Blocking patents: What they are and what they do♣

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Abstract

When the exclusionary power provided by patents is aimed at keeping competitors off a particular market or technology field rather than at protecting an invention, patents become a strategic blocking tool for offensive or defensive purposes. The aim of this paper is to identify patents strategically designed as blocking and analyse the factors contributing to their capacity to hamper the patentability of other patents. Based on a statistical analysis of all patent applications to the EPO with priority years between 1990 and 2000, we show that examination outcomes and citation categories in EPO search reports are significant for the identification of blocking patent applications and provide insights on their characteristics and impact. We find that patent applications cited as compromising the patentability of other applications that have never been cited as a contribution to the state of the art have a stronger impact on the likelihood of refusal or withdrawal than others. We also show that among them, those which are later withdrawn by their applicant appear as having the strongest "killing power" on others.

Key words: *Patents, blocking patents, quality, novelty, offensive and defensive patenting, entry barriers.*

JEL-classification: C25, C51, K41, L00, L20

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1. INTRODUCTION

The traditional role of patents is to provide their holder with an exclusionary power on the use of a particular invention. Certain patents, instead, are filed by firms in order to prevent others to obtain this power. This paper aims at identifying patent applications which are strategically used to pre-empt rivals from getting their patents granted and thus work as a barrier to entry into markets and technologies. We show that certain patents are filed with the sole objective to block, or "kill" other patent applications. We also show that these applications can either result in a grant, hence leaving a strong market power to their holder, or be withdrawn by the applicant once the objective of generating prior art to compromise the patentability of inventions made by rivals is fulfilled. A firm can indeed prevent rivals from getting a patent granted by filing patent applications without necessarily getting a grant herself, the objective being to prevent litigation suits, ensure freedom of operation or raise uncertainty in specific technology fields.

The increasing number of patent applications aimed at blocking other applications points to the growing importance of patents in the technology and market strategy of firms. It shows that businesses are devoting more resources to protect their intellectual property (IP) or defend themselves against the IP of others. It is both an outcome and a factor of the increasing number of patent applications (which have more than doubled in the US and in Europe since the mid-1990s): Blocking patent applications are partly a reaction to the growing number of applications which might hamper the freedom to operate of businesses, and they contribute themselves to the patents "arms race". The effect of blocking patents on the overall quality of the patent system is ambiguous: On the one hand, blocking patent applications can help maintain the quality of granted patents, when they kill bad applications, or bad claims within applications that are later eventually granted; on the other hand they may be of relatively low quality themselves.

We analyse the examination outcomes of all patent applications to the EPO with priority years between 1990 and 2000 and find that citation categories are significant for the identification of blocking patent applications. We exploit the fact that patent applications are cited by the EPO in search reports to determine the patentability of other applications under various categories, notably 1) as general state of the art (citation category A), or 2) as compromising the patentability of at least part of the citing application (categories X, Y, E). The initial intuition, confirmed by the empirical investigation, is that a patent application which is uniquely cited under the second category shows a "killing power" that exceeds its contribution to the art, and often reflects a strategic behavior by the applicant.

More precisely, using a multinomial logit model, we show that patent applications cited as compromising the patentability of new applications (X, Y, E) which have never been cited as a contribution to the state of the art elsewhere (A) have a stronger impact on the likelihood of refusal or withdrawal of other patent applications than the rest of cited applications. We identify this type of applications therefore as "blocking". Further, blocking applications which are withdrawn later by their owner appear as the most powerful in compromising the patentability of other applications. Withdrawn applications may correspond to abandoned filings that did not embody sufficient novelty for being deemed patentable in the view of the applicant or the EPO, possibly after a communication from the examiner informing about the high likelihood of refusal. Applications that limit the patentability of other applications before being later withdrawn can be characterized as "defensive", as they endow their owner with no exclusive right per se (as no patent is granted) but keep competitors away from the relevant technological field, hence presumably from the corresponding market. We find that their number has tripled in the past twenty years with respect to other types of cited patents, in particular with respect to applications contributing to the art and granted, which have relatively decreased during the same period. In turn, when the applications limiting the patentability of others without making relevant contributions to the art are granted, they can correspond to “offensive” blocking strategies, as in that case they would eventually need to be asserted in court or used in cross-licensing deals.

The paper is organized as follows. After some background information and a brief literature survey, we introduce descriptive statistics to present our case: a certain class of cited patents (cited as conflicting prior art but never as state of the art) appear to be the most effective in blocking patentability and the number of patents within that class has susbstantially grown in recent years. We then proceed to the formal statistical analysis where we show the existence of a significant relation between the outcome of examination procedures and this class of patents with a multinomial logit model.

2. BACKGROUND: WHY BLOCKING PATENTS?

2.1 Patents with strategic purposes

As shown by different surveys, patents have multiple purposes, with strategic motives, such as blocking competitors and preventing suits, usually being amongst the top motivations to patent, right after the traditional motive of protecting inventions from imitations (e.g. Cohen *et al*, 2000). It is even the main goal, or the main outcome, of certain patent applications, to prevent others from patenting. By holding up competitors, blocking patents may help maintain the control over specific technologies and their corresponding markets, and by forcing licensing through litigation threats, they may also constitute an important source of revenues for their holders, facilitating access to markets or ensuring advantageous cross-licensing deals.

Blocking patenting may work at the level of markets or at the level of technologies. Market blocking can occur when a marketed product needs several, complementary inventions: the holder of a patent on one particular invention can block others from commercialising a product, even though they may have control over other inventions conforming the same product. Hence the power of one particular patent can be leveraged on other inventions, endowing its holder with disproportionate market power. Further, because technologies are interdependent in products, players may find themselves mutually blocked. This situation has been reported notably in sectors characterised by complex technologies such as semiconductors and software, and is likely to occur in standard-setting contexts, where it is often solved by licensing or cross-licensing deals (Hall and Ziedonis, 2001). It can also lead to mergers and acquisitions. Marco and Rausser (2008) analyse the field of plant biotechnology, where the range of technologies necessary to market a new product is rarely controlled by a single firm, and provide evidence on acquisitions motivated by the enforcement of patent rights when firms have overlapping technologies. On the other hand, technology blocking can occur when a particular patent is broad enough to endow its holder with the power to control further developments related to the protected invention: like improvements on the invention, particular applications, other inventions relying on similar principles, etc. Examples of technology blocking patents can be found in the area of genetic materials. In the case of these complementary inventions, the purpose for a firm to prevent others from patenting is exactly to avoid this stalemate: to make the technological place free from interference by others. Once other parties have been prevented from entering the field, the field is either free (if no patent is there), or it is totally controlled by the blocker (if he obtains patent protection for at least one of these complementary inventions).

While there is no agreed definition of strategic patenting, most experts recognise two main orientations. The reasons for strategic (in contrast to traditional) patenting can be defensive or offensive (Blind *et al*, 2006). *Offensive* patenting is conceived to threaten, attack and weaken others. It can be used to prevent competitors from using a technology or to restrain their freedom to operate by filing patents at the margin of their areas of activity, for example surrounding high value patents with a screen of minor patents (covering incremental innovations on its periphery). Using patents offensively can also serve to leverage opportunistic cross-licensing deals or advantageous settlement conditions from litigation threats (Shapiro, 2006), a practice that has become the business core of the so-called patent trolls (Reitzig, Henkel and Heath, 2007). Hence the reward for the patent holder can take several forms but tends to go beyond the rents he could obtain by exploiting the protected invention.

In contrast, *defensive* patenting is used by firms to secure freedom to operate, in particular *"to prevent their own technological room to manoeuvre being reduced by the patents of others"* (Blind et al. 2006). Defensive patenting can be used by a firm –even when she does not need patents to obtain a return on her investment - to avoid finding that one of his own inventions has been patented by a rival and challenges him in court for infringement. Defensive patenting may be a motivation to patent even for traditional advocates of patent-free software markets who claim that their sole reason for filing patents is to build a defensive patent portfolio and be prepared to counter-sue or cross-license if they are attacked by other firms.[1] A firm can indeed try to prevent attacks through building "patent fences" to protect a specific technology, filing a number of patents to protect closely related and even overlapping inventions. Hence, defensive patents are conceived to keep others off a specific technology while reducing their expected profit from investing in it (raising entry barriers). Based on survey data, Nagaoka and Nishimura (2006) find that firms in industries with extensive cross-licenses (patent thickets) have a higher propensity to patent but their patents are to a lesser extent filed for defensive purposes, i.e. those which are filed with the sole purpose of preventing competitors to use the patented technology and remain later unexploited by their holders.

An important distinction between offensive and defensive patents is that the latter do not need to be strong to fulfil their pre-emptive role. They do not even need to be granted, as the uncertainty created by their filing and disclosure may serve their objectives without being necessary to assert them in court.[2] When this is the case, defensive patenting can be compared with other types of disclosures such as publishing inventions using commercial disclosure services or specialised journals[3] Recent theoretical studies on patent races have shown that defensive publishing may be used by firms to extend the patent race (rather than to abandon it, as it was traditionally assumed) because it can help gaining time by raising the patentability threshold and thus delay patent filings until further research is done (Baker and Mezzetti, 2005; Bar, 2006). This possibility – disclosing an invention to extend the patent race - has however been considered improbable and "highly theoretical" by the German firms interviewed by Henkel and Pangerl (2007) in one of the few existing empirical studies of defensive disclosures. More interestingly, this study shows that defensive publishing, understood as an *"insurance against being excluded from use of the respective technology"*, is widely practiced through a variety of methods: from

[1] http://progfree.org/Patents/testimony/statements/oracle.statement.html and www.redhat.com

[2] "An extremely defensive strategy consists in filing an application and withdrawing it before it gets granted. Firms consider such a strategy when they are willing to prevent any third party from filing a patent on their invention but are not ready to incur the costs of maintaining and enforcing a patent. Some firms file applications with the intention of polluting a technological field by creating uncertainty. In extreme cases such strategies can go as far as pure patent flooding or filing excessively large applications that become part of the existing art once published and so generate a smoke screen in the field." (Guellec *et al*., 2007).

[3] Two examples of commercial defensive publishing services are www.researchdisclosure.com and www.ip.com . They present themselves as a low cost alternative to patents for disclosing prior art with the aim to prevent others from patenting the same invention. In turn, the IBM Journal of Technical Disclosures, published between 1958 and 1998, is one example of a journal issued by a firm to disclose its own inventions.

specialised internet providers, peer-reviewed journals or public notice boards, to the patent system itself. Eleven companies (30% of their sample), most of them large ones, claim to have used defensive publications within the patent system (*i.e.* applying for a national patent and then letting the application lapse). One of the largest German firms interviewed recognised that it published defensively about 30% of its inventions using the patent system this way[4].

If the patent system is indeed used as a means to disclose inventions and stop others from obtaining patent protection it differs from other means traditionally used for defensive disclosures in a number of important aspects: i) using patent filings to disclose inventions keeps the possibility open for the applicant to seek patent protection, whereas defensive publishing destroys the novelty of an invention and thus prevents patenting (or raises the patentability threshold) for all, including its inventor; ii) the patent applicant can use the "pending patent" condition to his advantage from the moment of filing (e.g. trying to signal that he has a large likelihood of getting a grant and may thus be able to claim damages in the future if there is infringement); iii) patent applications are the most visible type of prior art to patent examiners; iv) patent filings have an incontestable time stamp; v) the contribution to prior art is done when the application is published, usually 18 months after filing, and the applicant can withdraw or abandon the patent application afterwards; vi) EPO and PCT filing fees represent a very small share of the full costs associated to getting patent protection, at EPO the lion´s share corresponds to the cost of validating protection at the national level after grant; vii) drafting claims in a patent application may be a more precise way to define the scope of an invention than its description in a journal.; and, lastly, vii) drafting a patent is usually more costly than describing a technical disclosure. It requires a combination of technical and legal expertise at a cost which needs to be incurred in addition to patent filing fees and other related costs.

As for offensive blocking, it aims to ensure or strengthen the control of the blocking party over a technical field, which can happen through various channels. If the blocking patent is granted, it gives exclusionary power to its holder, hence direct control. If it is not granted, the uncertainty created by having a patent-free area might in itself be an entry barrier for potential entrants who would only have incurred the cost of entry with a patent. Alternatively, the blocking party might have patents on complementary inventions (see above) which give it indirectly control over the field covered by the blocked patent.

When entry into an industry can only take place through the invention and patenting of a substitute for a monopolist´s product, Gilbert and Newbery (1982) show that it is rational for the incumbent, under certain conditions, to pre-empt entry of potential competitors by patenting the substitute himself and letting the patent sleep when it is not profitable for him to produce both his original product and the substitute. They also argue that for the pre-emption threat to be credible, the incumbent needs to commit the R&D needed to develop the innovation even if it is profitable not to employ the innovation once produced. Filing "sleeping patents" would be a form of defensive patenting, although very hard to identify because: *"it is difficult to distinguish product development that is the result of superior foresight*

[4] "A patent application at the EPO which is later published creates, in the designated states, state of the art at the time it is filed and in other countries at the time it is made public. Publication normally takes place after 18 months, or earlier at the request of the applicant. After publication, the patent application thus serves the purpose of a defensive publication and additionally carries the option to go through the examination process. Under German law, this option lasts particularly long: after the patent application has been filed the applicant can delay the request for search and examination for up to 7 years. That is, for a relatively small feee (as low as 50 euros in electronic applications, an inventor can secure freedom to use the technology, while maintaining for a rather long time the option to seek (national) patent protection" (Henkel and Pangerl, 2007, p. 10).

and technological capabilities from development that is motivated by entry deterrence".[5] One novel feature of our work is to rely on EPO examiners´ search reports to find evidence on pre-emptive and other forms of strategic patenting. Product development which is the result of superior technological capabilities would lead to patent applications cited as relevant contributions to the art (citation category A), whereas product development that is motivated by entry deterrence would lead to patent applications that are uniquely cited to limit patentability of other applications, never as contributions to the art. In addition, we argue that ungranted patent applications may also be effectively used as barriers to entry.

A cost-benefit analysis may lead to withdrawing the patent application before a decision is taken by the patent office if the main motivation to patent was to prevent patenting by others, if the patent has a small probability to get granted and if the cost of continuing the patenting process are too high. A recent survey shows that more than half of the costs to get a European patent (56% of 31 580 euros for a Euro-direct patent) are related to validation, translation, national fees and other costs associated with getting protection in the designated European states once the patent has been granted at EPO (Roland Berger Market Research, 2005). In addition, the level of R&D investment needed to make the pre-emption threat credible may be lower than when the objective is to get a grant, as filing can be done earlier in the process, when the invention is not yet mature.

2.2 Implications on innovation and welfare

The effect of blocking patents on social welfare is ambiguous. It has its positive and its negative sides, and different cases need to be separated. Preventing others from patenting can result in a patent free area. A patent free area can be an open field for innovation (see e.g. open source software), which has positive effects as transaction costs are reduced. On the other hand, a patent free area can neutralise the incentive effect of the patent system (as valuable inventions will be deterred in the first place as they could not be protected, hence rewarded); it can also simply leave the place to other mechanisms for certain firms to control the market, using other types of entry barriers. This is suspected to have happened in certain segments of the software market, and it has clearly a negative effect for society as it deters all innovatin by outsiders. In the case of offensive blocking the technical field is left under fuller control of the blocking party, which will therefore be in a position to extract higher rents from the market. Again it can mean stronger incentives to innovate (for the patent holder), or weaker incentives (as the competitive pressure is reduced). It probably means in most cases a higher price for customers (lower static efficiency due to reduced competition).

Another effect of blocking patents can be identified on the working of the patent system. In a way, blocking patents are a reaction to the growing threat of bad patent applications in a context of patent inflation. The blocked applications are rejected by the patent office (or withdrawn) notably because they do not fulfil the novelty or inventive step requirements: if blocking patents contributed to sort out insufficiently novel applications they would allow a better functioning of the patent system - which is good. However, blocking patents also contribute to a kind of arms race, in which blocking calls for counter-blocking etc., feeding patent inflation – which is not good.

[5] Gilbert and Newbery (1982), p.525.

3. DATA AND METHODOLOGY

The aim of this study is to investigate whether a pattern can be identified in the backward citations found in the search reports of unsuccessful patent applications. Considering that blocked applications are either filings for which patent protection has been refused by the patent office or which are directly withdrawn by applicants before a decision is reached at the office. We would expect blocked patents having more patent citations indicating conflicting prior art than granted patents, but the question is whether those citations are conflicting because they represent a relevant contribution to the art and thus "naturally" block further filings, or because they were simply "strategically" designed to limit patentability in a specific field? Patent data can help us answer this question, and also to find out whether patents filed strategically to block other filings are significantly different from the rest.

3.1.Using patent citation information

Insight into applicant strategies can be obtained from the analysis of patent data. The search reports of EPO examiners for direct EPO applications (and for international applications filed at EPO to follow the PCT route at WIPO) are a very rich source of information about potentially conflicting interactions between patents and the motivations of patent holders (Michel and Bettels, 2001; Webb *et al*, 2005). The main goal of the search report is to provide information on the state of the art relevant for the patentability of the patent application. Patent examiners classify relevant prior art in order to form their opinion about the novelty and inventive step of the claimed invention. This categorisation is our point of reference to identify and evaluate the blocking power of patents (based on X, Y and E citations, which compromise novelty and patentability of applications, and A citations, which correspond to a general contribution to the state of the art). **Table 1** below presents the meaning of the different categories. X citations are the most important ones to validate patentability of an invention. In case an application receives an X citation this indicates that the claimed invention does not meet the requirements of novelty or inventive step. Type Y references, when taken together or in conjunction with other documents, may have the same effect, but less directly so. Type A references merely provide technical background information. We will use these classifications in order to identify blocking patents and their characteristics.

Table 1. Citation categories in EPO and PCT search reports

Category	Meaning
X	Particularly relevant documents when taken alone (a claimed invention cannot be considered novel or cannot be considered to involve an inventive step)
Y	Particularly relevant documents if combined with one or more other documents of the same category such a combination being obvious to a person skilled in the art
A	Documents defining the general state of the art (but not belonging to X or Y)
E	Potentially conflicting documents – any patent document bearing a filing or priority date earlier than the filing date of the application searched but published later than that date, and the content of which would constitute prior art

Source: EPO

Some scholars have already attempted to disentangle the factors behind different applicant strategies using information from prior art search reports, such as total counts of backward (prior art cited in the search report of a particular patent) and forward patent citations (received by a particular patent in the search reports of other patents, filed at a later date). Blind, Cremers and Mueller (2007) find a relation between different motivations to patent and number of citations received by a patent (i.e. forward citations). In particular, they show that the traditional protection motive is related to more citations than the blocking or exchange motives (using patents as bargaining chips), and within the blocking motive, offensive blocking is related to a significantly lower number of citations than defensive blocking.

More sophisticated patent citation counts use information on categories assigned to each citation by examiners in the search reports (e.g. whether they contribute to the relevant art or limit the patentability of a particular invention). The system of citation categories is only used by the EPO and by PCT international search authorities (ISA). Other large patent offices, such as the USPTO, only use it in their international preliminary search reports when they act as ISA, but not for their internal examination procedures.

Information on citation categories was probably used for the first time in an econometric study by Harhoff and Reitzig (2004), who found that the likelihood of EPO opposition against a patent in the pharmaceutical and biotechnology fields increases with the number of patents cited as X in its search report (i.e. citations made or backward citations): for the first X-type reference by 1.2% points, and for an increase from zero to five such references by 3.0% points. Patents granted with X references indicate that their validity was questioned by the examiner, which gives some ground to third parties challenging them through the opposition system. They concluded that the likelihood of opposition increases with patent value and is particularly frequent in areas with strong patenting activity and with high technical or market uncertainty.

More recently, Grimpe and Hussinger (2007) consider the number of X and Y forward citations received by a patent within a five year window as an indication of the extent to which a particular patent threatens other patents' chance for being granted. They study a sample of horizontal acquisitions in Europe between 1997 and 2003 finding that the deal value of a target increases by 13% if there is a 0.01 increase in the blocking potential of the target firms' patent portfolio (corresponding to an increase of the deal value by approximately 37M Euro for the average patenting firm). The more X and Y forward citations a patent receives, the higher its strategic value for pre-empting competition in technology markets.

Other studies have used patent and industry data to examine the impact of patents on entry. For example, Cockburn and MacGarvie (2006) use the shifts in software patentability in the 1990s and the quality of the increased numbers of patent filings following those changes to identify pre-emptive patenting. If incumbents filed patents solely to pre-empt entry in their markets, with no real underlying technological progress, they argue, we would see a large number of patents, lower average patent quality and lower entry. They test this hypothesis and find that, the higher the number of patents in a market, the lower the probability of entry. There are however several problems associated to measure patent quality in terms of total counts of forward citations, as they acknowledge: First, the number of forward citations may reflect the scope of the cited patent rather than its technological significance. Second, it would also reflect the size of the pool of potential entrants, which is likely to be endogenous to entry. We believe these two issues do not affect the citation indicators we use in this paper, as we do not count total number of forward citations received but we identify different types of citations received. If a patent application has always been cited as a conflicting citation in other applications, and never as a contribution to the art, we take it as a sign of its strategic character.

Our study differs from previous ones in that our objective is to identify market and technology blocking behaviours by analysing patent citations together with other types of information contained in the same patent data (e.g. technology fields and applicants of citing and cited patents), rather than to use citations as a means to evaluate the quality of patents or the value of firms holding patents. Two points need to be mentioned however. First, one needs to keep in mind that the "most powerful blocking patents” are not necessarily observed (or easily observed) with the aid of patent data as they will simply deter further patenting by other firms in the surrounding protected area. It is of course more difficult to interpret the absence of patents in a given area than to interpret the information provided by actual patent filings, and we will do only the latter in this study. Further understanding is needed though about the nature of these patents and how to identify them. In this study, we focus on tractable blocking patents based on the search reports provided by patent examiners. Second, we are only working with EP to EP citations (including the “indirect” EP to EP citations, i.e. non-EP patent citations when there is an EP equivalent); while this shortcoming might be minor, it remains however to estimate and quantify the blocking activity associated to non-EP patents.

In order to identify the blocking patents we refine the analysis of citation information. We will make a distinction, first, between the following four categories of patent applications: the non cited (do not appear as reference in any later filing at EPO); the “pure X” (they are cited only in the X, Y or E category, in one or several subsequent filings), the “pure A” (cited only as A) and the “X and A” (cited both as A and as either X, Y, or E). The most important category from our perspective is the “pure X”. The “pure X” are the closest to our notion of blocking patents: these are applications cited for compromising (partially or completely) the patentability of other applications, whereas they are never cited as a reference to the general state of the art. It is therefore likely that their contribution to the state of the art is not commensurate to their ability to block others. We will verify this assumption by looking at the grant rate (a lower grant rate would suggest lower average quality of filings in the category), and by investigating the “killing power” of these applications (the proportion of citing applications which were not granted, indicating the lethality of the various types of citations). Our assumption will be verified if we can show a lower grant rate and a higher lethality for the “pure X” patents as compared notably with the X and A, after controlling for other characteristics.

We will investigate more in-depth one sub-category of the pure X, those which have been withdrawn. These patenst have proved detrimental to others while their holder himself have not seen value in trying to obtain them – either because the prospect of a grant was unlikely (due to low quality of the patent) or because the invention turned out not to have enough economic value for justifying the cost of a grant. This category includes patents which are of likely low technical quality, but still have reduced or suppressed the patentability of other inventions. We might expect to find the “defensive strategic” patents among this category: patent applications which result in keeping clean the patent field, letting all, including their holder, with no market control based on patents, so that other competitive strategies could prevail. Not all patents of this category are to be considered as strategic of course, as quite a few of them are simply normal applications which were abandoned because of their lower quality but happended to include information that would compromise or reduce the patentability of others. However we will test whether defensive strategic patents exist within this category, by measuring their relative lethality: as these patents are of the lowest quality as compared with other cited patents which are granted, they should be less lethal if it was a matter of quality only; if they are more lethal, it means that something else is at play than their technical content, for instance their strategic positioning or the way they are drafted.

3.2 Data Sources

Our main source is the EPO Worldwide Patent Statistical Database (PATSTAT) April 2007 edition. Our dataset consists of all patent applications filed at the EPO with priority years between 1990 and 2000 (859 706 EP patent filings), where we distinguish between filings with no forward citations (non cited patent filings) and filings that are cited under the citation categories X, Y, E and A (cited patent filings).

We have restricted our analysis to patents with search reports prepared by EPO examiners (for EPO direct and PCT filings at EPO) to assure homogeneity of criteria for identifying conflicting citations. Information on citations, the number of inventors, the non patent literature citations, country of origin of the first assignee, priority years (earliest) come from PATSTAT. Backward citations (X, Y, E or A) from EPO and PCT search reports have been combined (avoiding duplication of citations, see Webb *et al*, 2005). In order to have as much information as possible on conflicting citations, we have replaced non-EP patent citations by their EP-equivalents (if they do not have an EP-equivalent, they are excluded). Information on number of claims, main IPC class (first one listed) and withdrawn or refused procedural status come from other EPO sources.

3.3 Growth and incidence of conflicting citations

What is the share of the various types of patent applications that we have identified in all EPO applications? Among the 859 706 EPO applications with priority years in 1990-2000, 557 889 were never cited. The share of the three categories of interest among the cited patents are quite similar: 104 716 were cited as pure X, 86 423 as X and A, and 113 660 were cited as pure A (see **Table 2**). Hence, patents which block partially or totally other applications, cited as pure X, if they are not a majority of filings, still constitute a significant number. Moreover, they differ from other categories of patents in a number of dimensions. The share of non cited (on average lower quality) patents is higher in the consumer-construction category, among German and French applicants and among the withdrawn applications. It is interesting to note that the share of non cited patents is barely higher in the refused category than in the granted category, which raises questions regarding the meaning of citations (their ability to reflect quality): in fact, refused applications are often better than withdrawn ones, as for the latter the applicant did not even try to push them through, being aware of their low quality, whereas for the refusals there must have been chances of obtaining the patent to some point. It also happens that applications with significant technical advances are refused, on the ground that the claims go too far beyond the actual invention and the applicant refused to narrow them down.[6] The share of pure X is higher among US and Japanese applicants, and to a lesser extent among UK. It is striking that the share of pure X withdrawn is far higher among American applicants. For the latter category, UK applicants also are over-represented.

By technical fields, the pure X are more present among pharma-biotech and to a lesser extent among chemical patents. The pattern is similar for the pure X withdrawn. This might mean that there is more of a strategic game going on in these technical fields than in others, with more patents being filed mainly for the purpose of killing or at least restricting others, and would be consistent with economic studies which show that the value of patents is higher in the pharma-chemical area: blocking a patent with another patent is a costly strategy which will be worthwhile only if the value to be protected that way (for instance another patent) is high enough. It is also interesting to note the lower share of pure X in the most traditional fields (consumer, mechanics), where probably there is less strategic game than in others, but also in the electronics area. For the latter, one interpretation could be that (in accordance with Hall and Ziedonis 2001), much cross-licensing occurs in which entire patent portfolios are involved. Hence the value of individual patents might not be that high, and it would not justify the cost of attempting to kill them.

[6] *Source:* conversations with EPO examiners.

Table 2. Occurrence of cited and non-cited patent applications

Cited applications priority years: 1990-2000

	Non cited	Cited as pure X	Cited as pure X withdrawn	Cited as pure X granted	Cited as X and A	Cited as pure A	All filings
Technology field							
Electronics-electricity	65%	11%	3%	5%	10%	13%	100%
Instruments	62%	12%	3%	7%	12%	13%	100%
Chemicals-materials	63%	14%	4%	8%	11%	12%	100%
Pharma-biotech	66%	17%	6%	7%	9%	7%	100%
Industrial processes	65%	10%	3%	7%	9%	14%	100%
Mechanics-transport	66%	10%	2%	7%	9%	14%	100%
Consumers-construction	70%	9%	3%	5%	7%	13%	100%
Country of first applicant							
United States	61%	13%	5%	6%	13%	13%	100%
Japan	63%	13%	3%	8%	10%	13%	100%
Germany	68%	10%	2%	7%	8%	13%	100%
France	67%	10%	2%	7%	9%	14%	100%
United Kingdom	66%	12%	4%	7%	10%	12%	100%
Other	69%	10%	3%	6%	8%	12%	100%
Priority year							
1990-1995	53%	13%	4%	9%	16%	18%	100%
1996-2000	74%	11%	3%	5%	5%	9%	100%
Outcome							
Granted	60%	12%			12%	15%	100%
Withdrawn	70%	11%			7%	11%	100%
Refused	61%	12%			11%	15%	100%
Total	65%	12%	3%	7%	10%	13%	100%
	557 889	104 716	27 260	56 705	86 423	113 660	859 706

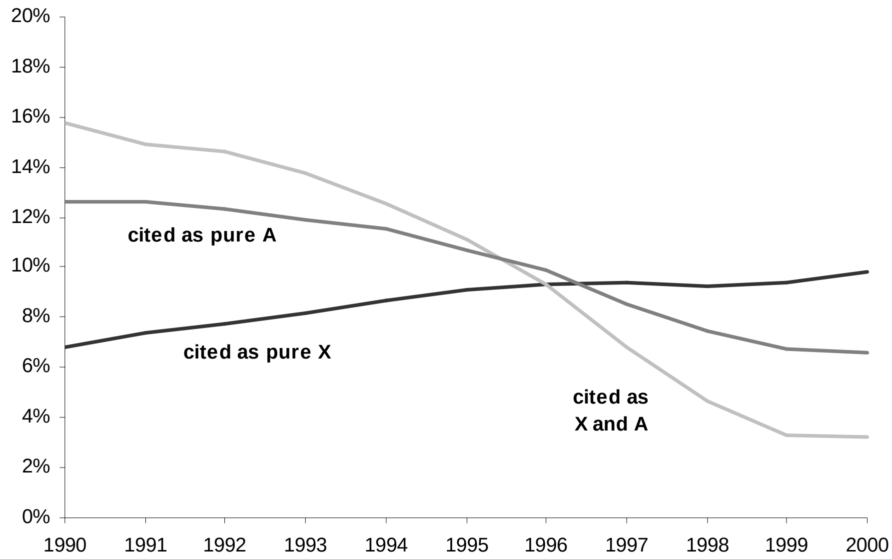
Note: Cited as pure X are patent applications cited as X, Y or E but never as A; Cited as pure A are patent applications cited as A but never as X, Y or E; Cited as X and A are patent applications cited as X, Y, E or A. The group of cited as pure X comprises applications withdrawn, granted, refused and pending. Only pure X withdrawn and pure X granted are set out in the table. Non cited patents are those not having received any forward citation X, Y, E or A.
Source: PATSTAT April 2007

To describe the evolution of cited applications we limit citations to those made by patents with priorities in the five years following priority of the cited. This allows us to limit the bias introduced in the data by the truncated availability of citations: it would be unfair to include in the analysis a patent with priority in 1990 and cited by another patent with priority in 2005, 15 years later, whereas for patents with priority in 2000 we are restricted to citations made in the next five years.

In terms of time trend, **Figure 1** shows a remarkable rise in the share of pure X over the 1990s (from 7% in 1990 to 10% in 2000), whereas the pure A (from 13% to 7%), and even more the X and A (from 16% to 3%) were declining steadily. This might reflect a change in the behaviour of applicants, with an increasing propensity to attempt to block others; alternatively, it might reflect a statistical artefact (pure X citations occurring later in the life of a patent, hence the analysis of truncated data would tend to show a time trend which is an observation bias) or a change in the behaviour of examiners (who would cite less and less A references because they have less time and therefore wish to focus on the references having a more clear impact on the patents they examine). The statistical artefact can be measured by looking at the time pattern of citations of various types, something we will do below. As for the change in examiners' behaviour it cannot be tested directly, but we will observe patterns in the profile of the pure X patents and their applicants that have no obvious link with examiners' behaviour.

Figure 1. Cited patents among EPO applications

Cited applications priority years 1990-2000
5 years window between priority of cited and priority of the citing application



Note: Cited as pure X are patent applications cited as X, Y or E but never as A; Cited as pure A are patent applications cited as A but never as X, Y or E; Cited as X and A are patent applications cited as X, Y or E and A. Five year limit between the priority year of the citing and the priority year of the cited patent application.
Source: PATSTAT April 2007

What is the incidence on grants of the growing class of patents only cited as conflicting prior art, pure X?. **Table 3** shows that the ratio of grants over filings is much lower for the group of EP applications with pure X citations (47%) than for EP applications with X and A citations (62%) and for EP applications with pure A citations (58%). Similar shares are found when excluding self-citations (see **Table A1** in the Annex). Consistently, EP filings citing pure X also have a rate of withdrawals above the average (35% compared to 30% for all filings) which together with the lower grant rate indicates that the applications citing pure X patents have a lower likelihood of success. Hence, the "lethal power" of pure X patents seems higher than the lethal power of A and X, which at first sight could seem paradoxical as being cited as A as well as X is a indication of technical quality. So, it must be that the pure X patents have something, not directly related to their technical quality, which makes them more dangerous to other patents. The rest of this section investigates the characteristics of the pure X patents as compared with others.

Table 3. Shares of filings by type of citations

Citing applications priority years 1990-2000

	All EP filings	EP filings citing Pure X	EP filings citing X and A	EP filings citing Pure A
Filings	859706	97467	328178	170622
Grants	475016	45985	189596	106241
Withdrawals	254792	33784	93258	45672
Refusals	24030	2595	9512	5030
Grants over filings	59%	47%	58%	62%
Withdrawals over filings	30%	35%	28%	27%
Refusals over filings	3%	3%	3%	3%

Note: Cited as pure X are patent applications cited as X, Y or E and never as A; Cited as pure A are patent applications cited as A but never as X, Y or E; Cited as X and A are patent applications cited as X, Y or E and A.
Source: PATSTAT April 2007

How do the patents that block others operate? Can we find different patterns for the pure X, X and A and pure A, which indicate the possibility of differing characteristics and possibily different strategies of the applicants? We focus on two characteristics of the modus operandi: the timing (how much time between the patent was issued and the patent was cited?) and the technical field (is the patent cited by another patent of the same technical field or from a different etchnical field?). In terms of timing, we look at the share of patents cited less than two years after filing among all cited patents, by citation category (pure X, pure A, etc.).

Table 4 shows that patents cited as X (comprising those cited as pure X and those cited as X and A) are cited earlier than pure A patents, but the X and A are cited more rapidly than the pure X. The X and A category includes patents of the highest quality, so it is not surprising to see that they are cited earlier (and in higher number, see below). It is still notable that the pure X are cited earlier than the pure A, and that the pure X withdrawn are cited more rapidly than the pure X granted despite their lower quality. That might indicate that they were particularly fitted to do quick blocking, despite their lower technical quality. Hence, by restricting to a 5 year horizon, as in Figure 1, we reduce relatively the share of pure A as compared with X, notably with the X and A. However there is no reason why this would affect the time trend (relative decline in pure A and X and A as compared with pure X).

Patents cited as pure X have the highest proportion of single forward citations (77% when they are later withdrawn and 75% when they are granted, compared to 74% for the pure A and to only 1% for the cited as X and A). This indicates that patents cited as X and A are of the highest technical quality, while the pure X, notably (but not only) the withdrawn ones, are not so good. But it may also indicate, if patents cited as pure X are effectively filed with strategic citation objectives, that they are more narrowly targeted to specific technical areas, with single patents or inventions. An argument that also seems consistent with the fact that patents cited as pure X and granted have the highest concentration of citations within the same IPC class, although differences in this respect are small (see shares of citations, all and excluding self-citations, within same IPC class in Table 4).

Table 4. Profile of citations

Cited applications priority years 1990-2000

	Cited as pure X	Cited as pure X withdrawn	Cited as pure X granted	Cited as X and A	Cited as pure A
No more than 1 year between earliest priority among all citing and the priority of cited (% all cited)	19%	19%	16%	26%	7%
No more than 2 years between earliest priority among all citing and the priority of cited (% all cited)	49%	46%	40%	81%	38%
Only one citation received per cited patent (% all cited)	76%	77%	75%	1%	74%
Citations within same IPC class (% all citations)	67%	70%	71%	70%	70%
No self citations within same IPC class (% all citations)	53%	58%	55%	56%	54%
All cited (all patent applications cited as X, Y, E or A)	104 716	27 260	56 705	86 423	113 660
All citations (couples of citing and cited patent applications)	139 983	35 882	76 710	325 163	156 790

Note: Cited as pure X are patent applications cited as X, Y or E but never as A; Cited as pure A are patent applications cited as A but never as X, Y or E; Cited as X and A are patent applications cited as X, Y or E and A. The group of cited as pure X comprises applications withdrawn, granted, refused and pending. Only pure X withdrawn and pure X granted are set out in the table. IPC class (IPC section plus 2 digits denoting the IPC class), e.g. H04

Source: PATSTAT April 2007

4. EMPIRICAL MODELLING

[ONGOING]

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ANNEX

Table A1. Shares of filings by type of non self citations

Citing applications priority years 1990-2000

	All EP filings	EP filings citing Pure X No self	EP filings citing X and A No self	EP filings citing Pure A No self
Filings	859706	80142	285629	144780
Grants	475016	37346	162710	89167
Withdrawals	254792	27843	82163	39295
Refusals	24030	2128	8257	4272
Grants over filings	59%	47%	57%	62%
Withdrawals over filings	30%	35%	29%	27%
Refusals over filings	3%	3%	3%	3%

Note: Cited as pure X are patent applications cited as X, Y or E and never as A; Cited as pure A are patent applications cited as A but never as X, Y or E; Cited as X and A are patent applications cited as X, Y or E and A. We define self citations as those for which the applicants of the citing application are the same as the applicants of the cited application.

Source: PATSTAT April 2007