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A Brief History of Space and Time: the Scope-Year Index as a Patent Value Indicator Based on Families and Renewals

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ABSTRACT
The renewal of patents and their geographical scope for protection constitute two essential dimensions in a patent's life, and probably the most frequently used patent value indicators. The intertwining of these dimensions (the geographical scope of protection may vary over time) makes their analysis complex, as any measure along one dimension requires an arbitrary choice on the second. This paper proposes a new indicator of patent value, the Scope-Year index, combining the two dimensions. The index is computed for patents filed at the EPO from 1980 to 1996 and validated in its member states. It shows that the average value of patent filings has increased in the early eighties but has constantly decreased from the mid-eighties until the mid nineties, despite the institutional expansion of the EPO. This result sheds a new and worrying light on the worldwide boom in patent filings.

Keywords: Patent value, geographical scope, renewals, patent statistics, patent families.

JEL classification codes: K1; L1; O34; O38

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1. Introduction

Over the past two decades the major patent systems have experienced a common trend: a substantial increase, if not an explosion, in the number of patent filings. This boom, thoroughly investigated by Kortum and Lerner (1999) for the US and Guellec and van Pottelsberghe (2007) for Europe, witnesses a more pronounced attention devoted to the protection of industrial inventions. This phenomenon comes from the emergence of new technologies (ICTs and biotechnologies), the arrival of new countries in the patent arena (e.g., China, South Korea, and Brazil), a higher propensity to patent inventions (notably by small firms and universities), and the development of more aggressive patenting strategies that consist for instance in filing several patents for a given invention.

This growth in the number of patent filings is increasingly questioned on the ground that their average value might be decreasing, particularly given the fact that it comes along with a severe inflation in the size of applications filed to patent offices (see van Zeebroeck et al. (2006) and Archontopoulos et al. (2007)). It is commonly agreed that only a few patents (3 to 5) out of one hundred are associated with some economic value. In this respect, how the value of patent filings has evolved over time is a question of utmost importance since patent applications with a low value constitute a cost for society (high examination costs, and high deadweight costs due to more potentially exclusive exploitation rights and to more uncertainty on the market). In this respect one may wonder whether patent offices should be more selective in their granting procedure.[1]

The answer is far from being straightforward, as patent value is rather difficult to grasp. Like any intangible asset it is highly volatile (especially in the frame of competing technologies) and subject to substantial information asymmetries (the buyer and the seller have different perceptions of both the technology and its potential market) (Guellec et al., 2007). The quest for 'valuable' patents has been the field of investigation of an emerging stream of economic research. This burgeoning literature has started in the mid eighties and intensified over the nineties.[2] Out of the myriad of potential candidates for patent value indicators or determinants, renewal data and patent families are probably the most widely recognized and used.[3] Indeed, they constitute two essential dimensions of a patent's life, its age and geographical scope respectively, which together reflect the efforts and costs incurred by patent owners to acquire and uphold their rights. In the two cases indeed substantial funds are required to keep the patent alive: renewal fees for each year of protection; validation fees and translation costs for each country of protection. Despite their symbiotic nature, these indicators are frequently used in the literature, but never jointly or simultaneously.

The objective of this paper is to analyse the evolution of the average patent value measured with these two indicators of survival and geographical scope. The field of observation is composed of all patent applications at the European Patent Office (EPO)

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[1] See Lemley (2001), van Pottelsberghe and François (2006) and van Pottelsberghe (2007) for broad discussions on patent systems, their effectiveness and their cost to society.

[2] Reitzig (2004) and Sapsalis and van Pottelsberghe (2007) provide in-depth surveys of this literature, including discussions on the variables used to measure the value, and the potential value determinants. The most frequently used indicators of patent value are applicants' perception of patent value through surveys (e.g., Harhoff et al., 2003; Gambardella et al., 2006), renewal data (e.g., Pakes and Schankerman, 1984), patent families (e.g., Harhoff et al., 1999), forward patent citations (e.g., Trajtenberg, 1990), and oppositions (e.g., Harhoff et al., 2003) or litigations (e.g., Lanjouw and Schankerman, 1997). van Zeebroeck and van Pottelsberghe (2007) provide quantitative evidence on the evolution of several value indicators at an aggregate level.

[3] Renewal data has been used by Pakes and Schankerman (1984), Pakes (1986), Schankerman and Pakes (1986), Pakes and Simpson (1989), Lanjouw (1993), Lanjouw et al. (1996), Cornelli and Schankerman (1999), Lanjouw and Schankerman (1999), and Bessen (2006). Data on patent families are very frequently used in different forms, such as the triadic patent data published by the OECD or patent families indicators used in a majority of papers on patent value.

between 1980 and 1996 that had been granted before January 2006. As the two indicators are naturally mutually dependent it is complex and sometimes restrictive to analyse one dimension without the other. We therefore put forward a new indicator, the Scope-Year Index, which aims at providing a synthetic value indicator combining the geographical scope for protection and the life span of a patent.

The paper is organised as follows: section 2 discusses the measurement issues and presents various indicators of patent value based either on the life span of a patent for a given scope of protection, or on its scope of protection for a given life span. In section 3 we develop and measure the Scope-Year index of patent value. Section 4 concludes.

The two indicators of life span for a given geographical scope and of geographical scope for a given life span suggest that the average value of the patents filed at the EPO has decreased since the mid eighties. The evolution of the Scope-Year index corroborates, if not exacerbates, this view of a sharp apparent decline in European patents' value from the mid-eighties to the mid-nineties.

2. Measurement issues

It is important to understand the basic functioning of the European patent system before investigating the effective measurement of the value of European patents. This section is subdivided in three parts. The first one briefly explains the granting process at the EPO. The second one underlines the timeliness issue associated with value indicators. The third sub-section presents the two indicators of geographical scope and renewal and the implicit complexity induced by their relationship.

The filing process at the EPO

The EPO is the granting authority of the European Patent Convention (EPC), which was composed of 11 Contracting States in 1980 and 31 in early 2007. Patents can follow various routes before being filed at the EPO (first filings are directly applied at the EPO, second filings follow a priority application in a national patent office, and PCT filings follow the so-called international route).[4] Once filed at the EPO, an application enters first into the search process (aiming at identifying relevant prior art) followed by the examination process that eventually leads to the grant of the patent. At the time of the request for examination, the applicant must designate the Contracting States (at least one) in which protection for the invention is desired. This gives rise to designation fees to be paid per designated country. Until the end of the granting procedure, annual fees are due to the European Patent Office in order for the application to be maintained.

Once the patent is granted the applicant is asked for a second time by the EPO to declare the designated states for protection (which can be the same number or less than the ones designated earlier). Then, the applicant must validate her patent in all desired national offices of the EPC where she aims at getting an effective enforcement of her rights, without any possibility to extend the scope at a later stage (once validated, the European patent scope can only shrink but not expand). As noticed by van Pottelsberghe and François (2006), the effective validation of a granted European patent may induce high administrative and translation costs. For each country, the payment of validation fees and a translation of the patent in one of the national languages are requested.[5] Therefore, the more the countries targeted for protection the higher the cost. In addition, each subsequent year the applicant will

[4] See Stevnsborg and van Pottelsberghe (2007) for an in-depth description of the European patent system and the various ways to file a patent at the EPO.

[5] "The period for supplying the translation shall end three months after the date on which the mention of the grant of the European patent or of the maintenance of the European patent as amended is published in the European Patent Bulletin, unless the State concerned prescribes a longer period." Article 65 EPC.

have to pay renewal fees to maintain the patent into force in each of the desired states, hence the longer the protection, the higher the costs as well. After twenty years from their date of filing at the EPO, European patents normally fall into the public domain.[6]

This 'expense' structure justifies the use of validation and renewals data to estimate the value of European patents (Pakes and Schankerman, 1984; Harhoff et al., 1999): On the one hand, the larger the geographical scope for protection is, the higher the perceived value of the patent will be, for the applicant has access to a larger 'exclusive' market, which is costly to acquire in terms of fees and translation costs. On the other hand, the longer the desired protection, the higher the cost to the applicant, as renewal fees are requested by national patent offices each year. Failure to provide a required translation or to pay the renewal fees in one country in one year makes the patent irreversibly lapse and fall into the public domain in this particular country. The renewal of a patent in a country therefore provides a clear message to the competitors, as it indicates that the patent owner is still willing to enforce her rights. It therefore sounds sensible to assume that patents validated in a large number of countries or renewed for a long period of time are of more value than others (Pakes, 1986; Schankerman and Pakes, 1986; Schankerman, 1998; Lanjouw, 1998).

However, this clearly illustrates the intertwining of those two dimensions of European patents' value, given that a patent can be maintained for a long period of time in some countries and lapse very quickly in other countries. This means that the size of the family of a European patent may decrease from one year to the next year and that the age reached by a European patent may be different from one country to the other. Therefore, speaking of the size of a European patent family always depends on the age at which the patent's scope is measured and, conversely, the age reached by a European patent inevitably depends on the geographical scope over which it is computed. Based on families and renewals data, the value of European patents may be measured at different points in space and time, possibly providing totally different pictures.

Timeliness

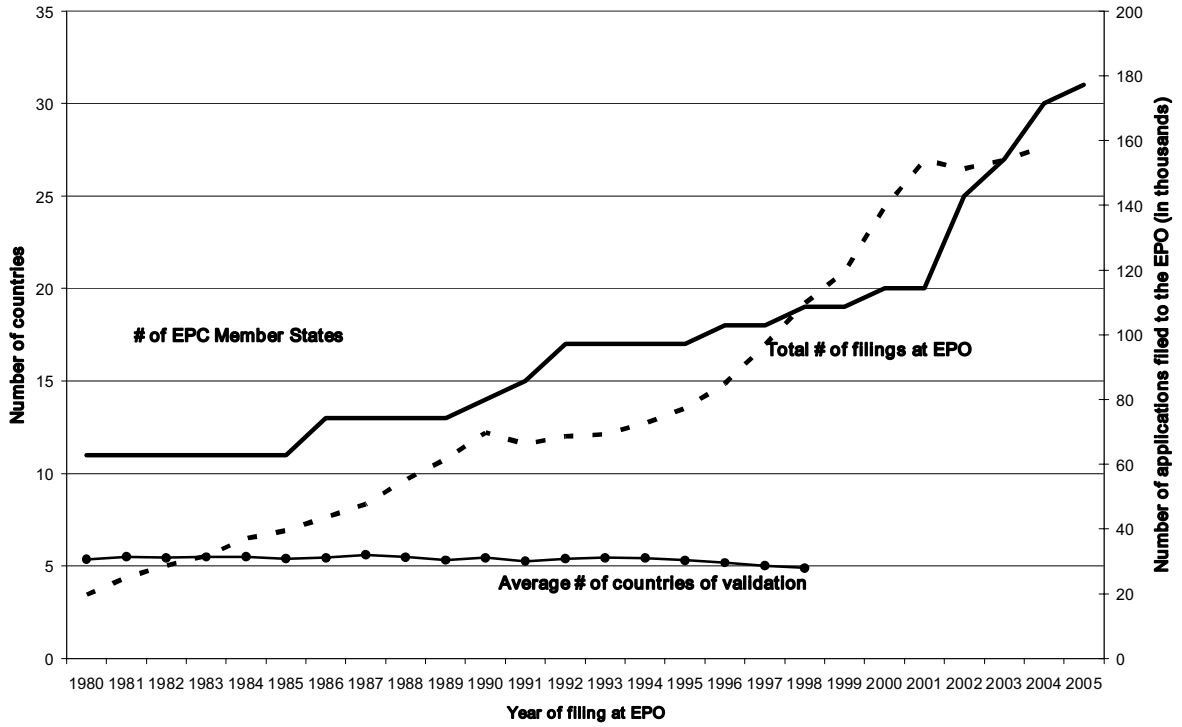
One of the major limitations to patent value indicators in general is their timeliness. If one assumes that a patent which has been maintained for 20 years is more valuable than a patent which has lapsed in all countries where it had been validated a few years after its grant, one needs to wait for twenty years from the date of filing at the EPO before being able to determine which patents were of any value and which ones were not, making such indicators of limited help to practitioners. However, at the end of each year in a patent's life, the relevance of the two value dimensions increases. At the time of filing, one may already know that an application now exists (for which filing fees have been exposed) and how many Contracting States have been designated (inducing designation fees), which define the maximum size of the patent's EPC family ever. At the end of the granting procedure, one can know for how long the application has been maintained in the pipeline (i.e. how many times annual processing fees have been paid to the EPO), whether the patent has been granted or not (an indication of value in itself following Guellec and van Pottelsberghe (2000, 2002)), and in how many countries it has been validated (the most expensive action to take due to the translations).[7] After the validation process, the age reached and family size can then be

[6] Article 63 (1) EPC. This justifies the choice of the date of filing as the reference date in what follows, for patents which took more time to be granted could only reach a smaller age than quickly granted patents if one considered the granting date as a reference. Note however that similar results as those presented in the paper have been obtained using grant dates instead of filing dates.

[7] Note however that the information on validations requires one year from the grant date to become available, that is the time for national patent offices to observe whether translations and validation fees have been duly paid and to notify EPO databases.

reassessed at the end of each year, refining the estimated value hence gaining in relevance. Therefore, the most accurate value indication becomes ultimately available twenty years after the filing of the application.

Figure 1 – The institutional expansion of the EPO



Source: Own calculations based on EPO Data

Since the major costs have been incurred by the time the patent has been granted and validated in some Contracting States, the first reliable indications on granted patents' value are provided by the age of the patent at the time of grant (since lengthy procedures are more costly) and by the size of the family formed by the countries where the patent was effectively validated. This information gets available after 6 or 7 years from the filing date on average, the average duration of the granting process at the EPO. The evolution of the initial family size of European granted patents (the effective geographical scope for protection targeted within the EPC) is illustrated in Figure 1. The average number of countries of validation per granted patent (by year of filing) is shown next to the total number of EPC Member States and the total number of patent filings. Despite the fact that the EPC has been increasingly successful (an increase from 11 EPC Member States in 1980 to 19 in 1998, associated with a quasi permanent increase in the number of patent filings), the average number of countries of validation has been strikingly stable, decreasing by about half a unit over twenty years (from about 5.5 in the early eighties to about 5 in the late nineties). In other words the effective geographical scope targeted by granted patents has been slightly decreasing over time, despite the arrival of 8 new EPC Member States over the period.[8] This indicator is however 'crude' as it does not take into account the size of the targeted markets or the age reached.

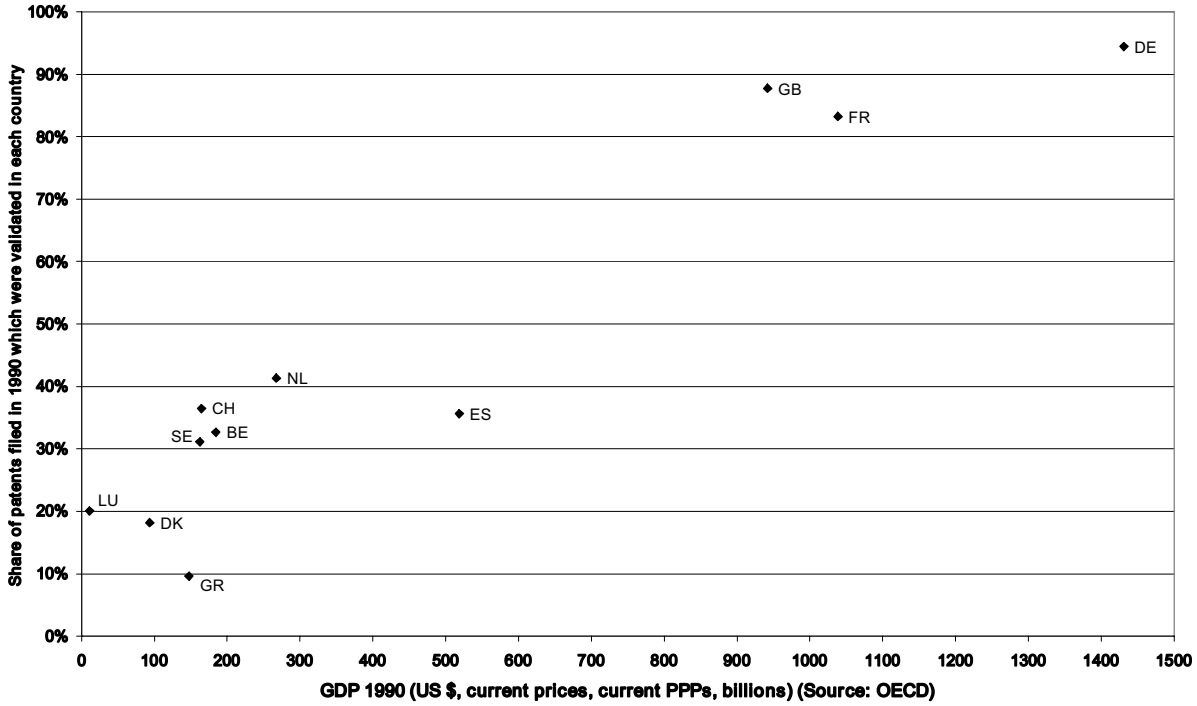
Geographical scope and renewals

[8] By comparison, note that the average number of designated states at grant (but not yet effectively validated) has very slightly but continuously increased over the same period, from about 6.2 in 1980 to about 8.5 in 1999, meaning that the number of designated states abandoned at grant (i.e. lapsed *ab initio*) on average has increased from about 0.4 to almost 2 over the same period.

Geography, and more particularly the size of countries, plays an important role in the filing strategies adopted by applicants. Figure 2 shows that three largest European countries (Germany, France and the UK) are the most frequently targeted for protection, with 83 to 94 percent of the granted patents filed in 1990 getting validated there. This share drops substantially for the Netherlands (41%), as well as Spain and Switzerland (36%) followed by the other member States. The figure also suggests that the market size (measured with the GDP) of the targeted countries plays an important role in the validation strategy of the applicants, as illustrated by a clear and nearly linear relationship.

A comparison of the share of granted patents validated in a country with the average age reached by those patents in the country is provided in Figure 3. It reveals that the countries that are the most frequently targeted are also experiencing the longest survivals, with the exception of the two smallest countries, Liechtenstein and Luxemburg, both above the abstract linear relationship, probably due to their attractiveness for the headquarters of (patent) holding companies. The patents that are validated in the largest countries are held for more than twelve years on average, against about 11 years in smaller countries.

Figure 2 – Frequency of validation and market size

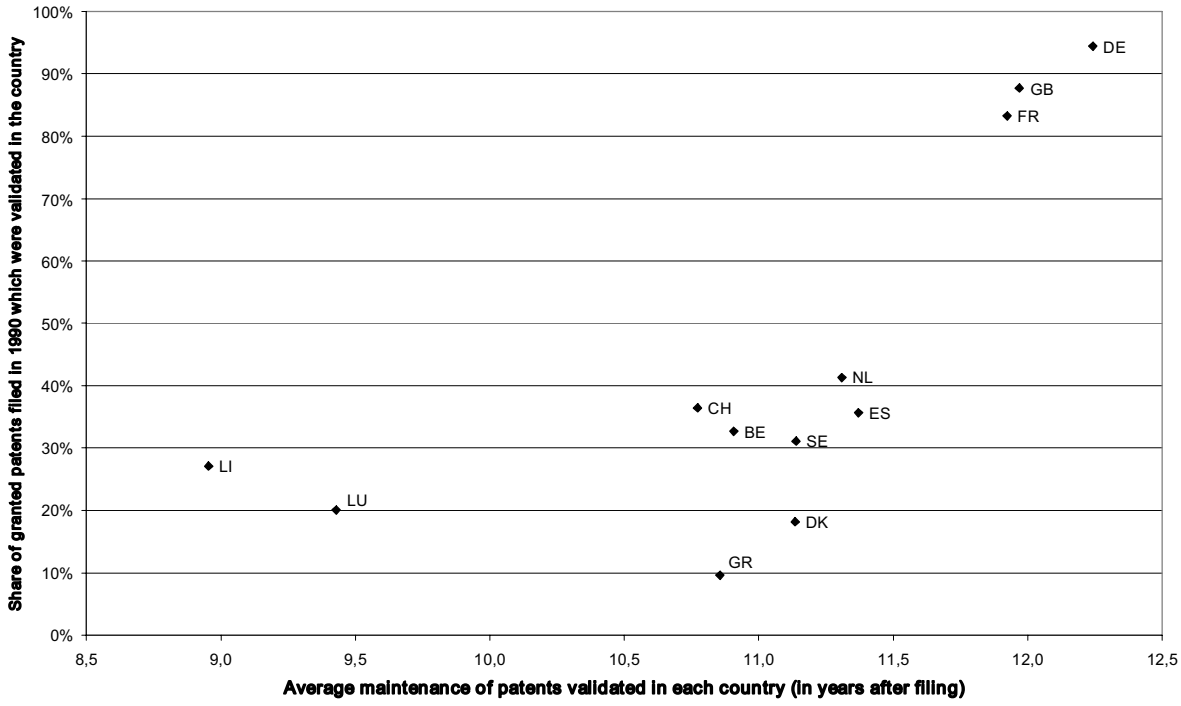


Source: Own calculations based on EPO and OECD Data

Another way of taking both dimensions into account at the same time is to measure the average scope of protection of each patent at a certain age. Figure 4 shows the evolution of the average geographical scope of protection per patent at four different points in their lifetime: just before grant (designated states), immediately after grant (validated states), 10 years after filing, and 15 years after filing. The figure emphasises three interesting phenomena: first, as expected, the longer the life of patents, the smaller the scope of protection at the end of their life (patents renewed over a longer period were maintained in a smaller number of countries in the end, a one country span between the average scope of validation for all patents and the average maintenance scope after 15 years for those that survived this long); secondly, the average number of countries designated by the applicants at the time of grant has been slightly increasing over time (from about 6 to 7 countries),

although much slower than the pace of expansion of the EPC; and thirdly, the effective geographical scope of protection has been slightly decreasing (by approximately half a unit) over time, no matter the age reached by patents.

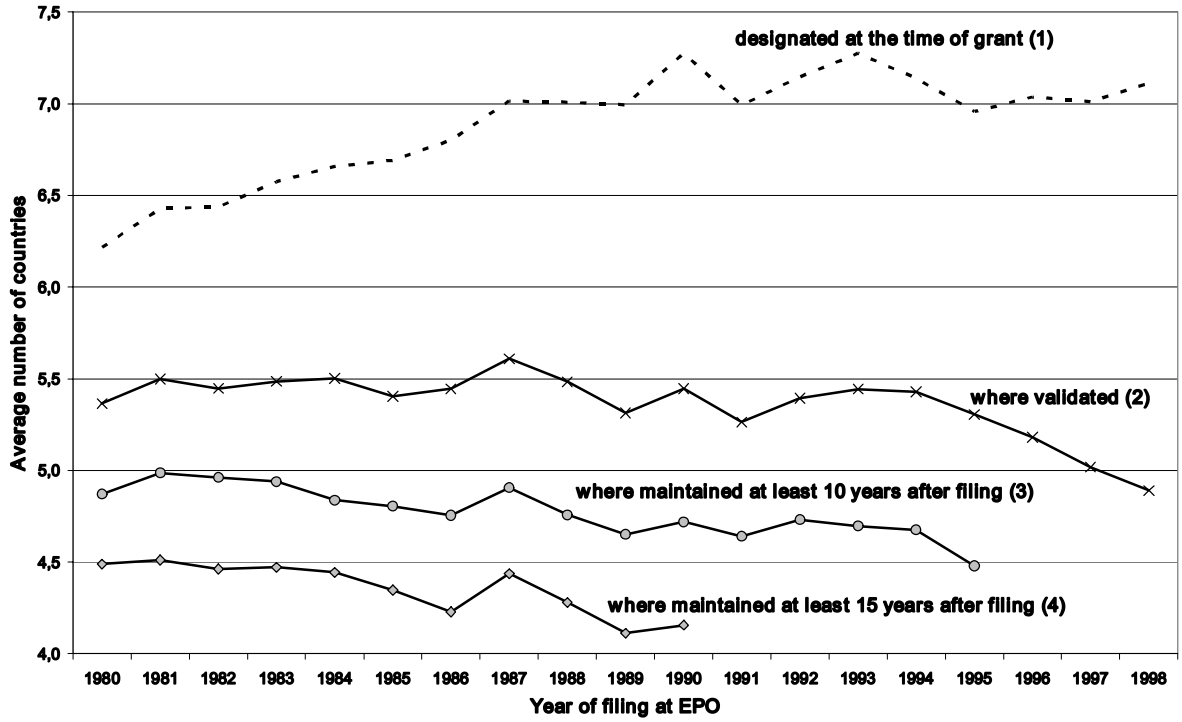
Figure 3 – Frequency of validation and average maintenance per Member State



Source: Own calculations based on EPO Data

A closer look at the picture reveals that although the number of designated states at the time of grant has increased by about one unit between the early eighties and the late nineties, the average scope of validation (also depicted in Figure 1) has been relatively stable around 5.5 countries until the mid eighties and has since then started falling down to less than 5 countries in 1998. Similarly, patents that have been renewed at least 10 years after filing have lost half a country in scope on average (from about 5 to 4.5), and those maintained at least 15 years have experienced a similar evolution (from 4.5 to about 4). In addition, the figure illustrates the growing gap between designated states and effective validations, suggesting that applicants are increasingly reluctant to incur the costs of expanding the scope of their patents to additional countries.

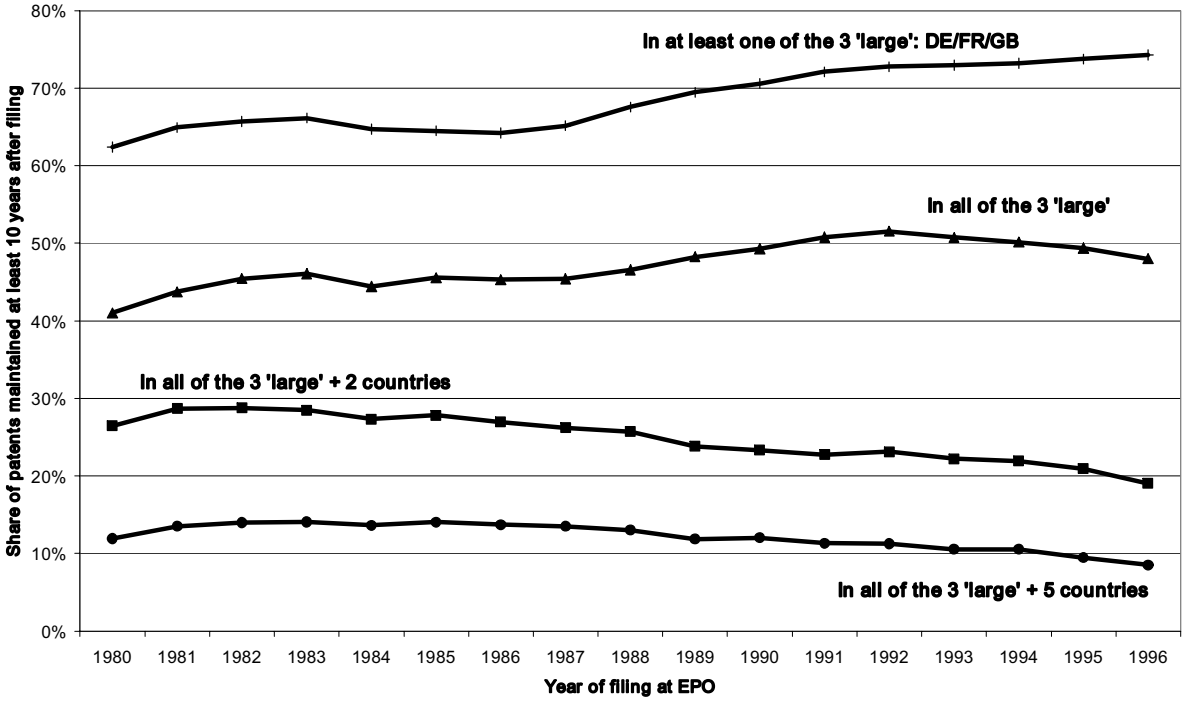
Figure 4 – Geographical scope at different points in a patent's lifetime by year of filing



Source: Own calculations based on EPO Data
(1) All granted patents | (2) All granted patents validated
(3) All patents maintained at least 10 years | (4) All patents maintained at least 15 years

Which countries are targeted is illustrated in Figure 5 for the patents that were granted and renewed at least 10 years after the filing date. An increasing share of these patents was validated in at least one of the three large countries (Germany, France and Great Britain), from 62 per cent in 1980 to 74 per cent in 1996. The share that was validated simultaneously in the three large countries is expectedly smaller but has increased over time, from 40 per cent in the early eighties to about 50 per cent in the mid-nineties, despite a noticeable downward inflection since 1992. According to this last indicator one might be tempted to conclude that the average value of patents has increased over time. However, the two lower curves reveal that the share of patents maintained 10 years in at least two countries in addition to the three large ones has decreased over time, from about 30 per cent in the early eighties to 20 per cent in the mid-nineties - i.e. about 65% of its original level. Looking at an even more 'valuable' combination, such as a maintenance in the three large countries and at least five smaller ones simultaneously, the relative share of patents appears obviously weaker (about 14 per cent in the mid-eighties) and has also decreased over time to fall in 1996 to two-third of its level in the early eighties. These results strongly suggest that applicants in the European Patent System increasingly target the three largest markets – validating and maintaining their patents there in priority – and less and less the smaller ones.

Figure 5 – Geographical scope after 10 years of maintenance



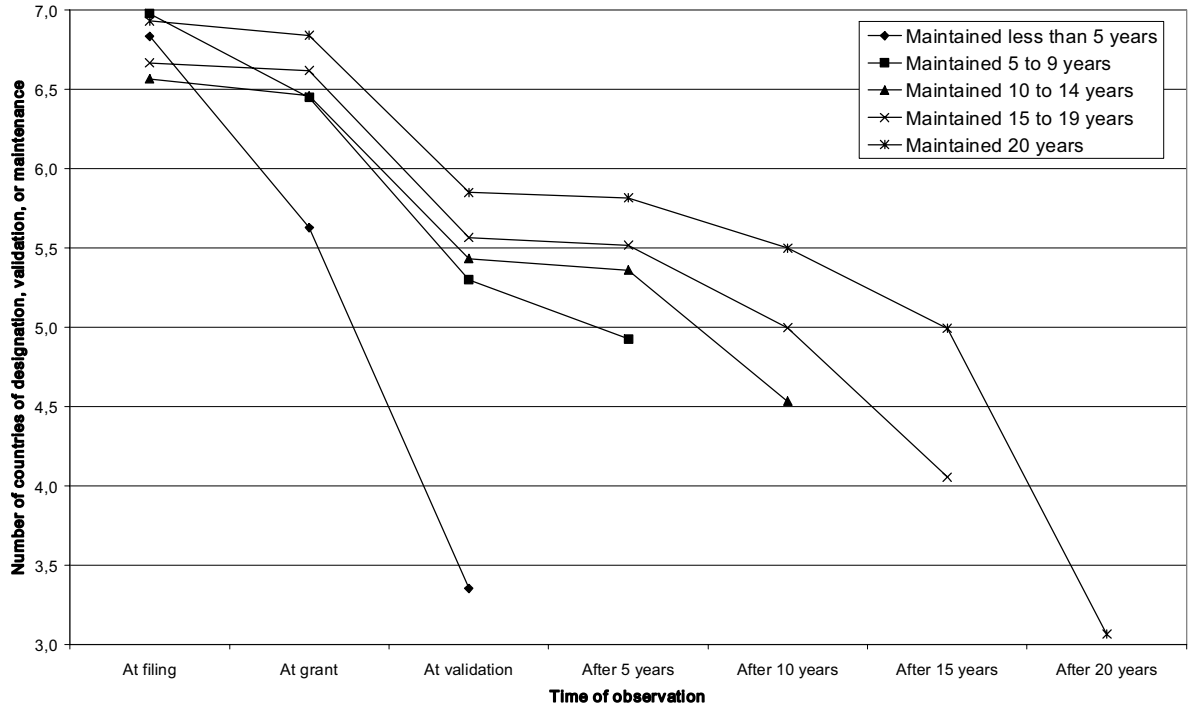
Source: Own calculations based on EPO Data

An additional light on these issues is shed by Figure 6, which displays the family size of different cohorts of patents filed at the EPO between 1980 and 1985 at different points in their lifetime. At first sight, the figure reveals that the geographical scope of European patents decreases on average before and after the effective validation step. In addition to the designated countries which are given up by the applicant once validation costs need to be exposed, patents may lapse each year in certain countries in which they were validated until they entirely fall into the public domain. In view of the observations from Figure 5, it is likely that such lapses occur more frequently in smaller countries than Germany, France and the UK. A second learning from the figure is that – at any point in their lives – the patents with the longest longevity had on average a larger scope of protection than those that lived shorter. For instance, ten years after their filing date, the family of patents that reached 20 years of maintenance was larger by one country than those that lapsed after 10 to 14 years. Nonetheless, older patents finished their lives on average with a smaller scope than younger ones, as they experienced the most severe post-validation reduction in the size of their family. On average, two countries were abandoned between the 15th and the 20th year.

One of the major drawbacks in the preceding analysis is due to the interdependence of the two potential value indicators, the scope and age of patents, since the measurement of one dimension depends on the threshold chosen on the second dimension. For instance one may be tempted to conclude that the average value of patents has increased over time as those who survived at least ten years are more frequently maintained in the three large countries simultaneously nowadays than before. But looking at a larger potential scope of protection reveals that those patents who reached 10 years of validity or more are in fact less frequently maintained outside those 3 large countries, suggesting that patents increasingly focus on the three large countries instead of smaller ones. Looking at different time frames or different geographical areas may hence provide very different value indications. In a nutshell, it seems

relatively easy to fine-tune the boundaries of an indicator so that it would level off or exacerbate an average value trend, or even reverse it.

Figure 6 – Average scope of EPO patents at different points in time per longevity (1980-85 filings)



Source: Own calculations based on EPO Data

The complexity of performing a joint analysis of duration and scope is somewhat illustrated in Pakes (1986) and Deng (2007). The two authors perform patent value simulation exercises based on the renewals data in a given patent office (i.e., separately for Germany, France, and the UK), but not for patent simultaneously filed in the three offices.

3. The Scope-Year Index

These apparent subjectivity and real complexity associated with the appropriate settings of a value indicator aiming at simultaneously grasping the geographical scope and the term of survival call for a potentially unbiased, or less biased, indicator. A solution that we put forward in the present paper, and which is relatively simple to compute and free of any subjective choice, relies on the following indicator:

$$SY_{CT,i} = \frac{\sum_{t=1}^{T}\sum_{c=1}^{C} G_i(c,t)}{C.T} \qquad (1)$$

Where $SY_{CT,i}$ stands for the Scope-Year index of a given patent i over C countries and T years of maintenance, and $G_i(c,t)$ is a variable that takes the value 1 if the granted patent i was active in country c in year t from its filing date, and 0 otherwise. The index is normalised to its maximum value representing T years of maintenance in C countries. The level of C and T should be decided in order to minimize the potential biases in the measure. For instance, if one is interested in measuring the Scope-Year index of patents filed up to 1995, T should be set to 10 years maximum (since the latest data on renewals and lapses available at the time of

the present study were observed for the year 2005). Similarly, one should exclude from the index countries which were not yet Contracting States to the EPC at the time the oldest patents were filed. As an example, when looking at patents filed as of 1980, one should only keep in the index the 11 countries which were already members of the EPC in 1980, so that all patents in the sample are treated equally.

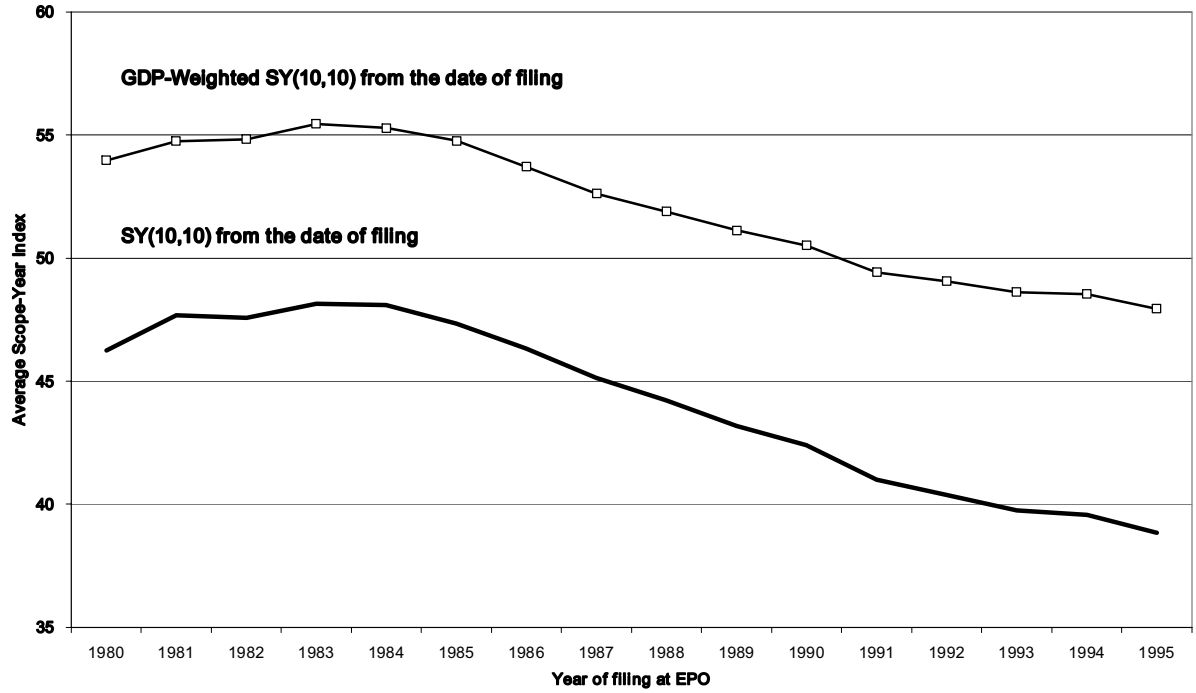
Under this definition, the average SY index across patents provides an indication of the average value of granted patents at the EPO taking into account the spatial and temporal dimensions of a patent's life. This index could be further improved by weighting the countries according to the size of their market, for instance by giving a score of 2 to medium sized countries and a score of 3 to the largest countries in terms of GDP for instance.[9] The weighted index may be computed as follows:

$$WSY_{CT,i} = \frac{\sum_{t=1}^{T}\sum_{c=1}^{C} W_c.G_i(c,t)}{T.\sum_{c=1}^{C} W_c} \qquad (2)$$

Where W_c represents the weight associated with country *c*.

The evolution of the SY index, both unweighted and weighted, is presented in Figure 7 for all the patents granted by the EPO that were filed between 1980 and 1995. Consistently with the preceding examples, the index presented has been computed over 10 countries (all the Contracting States in 1980 except Italy, due to a lack of information) and the first 10 years of renewal from the date of filing (logically inducing a 10-year delay in the index).

Figure 7 – The Scope-Year Index



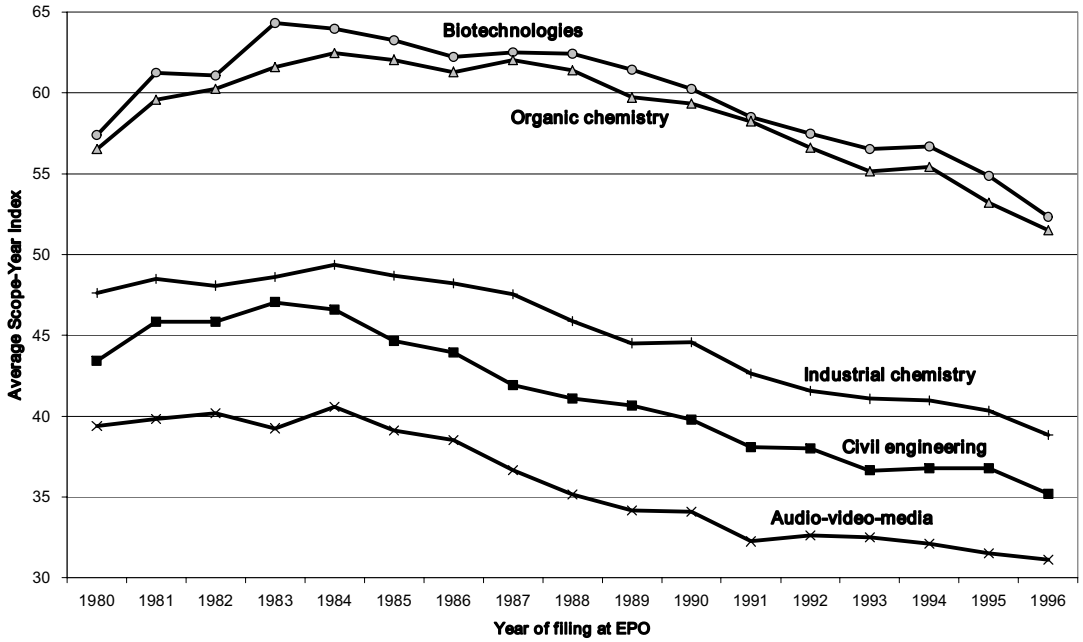
Source: Own calculations based on EPO Data - Scope-year index in 10 countries over 10 years

[9] Another option would be to use the GDP or population of each country as a weight.

Figure 7 shows that the SY index has witnessed an increase in the average value of patents from the early to the mid-eighties. From 1985 onwards there has been a clear and constant decrease in the index, suggesting that the average number of country-years of protection has lost about 20% of its average value (from 48 to about 38 country-years). The evolution of the weighted Scope-Year index is very similar to the one of the unweighted index and hence does not influence the conclusions, meaning that they may be used indifferently.[10]

The SY Index can also be computed per technological field or according to the geographical origin of patents. This is illustrated in Figure 8 for some selected sectors (the results of the remaining sectors are presented in Table A1 in the appendix) according to the Joint Clusters classification in use at the EPO (detailed in Archontopoulos et al., 2007). Two important observations may be drawn from this figure. First, there is a substantial heterogeneity in the SY index across technologies. Biotechnologies and organic chemistry display relatively high SY indexes, with values fluctuating between 50 and 65 over time, whereas Audio-video-media and civil engineering have a relatively low index. Second, there has been a visible drop in the index between 1985 and 1995, no matter the technological field. This drop has nevertheless been more pronounced in Telecommunications (-9.8), Handling and Processing (-9.4) and Organic Chemistry (-8.9). Such sectoral discrepancies may be explained by the time needed for inventions to mature in different fields (it is well known for instance that drugs take a very long time for their real market potential to be assessed).

Figure 8 – The Scope-Year Index, by technological field



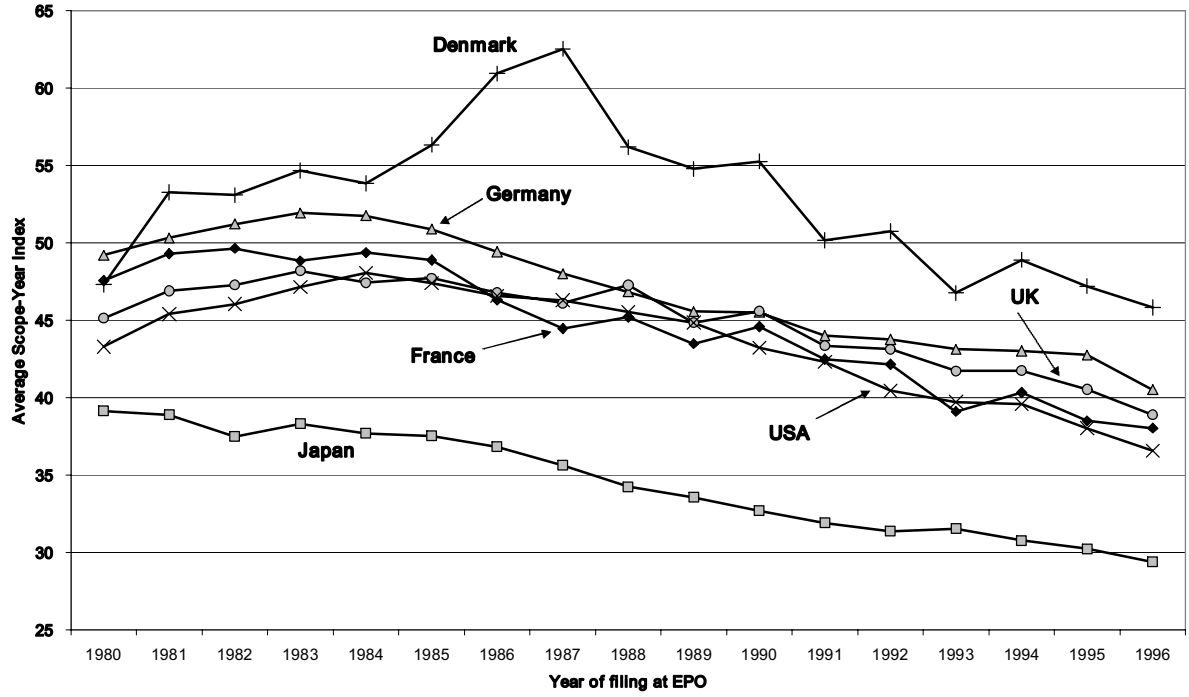
Source: Own calculations based on EPO Data - Scope-year index in 10 countries over 10 years

This decline in the Scope-Year index is also noticeable across applicant countries. However, there seems to be less heterogeneity across countries, as illustrated in Figure 9, with the noticeable exceptions of Denmark (which has the highest index, probably due to its strong

[10] Note that the weighted index could be even more sophisticated by weighting the years of maintenance as well (given for instance less weight to the first year since it is inevitable to any application filed and a much higher weight to the 20th year given it is the most difficult to reach).

specialization in biotech) and Japan (with the lowest index, probably resulting from a strategy that systematically focuses on the three largest countries).

Figure 9 – The Scope-Year Index, by country of applicant



Source: Own calculations based on EPO Data - Scope-year index in 10 countries over 10 years

One drawback of the proposed Scope-Year index, however, is that it is measured for granted patents only. Hence, it may not be used to assess pending, refused or withdrawn applications. Of course, such applications almost surely have much less value than granted patents, but they are not necessarily of no value at all, especially during the examination process, which may last up to 10 years. Indeed, by virtue of Article 67 EPC, applications while pending may have the same effects as a granted patent.[11] This is why some applicants deliberately try to slow down the examination process of their application to enjoy this provisional protection (using their pending patents as a threat or a bargaining instrument against competitors) at a much lower cost than a granted patent incurs (see Stevnsborg and van Pottelsberghe (2007) for a typology of applicants' filing strategies).

Therefore, an alternative index might be helpful in assessing the potential value of such applications: the provisional Scope-Year index. This index applies the same rationale to the applications under examination at the EPO as to granted patents, but must rely on an important hypothesis regarding the geographical scope for protection (since the patent is still pending, there is no information on the effective validation behaviour). One solution would be to use the information on the designated states chosen at the request for substantive examination. Unfortunately, this information is of a limited reliability because it has increased on average over the past decades whereas the number of countries of validation has decreased

[11] "A *European patent application shall, from the date of its publication under Article 93, provisionally confer upon the applicant such protection as is conferred [to granted patents] by Article 64, in the Contracting States designated in the application as published*" (Article 67(1) EPC). In addition, "*every State shall ensure at least that, from the date of publication of a European patent application, the applicant can claim compensation reasonable in the circumstances from any person who has used the invention in the said State in circumstances where that person would be liable under national law for infringement of a national patent*" (Article 67(2) EPC).

over the same period (see figure 4).[12] A more reliable option would be to rely on the average number of countries where the patents filed in the same year have been validated in each sector (in order to take into account the important sector to sector variations in validation patterns) as a proxy for the provisional scope of protection of pending applications. In order to cope with the systemic expansion of the time to grant, the actual examination duration should be weighted by the average duration for granted patents which were filed in the same sector and the same year. This approach is codified in the following equation:

$$PSY_{CT,i} = \frac{\dfrac{PT_{T,i}}{\left(\overline{PT}_{T,JCit} - 2\right)}\overline{S}_{T,JCit}}{C.T} \qquad (3)$$

Where $PSY_{CT,i}$ stands for the provisional Scope-Year index of a given application i over C countries and T years of processing, $PT_{T,i}$ is the number of years during which the application i was maintained in the examination process (with a maximum of T), $\overline{S}_{T,JCit}$ is the average scope of validation (over T countries) of patents granted which were filed in the same year in the same sector (JC_{it}) and $\overline{PT}_{T,JCit}$ is the average examination duration of patents granted which were filed in the same year in the same sector. Dividing the observed pending time of the application by the average delay in the same sector and the same year of filing is also a way to weight the importance of non granted applications as compared with granted patents.

Figure A1 in the appendix shows the evolution in the average provisional Scope-Year index as computed according to equation (3) for non granted patents, and the average value of all filings (using equation (1) for granted patents and equation (3) for non granted applications). The figure exhibits a continuous drop in the average value of non granted applications, by 1% a year on average from 1980 to 1995. This slight decrease in the provisional index only smoothens the observed evolution in the standard index computed over granted patents and depicted in figure 7.

4. Concluding remarks

There has been a boom in the number of patent filings over the past 20 years. This boom puts pressure on patent offices as witnessed by growing backlogs. In addition, it generates criticisms on the patent system and its myriads of applications, generating complexity and legal uncertainty. Indeed, if the average value of patent filings is decreasing it is legitimate to wonder whether the system is viable in the long run (see Guellec and van Pottelsberghe, 2007). The objective of this paper was to provide some basic measures of the average value of patents based on renewals data (i.e., the time of survival) and the geographical scope for protection within the framework of the European Patent Convention. The empirical ground consisted in analysing the historical evolution of all patents granted by the EPO from 1980 to 1998 along two essential dimensions in a patent life: the size of its family and its age reached.

Analysed separately, the two dimensions revealed some decreasing trends in the average value of granted patents. However, it turned out that playing with the definition or "metes and bounds" of the potential indicators (analysis of the geographical scope for a given duration, or analysis of the duration for a given geographical scope) could lead to sharper or leaner conclusions regarding the evolution of the average patent value. We therefore put

[12] In addition, designation fees are much lower than validation and renewal fees and they have been limited to 7 countries since July 1st, 1999. This means that as soon as an applicant pays for the designation of 7 countries, she gets all the others designated for free.

forward a new indicator, the Scope-Year index (SY), which explicitly combines the time and geographical dimensions. This index, consisting in quantifying the country-years covered by each patent with respect to a maximum potential reach, reveals a constant decrease in the average value of granted patents between 1985 and 1995. The fall of about 20% in the SY index must however be considered jointly with the increase of about 100% in the total number of applications over the same period. In other words the total number of country-years of maintenance has in fact increased over time in raw terms.

Substantial variations in the SY index appear across technologies, with biotechnologies and organic chemistry reaching the highest value, and audio-video-media the lowest. However, there remains a common tendency towards a marked decline in the average value indicator. Similar observations (though with less heterogeneity) can be made based on the geographical origin of patents.

Two lessons may be drawn from this empirical exercise. First, the institutional expansion of the EPC over the eighties and the nineties seem not to have resulted into an increase in the average geographical scope of protection of European patents, suggesting that applicants to the EPO increasingly focus on the three largest European markets (Germany, France and the UK). Secondly, despite the substantial delay between the time of filing of a patent and the time at which its value can be measured, the historical analysis reported in the present paper provides a clear evidence of a declining trend in patent value between the mid-eighties and the mid-nineties. In view of the surge in patent filings, this increase suggests a higher propensity of inventors to file patents with a lower value. The factors underlying this evolution, however, still need to be explored.

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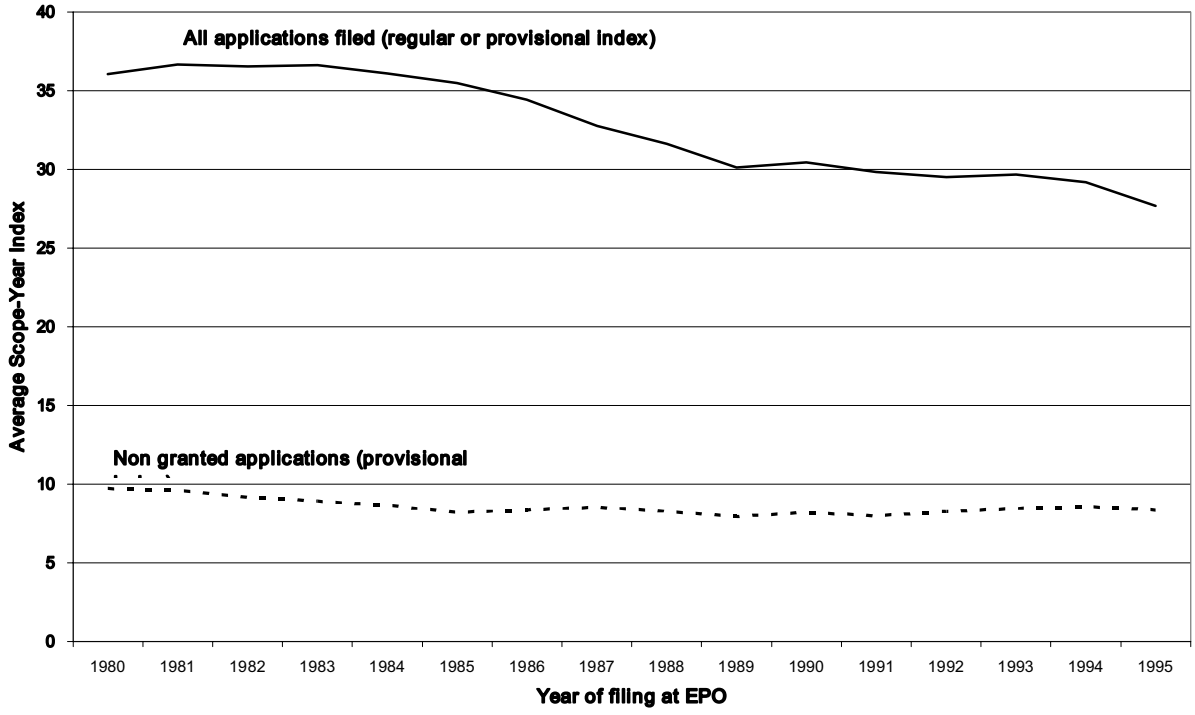
APPENDIXES

Table A1 – The Scope-Year Index, by JC cluster

	Year of filing at EPO				
Joint Cluster	**1980**	**1985**	**1990**	**1995**	**95-85**
Industrial Chemistry	47,6	48,7	44,6	40,3	-8,4
Organic Chemistry	56,5	62,0	59,3	53,2	-8,9
Polymers	47,8	49,2	44,8	41,3	-7,9
Biotechnologies	57,4	63,2	60,2	54,9	-8,4
Telecommunications	45,5	44,4	44,0	34,6	-9,8
Audio-Video-Media	39,4	39,1	34,1	31,5	-7,6
Electronics	40,5	39,7	35,5	33,0	-6,7
Electricity	41,3	40,7	35,1	33,1	-7,7
Computers	40,8	40,2	34,2	32,4	-7,7
Measuring Optics	41,7	43,0	37,7	35,1	-7,9
Handling & Processing	45,9	48,6	42,2	39,2	-9,4
Vehicles	39,9	40,3	35,7	33,4	-6,8
Civil Engineering	43,4	44,6	39,8	36,8	-7,9
Human Necessities	46,1	48,0	42,9	39,7	-8,2
Overall	**46,2**	**47,3**	**42,4**	**38,8**	**-8,5**

Source: own calculation from EPO data, see equation 1 in main text.

Figure A1 – The Provisional Scope-Year Index



Source: Own calculations based on EPO Data – Provisional Scope-year index in 10 countries over 10 years