5.1. Patent data analysis

The goal of our empirical analysis is to identify above process patterns in patent data. We analyze all direct patent applications at the German Patent and Trademark Office (GPTO). This dataset includes applications that were directly filed at the GPTO by the applicant. We exclude PCT applications and granted EPO patents that were transferred to the GPTO (we label the remaining applications “GPTO direct filings”). Furthermore, we exclude patent applications with foreign or internal priority. The remaining applications are labeled “GPTO direct first filings”. In other words, we only analyze patent applications where the office that received the first filing is the GPTO. We do so for the following reason. We argued above that even applications that are never internationalized or that lapse very early carry specific value components. If we allowed for applications with foreign priority, we would include applications at other authorities that are worth the cost of internationalization. At the same time we would ignore those that were not extended to the GPTO, but nonetheless might have a valuable FTO-maintaining function.

In order to avoid truncation problems from pending patent applications we cut off applications with filing dates later than 31.12.2000. Our further analysis refers to a set of 443,988 GPTO direct first filings filed between 1986 and 2000. Figure 2 presents the temporal distribution of our dataset.

--- *Insert Figure 2 about here* ---

The construction of the dataset was done as follows. We used data from the “DPMAdatenabgabe” data file of the GPTO in order to construct a set of all direct first filings at the GPTO. DPMAdatenabgabe contains raw data on all patent applications processed by the GPTO. It is delivered in an EBCDIC format (Extended Binary Coded Decimals Interchange Code). We used a C#-program to transfer the EBCDIC data into a SQL database.<sup>16</sup> DPMAdatenabgabe contains information on the legal status of patent applications. Our analysis of patent process patterns is based on this information. In the next step we joined the data-

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<sup>16</sup> C# (“C Sharp”) is an object-oriented programming language developed by Microsoft.

set with the EPO Worldwide Patent Statistical Database (PATSTAT). That way, we were able to include bibliographic information and patent family size in our set of GPTO direct first filings. In the final step we enriched the dataset with information on the timing of legal events from the INPADOC backfile of the European Patent Office. INPADOC is delivered in a XML format (Extensible Markup Language) and contains legal status information of various patent authorities (such as the EPO, GPTO, or the USPTO). We used Java application to import it into a SQL database and then linked it to PATSTAT.

### **5.2. Interviews with inventors**

In order to improve the interpretation of the process patterns that we identified in patent data, we conducted a qualitative survey among inventors. Therefore, a random sample was drawn from the population of patents that show process patterns relevant to our analysis. As a next step, letters requesting an interview were sent out to the inventors indicated on the patent documents. In the weeks after, we were able to conduct 25 interviews with inventors. We asked our interviewees about the motives behind the respective patent application. In particular, we asked about the inventive step of the underlying invention, its potential commercial value, and the role that securing FTO and pendency played in the patenting process. All interviews were documented in written protocols and then analyzed. The average duration of the interviews was 15 minutes.

## **6 Empirical results**

In the previous sections, we related specific patterns of the patent process to motives for filing a patent. This section identifies such patterns and quantifies the extent of their occurrence in patent data. Thereof, we draw conclusions on the relative frequency of the motives to patent that we discussed above (cf. Table 1). Figure 3 presents the outcomes of 443,988 GPTO direct first filings at the GPTO in our dataset in an aggregated way. It shows the frequency (in percent) and the timing (before publication, year 2-7 after filing date) of legal events that either terminated the patent process or induced examination.

--- *Insert Figure 3 about here* ---

In the context of our analysis we distinguish two elementary ends of the process that is induced by filing a patent. First, we find the dominant share of 64.7% of all applications for which examination was requested. In these cases, as we argued above, obtaining an exclusion right (whatever it might be intended to be used for) was among the motives for patenting. Sec-

ond, we find that for 35.3% of all applications no examination is started. These applications lapse before examination, either through being deemed to be withdrawn or through an active withdrawal by the applicant; nonetheless, they fulfill the function of securing FTO. Furthermore, 51% of them (that is, 18% of all filings) have subsequent applications. That is, although they lapsed at the GPTO they served as priority filings at other patent authorities.

The motives for patenting that we discussed in the previous sections become even clearer when we look into the timing of events in the patent process. We analyze the timing of the request for examination first.

### **6.1. Immediate start of examination**

In the case of 47.8% of all GPTO direct first filings the request for examination was filed before the application was published. Most of the requests were filed together with the patent application. These applications correspond to the “accelerated process” pattern. We argue that they were filed in order to obtain an exclusion right as fast as possible. We further argue that this motive holds uniformly for individual (16.4%) as well as corporate or institutional applicants (83.6%). The share of individual applicants is slightly above the average of all applications at the GPTO (which was at 14.6% between 1986 and 2000).<sup>17</sup>

### **6.2. Pending patents**

We identify further 16.9% of all GPTO direct first filings for which examination was requested, but not immediately. We argue that a significant share of value of these applications comes from the *option* to request examination. In these cases, applicants wanted to gain time in order to assess whether it is worthwhile to carry out a full examination process. Further value comes from the applications’ pendency in the process. As we noted above, it might be desirable for an applicant to have a lengthy patent process in order to create insecurity for competitors. Our notion is supported by a closer analysis of the timing of lately filed requests for examination as presented in Figure 4.<sup>18</sup>

--- *Insert Figure 4 about here* ---

The analysis shows very clearly that the largest share of lately filed requests for examination (8.9% of all GPTO direct first filings) is filed as late as possible, namely in the sev-

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<sup>17</sup> Annual reports of the GPTO, <http://dpma.de/service/veroeffentlichungen/jahresberichte/index.html> (accessed 15.02.2009)

<sup>18</sup> The variation in timing and pendency longer than seven years are due to grace periods at GPTO and delay in publication of legal event in the INPADOC data file.

enth year. Thereof, 90.4% were filed by corporate or institutional applicants. The shares of applications that have their request for examination in the years two, three, four, five or six are much smaller. Altogether, they account for 8% of all applications (83.3% of them were filed by corporate or institutional applicants). The 8.9% share of applications with request for examination in the seventh year falls under the “gain time” process pattern of the previous section (cf. Table 1). We argued above that delayed requests for examination may have two explanations. Firstly, applicants may wait as long as possible in order to gain as much time as possible to assess the value of a potential exclusion right. Second, they may want to keep their application’s pendency as long a possible.<sup>19</sup>

In our interviews, we asked inventors about the role of such long pendencies. The interviews reveal that under certain conditions a pending patent offers enough protection (as compared to a granted patent) while at the same time involving much lower cost. Such costs accrue from the examination fee, from patent attorneys or internal staff communicating with the patent examiners and from patent prosecution.

In the case of individual, non-corporate applicants patent applications are often kept pending while the applicant is actively searching for or while it is expecting to be contacted by licensees or buyers of a potential patent. One interviewee stated that “[*pendency*] is less expensive than a patent but still effective enough to negotiate [*with potential licensees*].”

In the case of corporate or institutional applicants, it seems to be common practice to maintain pendency of patent applications covering technologies that belong to a field considered strategically important but that are not yet embodied in concrete products or processes. When the future role of such a technology is clear, e.g. when it is clear that a new product will rely on that technology, then the request for examination is filed.

This strategy has another important advantage.<sup>20</sup> It makes it difficult for competitors to identify potentially important technology fields in public patent data. Assume a firm that has filed 100 patent applications, 50 covering important inventions that will likely be embodied in future products, and 50 covering less important inventions. Even if the firm already knows the 50 valuable inventions today, it has an incentive to keep all 100 patents pending. There are two reasons. Firstly, if it requests examination for its 50 important filings immediately and let the remainder lapse, then it would reveal to its competitors which and how many of the 100

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<sup>19</sup> If they want to keep it even longer than seven years they will, at the end of that period, file the request for examination (at a cost of 350 €). Overall, they thus arrive at far more than seven years of pendency. In fact, we find patents in the dataset that were granted not until 13 years after application. E.g. patent publication number DE000004230299A1, application filed: 10.09.1992, grant published: 22.12.2005

<sup>20</sup> One further advantage is that patent application can be modified until examination is requested provided the subject-matter of the initial application is not expanded (cf. §38 PatG).

inventions are valuable. Thus, from a firm's perspective, holding a multitude of pending patents effectively mitigates negative effects of patent disclosure (e.g. Anton and Yao, 2004) since relevant information is being diluted.<sup>21</sup> Secondly, if the firm requests examination early, it would incur the cost of examination and prosecution earlier than necessary, since the inventions have not yet been embodied in a product or process (by the focal firm or by a competitor). Concluding, it seems that while both individual as well as corporate applicants benefit from the option value of a pending patent, corporate applicants further profit from the resulting insecurity for competitors.

We should expect to observe long pendency also for patent applications deemed to be withdrawn if they have been filed by corporate applicants. Figure 5 presents the timing of deemed withdrawals that refer to patent applications by corporations (and institutions) that do not have a request for examination.<sup>22</sup> These applications are deemed to be withdrawn due to non-filing of the request by the patent office the latest in the seventh year or earlier (due to non-payment of the annual fee) if the applicant stops paying annual fees.

--- *Insert Figure 5 about here* ---

As expected, we observe a peak around the seventh year. It represents corporate and institutional patent applications that were rejected due to absence of a request for examination. It accounts for 6.0% of all patent applications. Further 3.5% drop out due to non-payment of the annual fee in the seventh year.

If we run a similar analysis for individual (non-corporate) applicants, we obtain a different distribution (Figure 6). Although we observe long pending patents, they do not constitute a majority.

--- *Insert Figure 6 about here* ---

This finding indicates that corporate or institutional applicants exploit pendency more intensively than individuals. They keep a larger share of their patent applications pending for the maximum statutory period of seven years, even if they finally do not pursue them further.

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<sup>21</sup> One interviewee from the machinery industry described the role that patent documents play in competitive intelligence as follows: "If there were no patents, competitors would not know what the other does. Patents are an open book and show towards what direction [technologies] are being developed."

<sup>22</sup> The variation in timing and pendency longer than seven years are due to grace periods at GPTO and delay in publication of legal event in the INPADOC data file.

### ***6.3. Early lapsed patents***

We ultimately have a remainder of patent applications (corporate and individual) that lapsed in the third year after filing when the first annual fees would have been due either because fees were not paid (7.6%) or because they were actively withdrawn (2.8%). In the previous section we discussed two potential motives that might stand behind such patent applications.

We argue that if such applications are referenced as priority by subsequent filings, then the motive for filing them could simply have been to secure priority for one year while assessing and preparing a plan for international patent protection. Around 32% of applications that lapse in the third year due to non-payment of fees have subsequent filings (2.4% of all GPTO direct first filings). The same logic applies for withdrawals. Most of them take place in the second year (2.1%, cf. Figure 3). A majority of 85.9% of applications actively withdrawn in the second year has subsequent filings. Securing priority would be consistent motive for filing a GPTO patent first, then filing patents at other authorities, e.g. the EPO, and withdrawing the German application afterwards.

It remains a share of 14.1% of applications actively withdrawn in the second year and a surprisingly high share of 68% of all applications lapsed in the third year that do not have subsequent applications (in total 5.4% of all GPTO direct first filings). From an ex post perspective, it is obvious that their applicants supposed that if these patents had been granted, they would not have been valuable enough to compensate the cost of a full examination process. Otherwise they would have filed the request for examination. The sole effect that such a patent application has ex post is that it was pending for a short period, and that it created prior art.

For the discussion of the FTO-maintaining effect, we first exclude patents filed for by individual inventors (in contrast to corporate applicants) since they are normally seeking profits from licensing instead of operating own production facilities. Apparently, individual inventors have no value from securing FTO. A considerably high share of 54.8% of all applications lapsed in year three that have no subsequent filings was filed by individual inventors<sup>23</sup> (2.8% of all GPTO direct first filings, cf. Figure 6). Our interviews reveal a clear picture of these applications. While the applicants were hoping for income from licensing or sale of the patent at the day of filing, they later realized that their invention had no commercial value and let the application lapse.

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<sup>23</sup> Note that on average 14.6% of GPTO patent applications between 1986 and 2000 were filed by individual inventors (cf. annual reports of the GPTO, <http://dpma.de/service/veroeffentlichungen/jahresberichte/index.html>, accessed 15.02.2009).

The group of applications that is relevant to our discussion of maintaining FTO is constituted by patents filed for by corporate or institutional applicants. This share amounts to 45.2% of early lapsed patents that have no subsequent filings (2.3% of all GPTO direct first filings). The critical question for our analysis is what role of the FTO-maintaining effect played *ex ante*, i.e. when the application was filed.

First, it could have been *one motive among others* (namely exploiting pendency or the examination option). If so, securing FTO can be understood as some kind of “fallback position,” or basic result. A firm might file a patent on an invention (for which the value of an exclusion right cannot be estimated) “just in case.” They know that they will secure FTO in any case. If it turns out that an exclusion right would over-compensate its cost the firm can carry out the examination process. If the opposite turns out, the firm will drop the patent application and at least maintain their FTO. We observe this behavior for more than 2% of all GPTO direct first filings in the third year. Here, the applicants’ interest in holding the examination option or maintaining pendency seems to be small since they are not even willing to pay the (rather modest) first annual fee of 70€ The same argument holds for applications that dropped out later. The difference is that it took the applicant longer than until the third year to realize that an exclusion right would not be worth its cost.

Second, securing FTO could have been the *only motive ex ante*. That is, a firm has never had the intention to obtain an exclusion right, but to use the patent system as a low-cost medium for publishing an invention (remember that filing a GPTO patent costs not more than 60€): that is, defensive publishing (DP) in the patent system. If DP was the sole *ex ante* motive for filing a patent, then the application will neither have a request for examination nor subsequent filings. Furthermore it will lapse after 3 years. More than 2% of all direct first filings at the GPTO show this pattern. This can be interpreted as an upper limit for the share of patent applications that have DP as their *sole* motive *ex ante*. As we discussed above, the share of applications that has this motive as *one among others* will be much higher.

In the previous section we argued that the strongest indicator of DP in the patent system were early published patent applications. 2.0% of all GPTO direct first filings are published earlier than 18 month after filing upon request by the applicant. Thereof, a few hundred have no request for examination, no subsequent filings and lapse in year three and were filed by corporate or institutional applicants (0.057% of all GPTO first filings). They show two special features. First, their sole effect is securing FTO. We discussed this mechanism in the pervious paragraphs. Second, the applicant took measures to shift the point in time where FTO is ultimately secured closer to the filing date. From this behavior, we conclude that it has

maximum value from securing FTO and no value from an exclusion right. Our interviews with inventors of such patent applications clearly confirm this conclusion. We interpret this 0.057% of all GPTO first filings as the tip of an iceberg of decreasing relative value of securing FTO of patent applications.

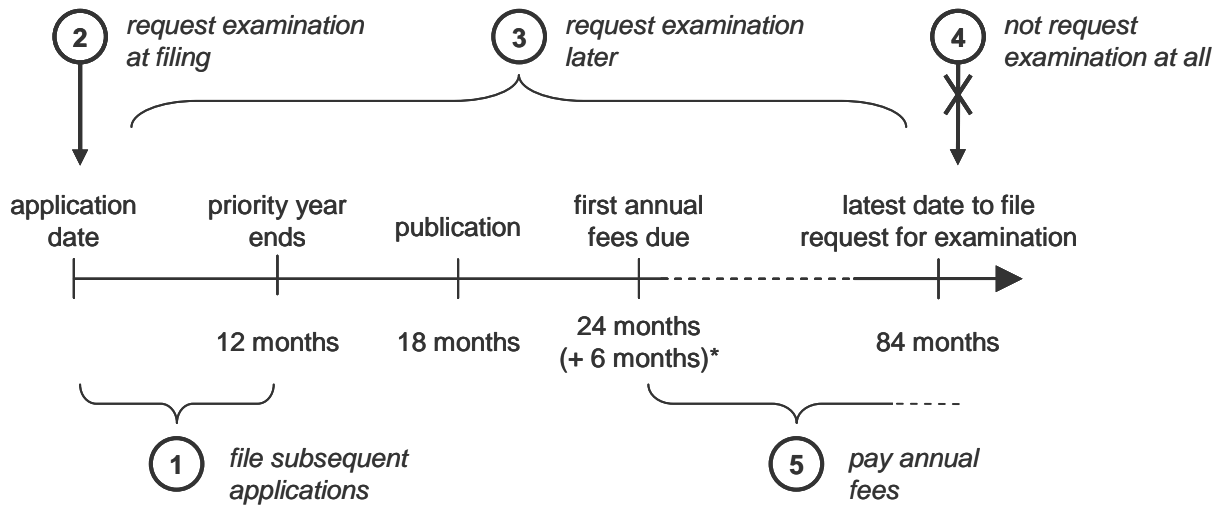
## 7 Conclusions

In this paper we analyze how firms and individuals profit from pendency and publication of patent applications. Although these aspects of the patent system are publicly debated, empirical findings from patent data are scarce.

We use a unique approach of analyzing patent data and combining it with interviews conducted with inventors of patent applications that exhibit process patterns interesting to our analysis. In total, we analyzed a set of 443,988 patent applications at the GPTO and conducted 25 interviews. Our analysis shows that 20.3% of the applications are pending seven years until they are either (deemed to be) withdrawn without examination or until examination starts. This suggests that applicants benefit from long pendency of their patent applications. We assume that this benefit is based on the gain of time in order to evaluate if an exclusion right is worth its cost. In the case of corporate (instead of individual) applicants further benefit is based on the creation of insecurity for competitors through pending patents. This practice seems to be effective for generic technologies whose market is considered “strategic” as a whole, but which are not yet embodied in concrete products.

Our analysis further suggests that a significant share of patent applications could actually turn out to be defensive publishing. Empirical evidence, both from interviews (cf. also Henkel and Pangerl, 2008) and from a large scale survey (de Rassenfosse et al., 2008), reveals that securing FTO is an important motive for patenting. Our study is a first step to identify defensive publishing in the patent system. The results obtained indicate that more than 2% of the direct first filings at the GPTO could be *pure* defensive publications. The share of applications where DP is *one motive among others* will be much higher. In fact, value from securing FTO inheres in all patents that are filed on inventions used in the applicant’s own operations. They all are to some degree defensive publications.

## Figures and Tables



**Figure 1:** Major events in the patenting process at the German Patent and Trademark Office (\* §3 (2), §7 (1) Pat-KostG)

<b>Event</b>	<b>Filing of subsequent applications</b>	yes/no	yes/no	yes	no
	<b>Filing of request for examination</b>	before publication	after publication or not at all	no	no
	<b>Payment of annual fees</b>	yes	yes	no	no
<b>Revealed intention</b>					
<b>Accelerate process</b>		<b>Gain time</b>		<b>Secure priority</b>	
<b>Potential motives for filing patent</b>					
Obtain (international) exclusion right as fast as possible; maybe secure FTO		Obtain option to channel application into national examination process; maybe obtain international exclusion rights; create insecurity through pending patent; maybe secure FTO		Have a “foot in the door” to international exclusion rights; maybe secure FTO	
Secure FTO only					

**Table 1:** Observed patterns of behaviour in the patent process and potential motives for a filing patent

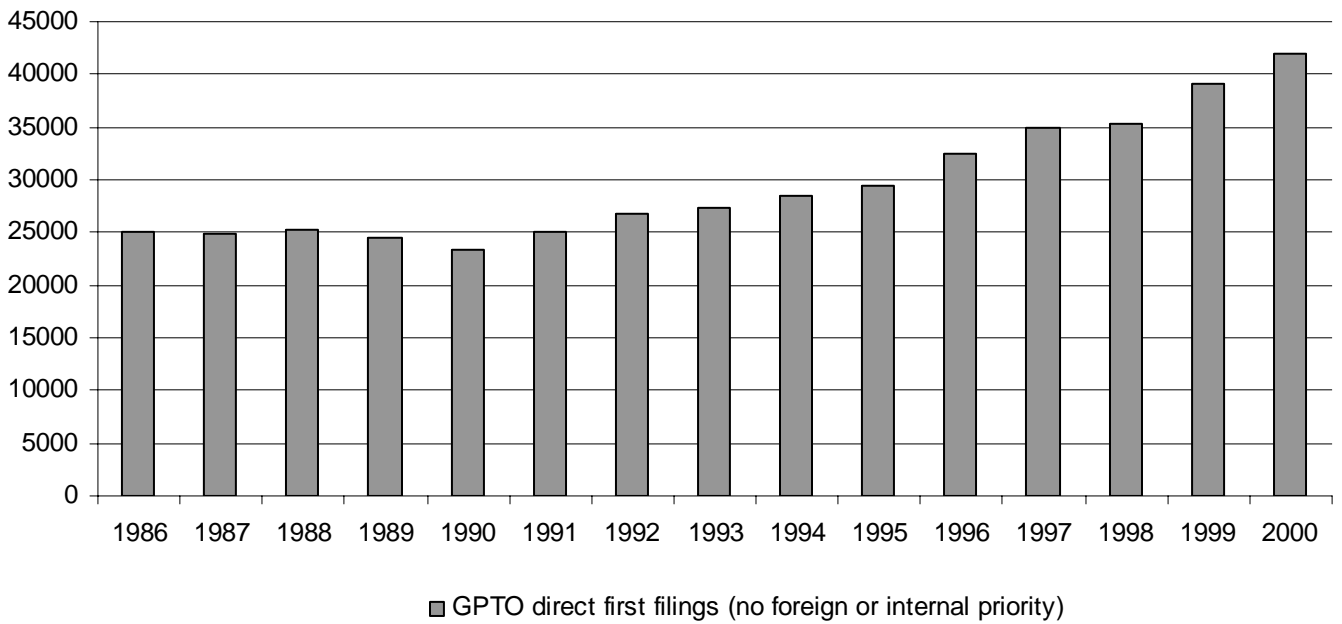


Figure 2: Number of direct first filings at the GPTO by application filing date

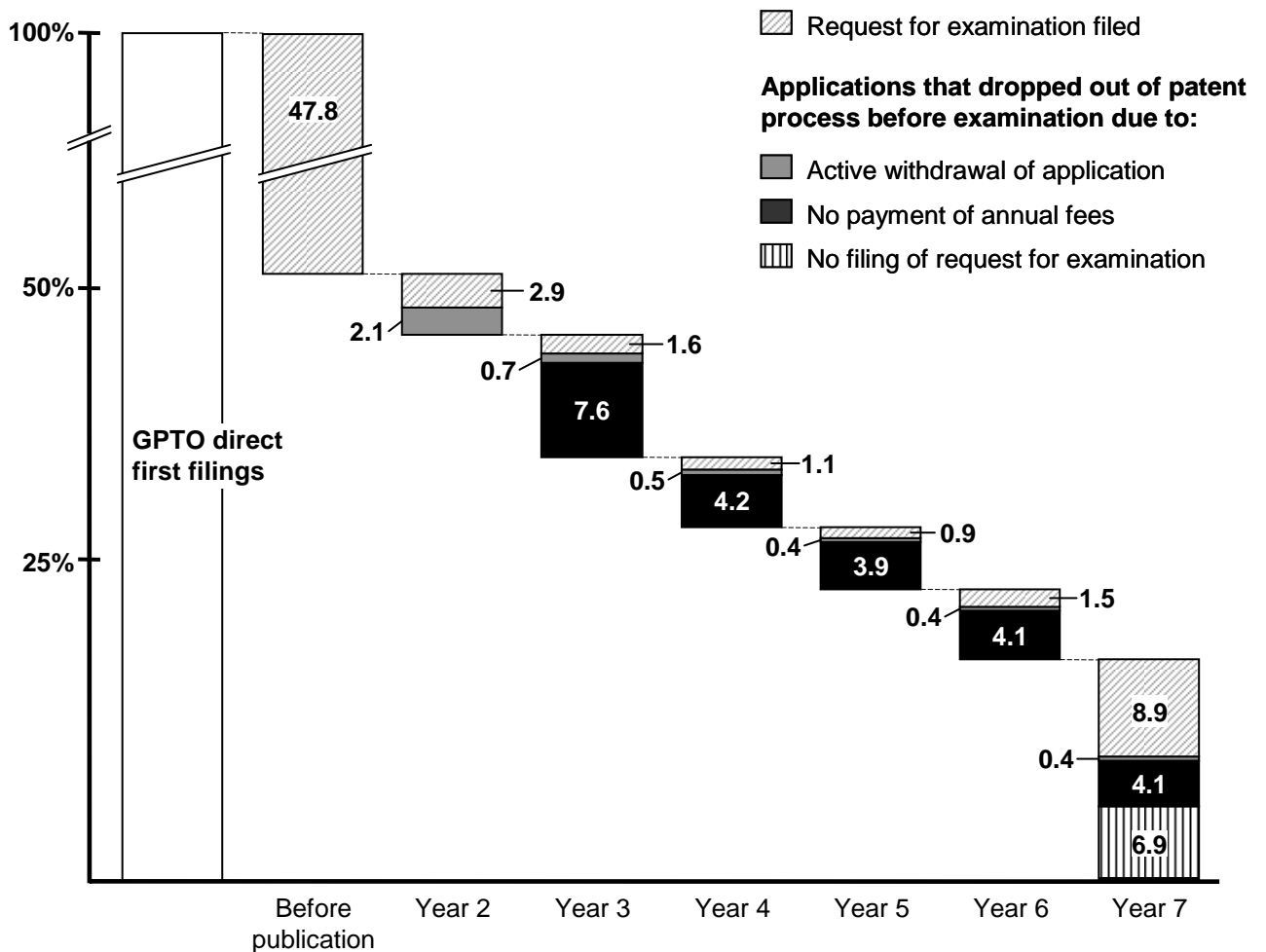
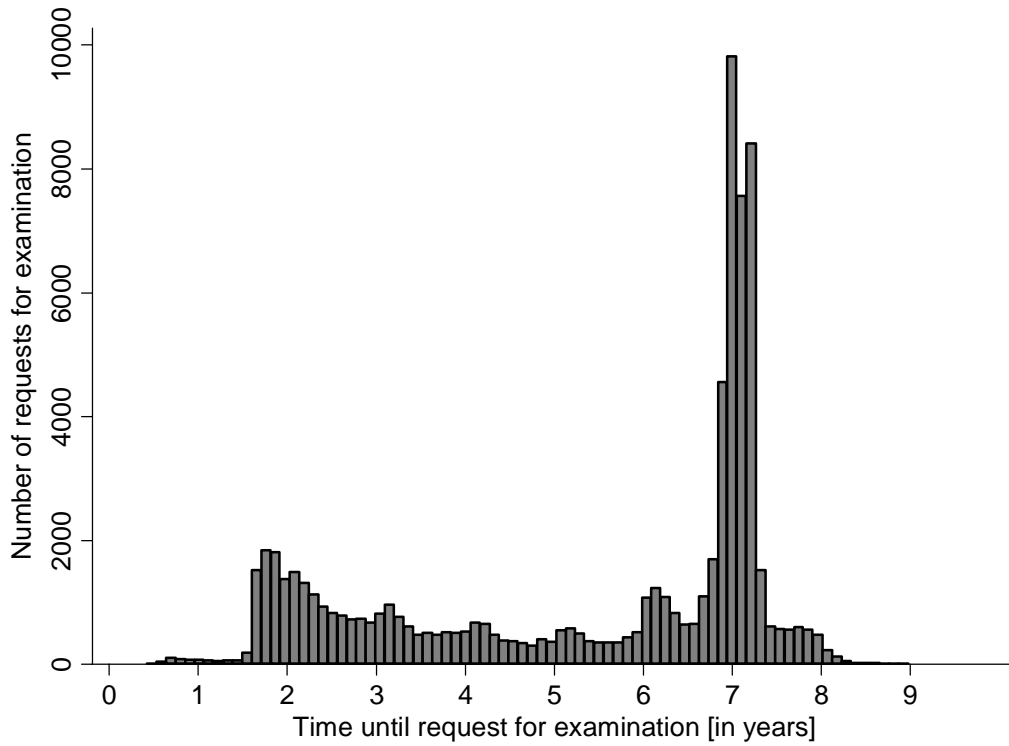
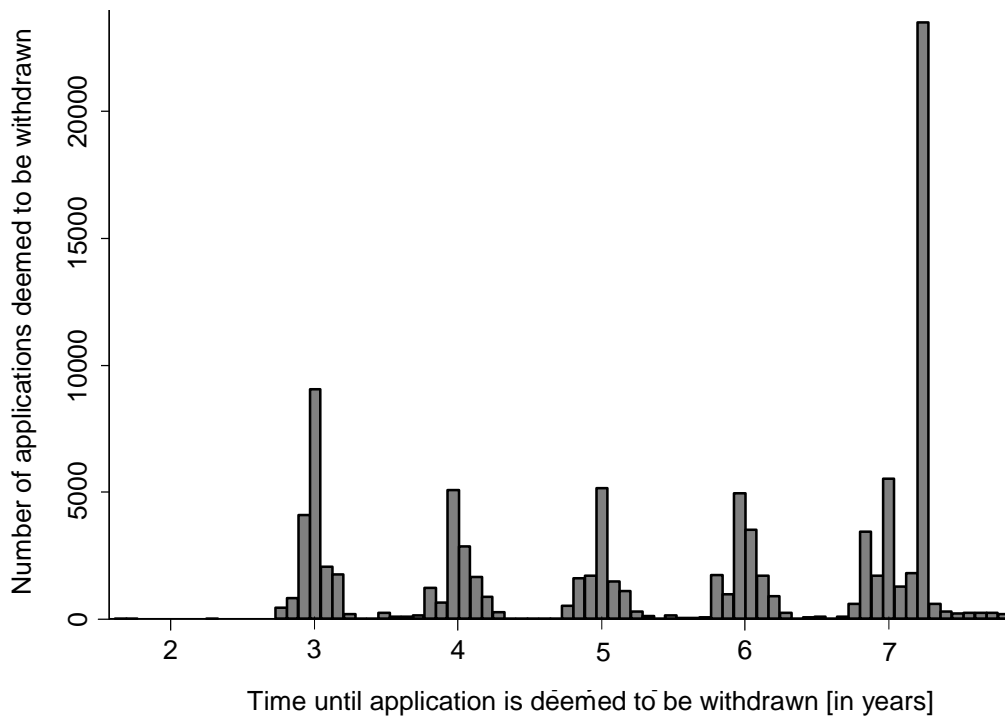


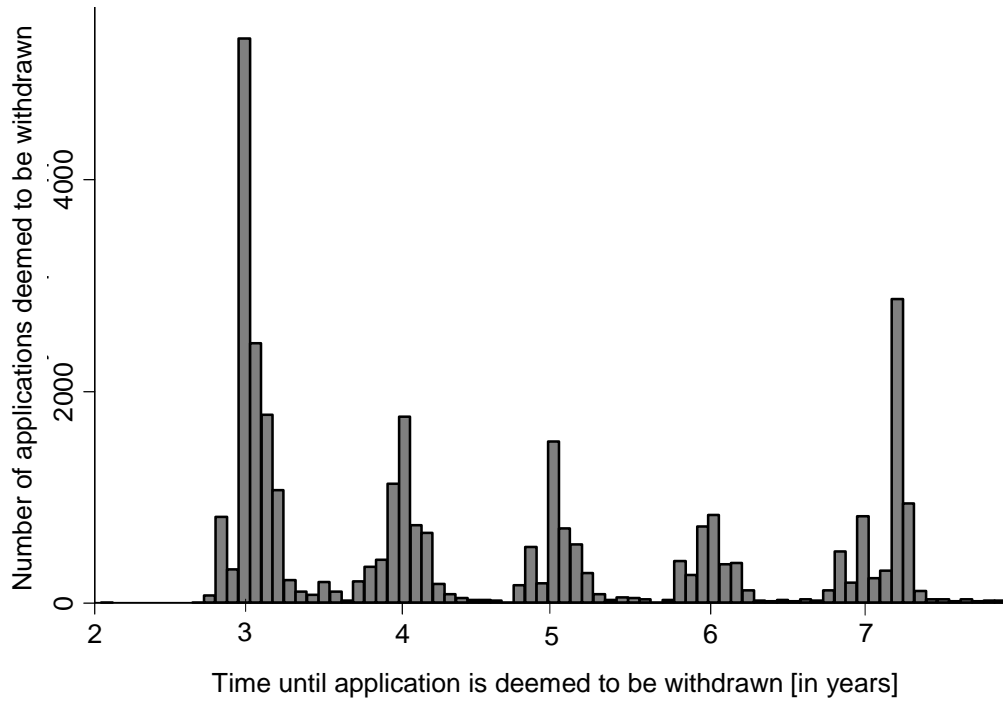
Figure 3: Shares of drop-outs or examination requests per year after filing date of GPTO direct first filings in [%]



**Figure 4:** Timing of lately filed requests for examination



**Figure 5:** Timing of deemed withdrawals of applications without request for examination (filed by corporate or institutional applicants)



**Figure 6:** Timing of deemed withdrawals of applications without request for examination (filed by individual applicants)

## References

- Anton, J. J. and D. A. Yao (2004). Little patents and big secrets: managing intellectual property. *RAND Journal of Economics* 35(1): 1-22.
- Aoki, R. and Y. Spiegel (in press). Pre-grant patent publication and cumulative innovation. *International Journal of Industrial Organization*.
- Arundel, A. (2001). The relative effectiveness of patents and secrecy for appropriation. *Research Policy* 30(4): 611-624.
- Arundel, A. and P. Patel (2003). Strategic patenting. Background report for the Trend Chart Policy Benchmarking Workshop New Trends in IPR Policy. Luxembourg.
- Arrow, K. J. (1962). Economic welfare and the allocation of resources for invention, in Nelson, R. The rate and direction of inventive activity. Princeton University Press. Princeton, NJ.
- Blind, K., K. Cremers and E. Mueller (2009). The influence of strategic patenting on companies' patent portfolios. *Research Policy* 38(2): 428-436.
- Blind, K., J. Edler, R. Frietsch and U. Schmocha (2006). Motives to patent: Empirical evidence from Germany. *Research Policy* 35(5): 655–672.
- Cohen, W. M., R. R. Nelson and J. P. Walsh (2000). Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not). NBER Working Paper No. 7552, February 2000.
- de Rassenfosse, G., D. Guellec and B. van Pottelsberghe de la Potterie (2008). Motivations to patent: Empirical evidences from an international survey. Mimeo. Université Libre de Bruxelles, ECARES.
- Granstrand, O. (1999). *The Economics and Management of Intellectual Property*. London: Edward Elgar.
- Guellec, D. and B. van Pottelsberghe de la Potterie (2000). Applications, grants and the value of patent. *Economics Letters* 69(1): 109-114.
- Guellec, D. and B. van Pottelsberghe de la Potterie (2007). *The Economics of the European Patent System: IP Policy for Innovation and Competition*. Oxford: Oxford University Press.
- Hall, B. H. (2005). Exploring the Patent Explosion. *The Journal of Technology Transfer* 30(1-2): 35-48.
- Hall, B. H. and R. Ham Ziedonis (2001). The patent paradox revisited: an empirical study of patenting in the U.S. semiconductor industry, 1979-1995. *RAND Journal of Economics* 32(1): 101-128.

Hall, B. H., A. Jaffe and M. Trajtenberg (2005). Market value and patent citations. *RAND Journal of Economics* 36(1): 16-38.

Harabi, N. (1995). Appropriability of technical innovations an empirical analysis. *Research Policy* 24(6): 981-992.

Harhoff, D. and M. Reitzig (2004). Determinants of opposition against EPO patent grants - the case of biotechnology and pharmaceuticals. *International Journal of Industrial Organization* 22(4): 443-480.

Harhoff, D., F. M. Scherer and K. Vopel (2003). Citations, family size, opposition and the value of patent rights. *Research Policy* 32(8): 1343-1363.

Harhoff, D. and S. Wagner (2005). Modelling the duration of patent examination at the European Patent Office. *CEPR Discussion Paper No. 5283*.

Henkel, J. (2007). *Offene Innovationsprozesse - Die kommerzielle Entwicklung von Open-Source-Software*. Gabler. Wiesbaden.

Henkel, J. and S. Pangerl (2008). *Defensive publishing - An Empirical Study*. Working Paper. Technische Universität München.

Henkel, J. and M. Reitzig (2008). Patent Sharks. *Harvard Business Review* 86(6): 129-133.

Horstmann, I., G. M. MacDonald and A. Slivinski (1985). Patents as Information Transfer Mechanisms: To Patent or (Maybe) Not to Patent. *Journal of Political Economy* 93(4): 837-858.

Johnson, J. P. (2004). *Defensive publishing by a leading firm*, Working Paper, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=606781](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=606781), Retrieved May 06, 2008.

Johnson, D. K. N. and D. Popp (2003). Forced out of the closet: the impact of the American Inventors Protection Act on the timing of patent disclosure. *RAND Journal of Economics* 34(1): 96-112.

Jaffe, A. B. (2000). The U.S. patent system in transition: policy innovation and the innovation process. *Research Policy* 29(4-5): 531-557.

Kash, D. E. and W. Kingston (2001). Patents in a world of complex technologies. *Science and Public Policy* 28(1): 11-22.

Kortum, S. and J. Lerner (1998). Stronger protection or technological revolution: what is behind the recent surge in patenting? *Carnegie-Rochester Conference Series on Public Policy* 48: 247-304.

Lanjouw, J. O., A. Pakes and J. Putnam (1998). How to Count Patents and Value Intellectual Property: The Uses of Patent Renewal and Application Data. *The Journal of Industrial Economics* 46(4): 405-432.

- Lazaridis, G. and B. van Pottelsberghe de la Potterie (2007). The rigour of EPO's patentability criteria: An insight into the "induced withdrawals". *World Patent Information* 29(4): 317-326.
- Levin, R. C., A. Klevorick, R. R. Nelson and S. G. Winter (1987). Appropriating the returns from industrial research and development. *Brookings Papers on Economic Activity* (3), 783–820.
- Macdonald, S. (2004). When means become ends: Considering the impact of patent strategy on innovation. *Information Economics and Policy* 16(1): 135-158.
- Pakes, A. and M. A. Schankerman (1984). The Rate of Obsolescence of Knowledge, Research Gestation Lags, and the Private Rate of Return to Research Resources. NBER Working Paper No. 0346.
- Parchomovsky, G. (2000). Publish or perish. *Michigan Law Review* 98: 926-951.
- Popp, D., T. Juhl and D. K. N. Johnson (2003). Time in Purgatory: Determinants of the Grant Lag for U.S. Patent Applications, NBER Working Paper No. 9518.
- Reitzig, M. (2004). Improving patent valuations for management purposes—validating new indicators by analyzing application rationales. *Research Policy* 33(6-7): 939-957.
- Reitzig, M., J. Henkel and C. Heath (2007). On sharks, trolls, and their patent prey - Unrealistic damage awards and firms' strategies of "being infringed". *Research Policy* 36(1): 134-154.
- Sattler, H. (2003). Appropriability of product innovations: an empirical analysis for Germany. *International Journal of Technology Management* 26(5/6): 502-516.
- Shapiro, C. (2001). *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting. Innovation Policy and the Economy.* A. Jaffe, J. Lerner and S. Stern. Cambridge, The MIT Press. 1: 119-150.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy* 15(6), 285–305.
- van Pottelsberghe de la Potterie, B. and D. François (2006). The cost factor in patent systems, Solvay Business School, CEB Working Paper No. 06/002.