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When small is beautiful: measuring the evolution and consequences of the voluminosity of patent applications at the EPO[ϖ]

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Abstract

The joint increase in the number and size of patents filed around the world puts patent systems under pressure. This paper addresses issues in measuring the voluminosity of patent applications and highlights several patterns in its evolution. The results – based on a 2 million EPO applications database – show that the average size of applications has doubled over the past 20 years and that it is mainly associated with PCT applications having a US priority. Voluminosity indicators are also influenced by geographical origins, technological areas, and various measures of complexity. They strongly impact the workload of the EPO, justifying the need for regulatory and policy actions.

Keywords: Patent drafting, patent voluminosity, patent applications, patent statistics, patent systems, workload.

JEL classification codes: O31; O34; O50

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1. Introduction

The past twenty years have witnessed a dramatic increase in both the number of inventions for which protection has been sought from patent offices around the world and in the average size of patent applications. This joint evolution of the number and size of patent applications raises serious concerns about the ability of the patent system to master the workload that it imposes on patent offices, in particular with respect to the efficiency and timeliness of search and examination procedures.

Although the phenomenon has become particularly pronounced in the last decade, the issue of patent complexity and voluminosity is far from being of recent concern.[1] For instance, in 1933 the US Patent and Trademark Office Society was seeking advice on recommendations to eliminate the multiplicity of claims and on a fee schedule dependent on the number of claims (Smith, 2003). About three decades later, in 1965, the problem of complexity was reported to have such a major influence on the delay in processing patent applications that it was proposed again, in addition to hiring more examiners and introducing mechanised searching and procedural modifications, to increase filing and renewal fees (Duncan, 1965).

In recent years, the growth in patent voluminosity became so extreme that the term "mega-applications" was coined, often in relation to applications filed together with biological sequence listings. In one such case, the EPO received an application (EP20000301439) with 283 priorities, 80,259 sequences and an estimated 50,000 pages. Including all priority patents, the case totalled around 600,000 pages. In the US, the application US20050182468 was originally filed with 13,305 claims, for which a small-entity fee of 1,249,075 US$ was initially requested by the USPTO. According to Dudas (2005), 7% of applications now filed at the USPTO represent about 25% of the patent claims that are examined.

Several recent reports prepared by the US Federal Trade Commission (2003), the National Academy of Public Administration (USPTO, 2005) and the United States Government Accountability Office (Mittal and Koontz, 2005), and in Japan by the Patent System Subcommittee, the Intellectual Property Policy Committee and the Industrial Structure Council (Patent System Subcommittee, 2002) have highlighted this voluminosity issue. Further studies on the US patent system and the voluminosity in the USA include Lemley (2000), Allison and Lemley (2001) and Moore (2005). At the EPO, the incoming workload has been publicly discussed as one of the factors influencing its current efforts in mastering the workload [2] and is now an element of the ongoing strategy debate on the future of the patent system in Europe.[3]

The objective of this paper is to address several issues regarding the voluminosity of patent applications at the EPO: how can one measure the voluminosity, are there some patterns in the potential factors underlying its surge and is there any identifiable social cost induced by this phenomenon? Besides its objective, the originality of this analysis is that it relies on a database that has been built specifically to measure and address these phenomena in the context of the EPO. It is made of a large number of variables providing information on more than two million documents filed at the EPO between the creation of the Office in 1978 and the end of 2004.

[1] From the Merriam-Webster Online Dictionary, voluminosity is "the quality or state of being voluminous".
[2] European Patent Office, Proceedings of Session 2: A Closer Look at the Nature of the Incoming Workload, Mastering the Workload, A European Patent Office Customer Workshop, Munich, Germany, 2003 and European Patent Office Conference on Quality in the Patent System, The Hague, November 2005.
[3] The Increased Voluminosity of Patent Applications Received by the EPO and its Impact on the European Patent System. http://ac.european-patent-office.org/strategy_debate/documentation/pdf/ec05073.pdf

The paper is organised as follows: section 2 discusses the measurement issues and scrutinizes the candidates for voluminosity indicators, section 3 investigates potential explanatory factors, section 4 elaborates on the social cost of patent voluminosity and section 5 concludes.

The main results are that the voluminosity of patent applications at the EPO can be measured with the number of claims and pages of applications, that these indicators have doubled over the past 20 years, and that this phenomenon – mainly associated with applications that have been filed via the PCT route, with a US priority filing, in the biotech sector, or with a large number of inventors – has a tangible impact on the Office's workload. These findings will provide a useful basis for further analytical work in the field.

2. Measurement issues

Volume as an overall concept can have different facets and be measured in different units, especially when it is applied to documents such as patent applications. Table 1 summarizes the main potential measures with their advantages and disadvantages. The most intuitive measure of the voluminosity of a document is probably its number of pages. It has the great advantage of quantifying the amount of workload and processing cost incurred by the granting authority to examine the application. It may also inform on the extent of the disclosure provided by the applicant on the invention.

Table 1 – Potential voluminosity indicators

	Proxy for	**Advantages**	**Disadvantages**
Claims at Filing	Complexity, Workload, Scope, Breadth	Legal core of patent Format and language neutral	Relationship with scope/breadth difficult to interpret. Ideally, should distinguish between independent and dependent claims
Pages at Filing	Workload, Disclosure, Processing cost	A physical representation of the examiner's workload	Format and language sensitive
Description Pages at Filing	Disclosure	Technical core of patent	Format and language sensitive
Drawing Pages at Filing	Complexity, technicality		Format and type of illustration sensitive
Size of document filed (KB)	(IT) Processing cost, Workload		Format and language sensitive
Claim pages per claim	Complexity, Relative size of claims		Very loose measure due to approximate page counts. Format and language sensitive

As patent publications are drawn up according to a standardised structure, the total number of pages can further be divided into the number of pages of each of the different parts it is made of, hence providing a more precise indication: the bibliographic section provides information on the patent such as its serial number, the date of filing, the date of publication, the designation of any claimed priority application, data on the inventors and applicants, etc. It is followed by a description of the invention and then by the claims section. The claims specify in detail the "components" or building blocks of the patented invention, and hence their number may be indicative of the "scope" or "width" of the invention (Hall *et al.*, 2001). The description and claims may be complemented by various illustrations (e.g. drawings, figures, sequences, flow diagrams) grouped together in the "drawing" section. Considering the number of pages in each successive section of a patent document may present several advantages. When looking at the size of incoming applications, this allows for the possibility of disregarding from the overall voluminosity the pages of the bibliographic and search sections, which are actually added or modified by the office after the search process. What is more, it provides a more precise measure, which would enable to identify whether large applications are actually due to longer descriptions, longer claims, or just numerous illustrations.

Since all EPO patent documents are available in an electronic format, the size of the digital publication – expressed in kilobytes – makes yet another potential measure of the size of a document. As it appears in table 2, one may obviously expect such a measure to be strongly correlated with the number of pages the document is made of.

Since pages and kilobytes depend on both the substance and the form of a document, one should rather look at potential content-based measures. The core section of a patent is made of the claims, which define the legal scope of the invention for which protection is being sought. Therefore, the number of claims in itself may provide a much more neutral measure of patents voluminosity. Much has been written on the meaning and interpretation of the number of claims (see for instance Tong and Frame (1994), Lanjouw and Shankerman (1999) and Scotchmer (2004)), but there is still no clear-cut interpretation of the relationship between the number of claims and the scope or breadth of protection.

Another format-independent measure could be made of the number of words in a publication, or in each of its sections. Similarly, the number of illustrations in the drawing section might be more revealing than the number of pages of this section. Such measures could indeed provide a relatively unbiased indication on the richness of the content of a document, but drawings may be very diverse in complexity and nature and words are obviously language-dependent. What is more, none of these indicators are available as such for all patent filings at EPO.

There is probably no such thing as one single helpful definition of a patent document's voluminosity, and it all depends on what one is willing to analyse. While the number of claims can give an idea about the scope or breadth of a patent, the number of words or pages may rather reveal the level of the disclosure or the level of complexity of an invention for which protection is being sought or on the workload that the processing of an application may impose on the examiner. As expected, these different measures are quite well correlated as illustrated in table 2, especially between page-related counts but also between page and claim counts.

Table 2 – Correlations between voluminosity indicators

	Claims	Pages	Desc. Pg.	Claims Pg.	Draw. Pg.	Doc. Size
Claims at Filing	1,00					
Pages at Filing	0,37	1,00				
Description Pages at Filing	0,30	0,89	1,00			
Drawing Pages at Filing	0,18	0,64	0,25	1,00		
Size of document filed (KB)	0,35	0,92	0,83	0,59	1,00	
Claim pages per claim at Filing	-0,06	0,17	0,14	0,01	0,12	1,00

All coefficients are significant at a 5% probability threshold

Source: Own calculations based on EPO Data

There are, however, some limits to the unbiasedness of every potential indicator described here above. Measures consisting in or based upon the number of pages are inherently dependent on the format (paper format, margins, line and paragraph spacing, font size, hyphenation, etc.) as well as on the language of the document. As long as the format of patent applications is left to the choice of the applicant or his representative, one may expect to have a very wide variety of formats, making such measures highly unpredictable.

At the EPO, one may distinguish between original facsimile formats and official EPO-formatted documents. Indeed, since the very beginning of its activities, the European Patent Office has always published granted patents in a specific – very compact – format referred to as "*type-set format*",

with standardized fonts and uniform page layouts.[4] Hence, the number of pages in published granted patents, always expressed in terms of the homogenously reformatted document, can be expected to be quite uniform. One major drawback of this format for granted patents publications only is however that the claims – as required by the European Patent Convention (EPC) – are always provided into the three official EPO languages (English, French and German). Therefore, the number of pages of the claims section is always about three times larger than it should really be. Contrarily to grants, incoming applications, published generally 18 months after the priority date, have only been harmonized from the mid-eighties and for non-PCT applications exclusively. Therefore, one may look either at the numbers of pages in the original, highly heterogeneous, facsimile documents or at the numbers of pages in EPO-reformatted publications. The former are highly volatile and poorly comparable to each other while the latter are hard to interpret for filings preceding the progressive implementation of this standard format and are not available for PCT applications.

As far as the detailed numbers of pages making up the different sections are concerned, the available data provides less straightforward indications. As it contains the numbers corresponding to the starting page of each section, the difficulty lays in the continuity of the documents (each section starting on the same page where the previous one ends) and in the optional nature and order of some sections.[5] Indeed, generally speaking the only mandatory sections in any patent publication are the bibliographic data, the description, and the claims.[6] The search report – preceding or following the application itself – and the drawing sections are not always present and some amendments may sometimes be inserted anywhere within the application. Determining the exact number of pages of each section is indeed not a straightforward or clear-cut exercise. An example is provided in table A1 in the appendix. It shows that the length of each section may vary widely from one technological area or country of residence of applicants to the other. It also shows that the description section totals the largest share of the documents' size.

In addition to these layout and formatting issues, measures made of a number of pages as well as of a number of words are highly dependent on the language used in the application. It is well known for instance that for the same document translated into different languages there are more words in Latin than in Germanic languages but that words are longer in the latter.[7] One should therefore consider this potential language bias when relying on the number of pages or words in a document. Nevertheless, for institutional reasons, applications must be filed at the EPO in any of the three official languages (English, French or German), which is the case for about 90% of EPO applications and hence confines this issue to a certain extent.

The number of claims is in fact no perfect indicator either. There are independent and dependent claims[8] and there are different types of independent claims (product, process, apparatus or use). A

[4] This format appears to shrink the number of text pages from facsimile documents by 50% on average.

[5] The burden to the computation of sectional pages is due to the starting of each section as a continuation of the previous one, hence on the same page where the previous section ended. As an example, if the specification starts on page 2 and the claims start on page 5 and end on page 7, should page number 5 be computed as part of the claims or of the specification section? As a matter of fact, the specification may end and the claims may start anywhere on page 5. Hence the best option is to make the assumption that the place on a page where one section ends and the next one starts is a random process and that it should be even all over the page. Therefore, it should be safe to cut page 5 into two parts and grant half a page to both sections, thus resulting in 3.5 pages for the description and 2.5 pages for the claims.

[6] The claims define the scope of protection of a granted patent, and thus are subject of a detailed scrutiny in the process of substantive examination. Therefore, they are mandatory in each stage of the patenting process. However, in certain jurisdictions, such as in the US and UK, it is allowed to file a patent application with no claims at all; claims would then be introduced during the examination phase. Such notice is known as a continuous application (see Quillen *et al.*, 2002).

[7] For instance, the text of the 2002 edition of the EPC, comprises 73,629 words (427,113 characters) in German, 84,583 words (396,710 characters) in English and 86,353 words (413,769 characters) in French.

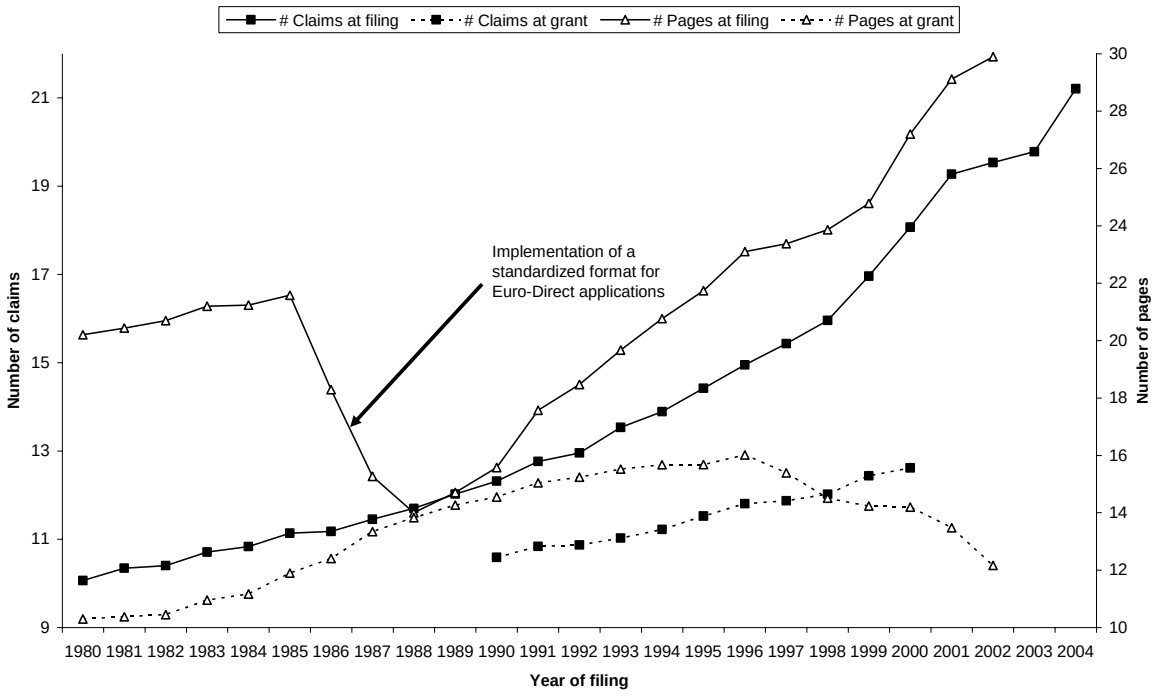
[8] The independent claims stand on their own, whereas the dependent claims rely on a single claim or on several claims and generally express particular embodiments (Wikipedia, http://en.wikipedia.org/wiki/Claim_(patent)).

more accurate measure of the number of claims should hence provide separate counts of the number of dependent claims and the number of independent claims of each type, although this information is unfortunately not available. Moreover, patent drafting styles may be strongly influenced by national or regional systems, cultures and modes. The practice of using dependent claims as fall-back positions (i.e. a set of different versions of a same claim or of overlapping claims to serve in different contexts and maximize chances for the main claim to stand in front of an examiner or court) is not evenly spread around the world and the level of details in the specification may depend on the inventor's expectation about the potential behaviour of a court in case of litigation, not to mention important country to country differences in patent drafting practices.

Even before investigating all these potential drawbacks with voluminosity measures, a choice has to be made in terms of the document type one is looking at: applications are more appropriate to the investigation of workload issues and grants should be preferred when looking at patent quality or legal validity. Once this choice has been made, one may also have to deal with the existence of several publications for one single application or grant. This may be due to various factors occurring during the granting process, e.g. an amendment filed after the initial publication of an application may provoke a new document to be published, oppositions and appeals after grant may also require a new version of the granted patent to be printed.

Comparing voluminosity measures between the application of a file and its grant may obviously reveal very interesting information on the effect of the granting process. But such a comparison is probably not straightforward. First, formatting and layout considerations may hamper the comparability of the number of pages, except for non-PCT applications filed after the implementation of EPO's harmonized format to direct incoming applications. Second, the amount of text in the claims section is approximately multiplied by three in grant publications, since the claims must be provided in the three official languages. Finally, even when it turns to the number of claims, any variation in this number between application and grant could give rise to different interpretations: some claims may have been removed, but also merged with others, resulting either in a reduction or enlargement of the patent scope.

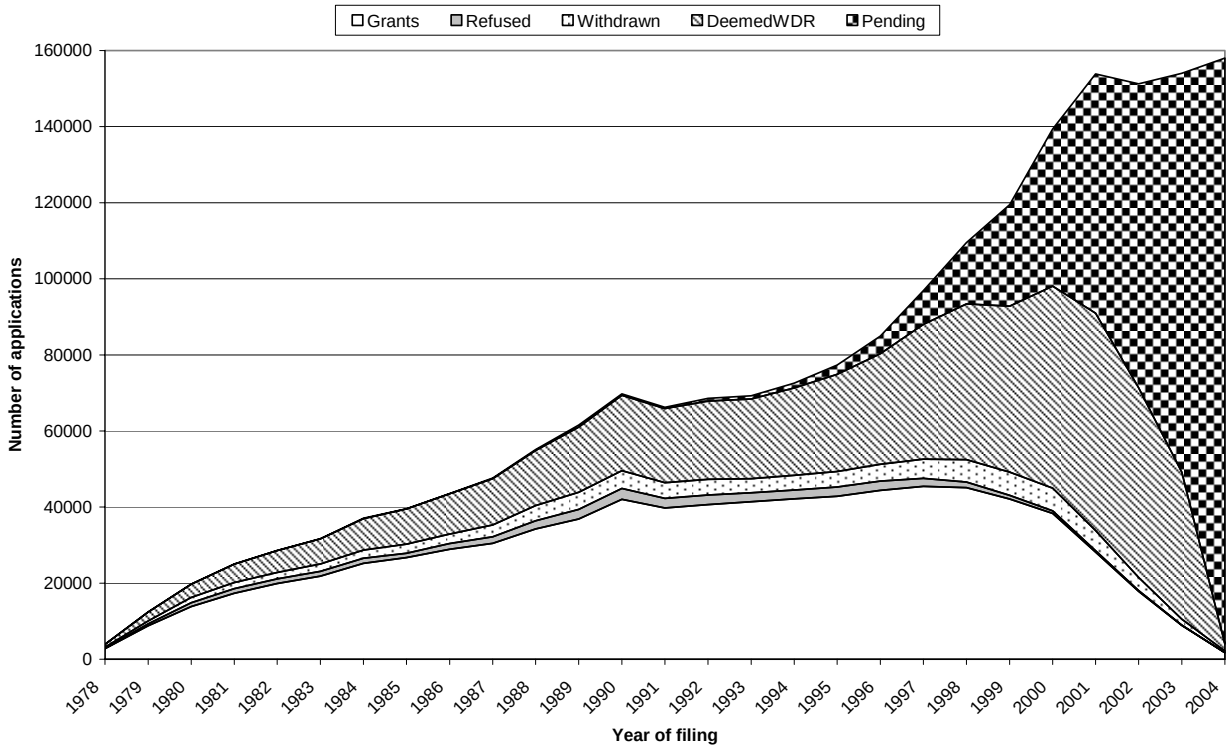
Figure 1 – Average number of claims and pages in incoming applications at EPO (1980-2004)



Source: Own calculations based on EPO Data

In what follows, the focus will be on the two main voluminosity indicators detailed in table 1, the number of pages and the number of claims. Our dataset covers applications filed at the EPO from the 1st of January 1978 through the 31st of December 2004, which represents 2,069,698 documents.[9] This dataset is made of variables computed from different EPO databases (including EPO, 2006). It contains the number of claims in the original application and in the resulting granted patent if issued (only for post-1990 filings) and the number of pages, and of description, claims and drawing pages in type-set (when available) or facsimile format, in both the published application and granted patent. Table A2 in the appendix further provides some basic statistics on the main dataset variables. The evolution of these indicators, illustrated in figure 1, is to be balanced with the fast-increasing number of applications received by the EPO as depicted in figure 2.

Figure 2 – Status of applications at the EPO by year of filing as on January 2006



Source: Own calculations based on EPO Data

Figure 1 shows a drastic increase in all voluminosity indicators during the eighties and the nineties. Both distributions actually present some extreme values in recent years, with up to nearly ten thousand pages and a thousand claims. Further to this phenomenon, WIPO has even received in 2004 a series of related PCT applications with US priority in the biomedical field with up to nearly 20,000 claims for the largest of these filings, as illustrated in table A3 in the appendix.[10]

Figure 1 exhibits a drop in the average number of pages of granted patents since 1996, which suggests at first sight that patents granted more recently tend to be smaller. This could be the result of smaller applications getting granted faster than larger ones. It may also be a consequence of page

[9] Following Hall *et al.* (2001) for quantitative analyses, and Dernis et al. (2001) for statistical purposes, the actual timing of patented inventions is closer to the application dates than to the (subsequent) grant dates, and since the interest is on the volume of incoming applications, the data always refers to cohorts of applications in terms of their filing date at the EPO.

[10] These applications have later entered the Regional phase at the EPO where the number of claims per application is now in the order of tens rather than thousands. See Stevnsborg and van Pottelsberghe (2007) for a typology of drafting styles and their induced filing strategy.

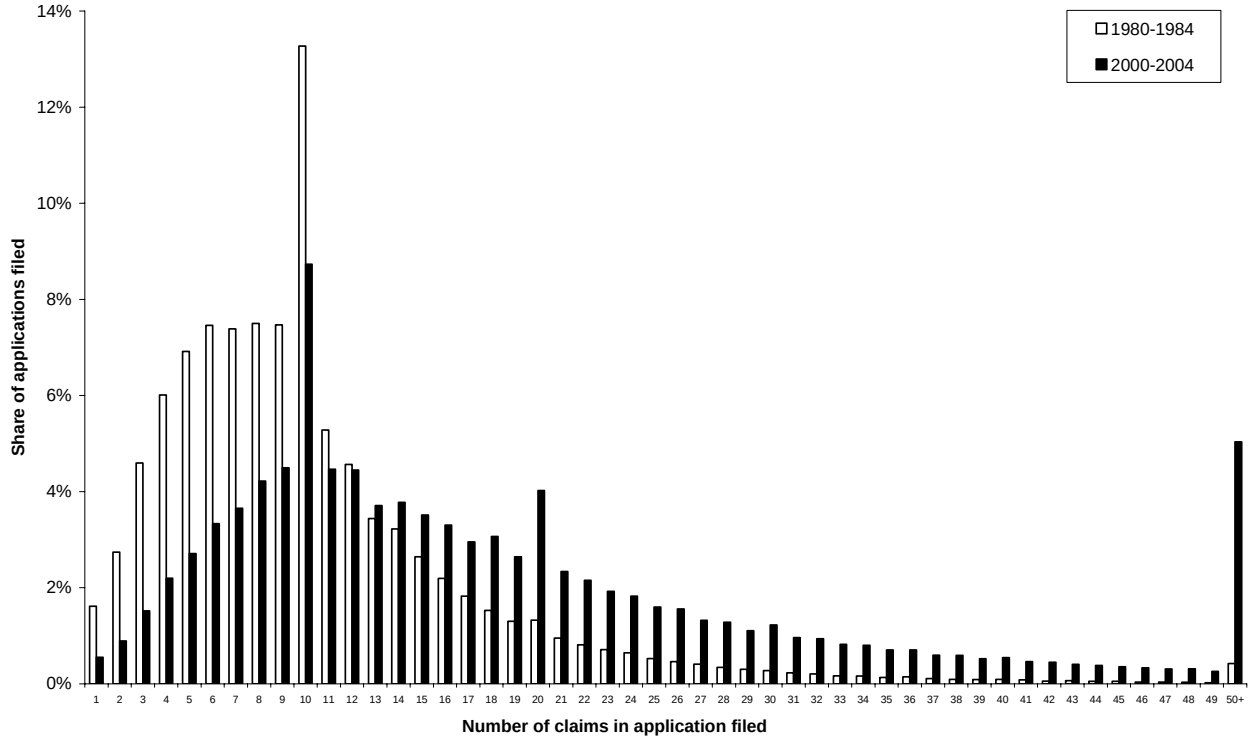
counts at grant necessarily referring to harmonized type-set format publications whereas page counts at filing are provided in facsimile format for PCT applications. Section 3 will investigate some patterns and explanatory factors in this evolution.

Figure 2 shows a striking decline in the rate of grant according to the year of filing. This is naturally due to the inherent delays in the granting process, so that the more recent the application, the less likely it is to be yet granted, withdrawn or refused. Section 4 will investigate the potential impact of the voluminosity on the delays in the granting process.

3. Explanatory factors

This section investigates the potential role of various factors on the voluminosity of applications. These factors include claim-based fees, filing routes, geographical origins and technological specificities.

Figure 3 – Number of claims in EPO applications



Source: Own calculations based on EPO Data

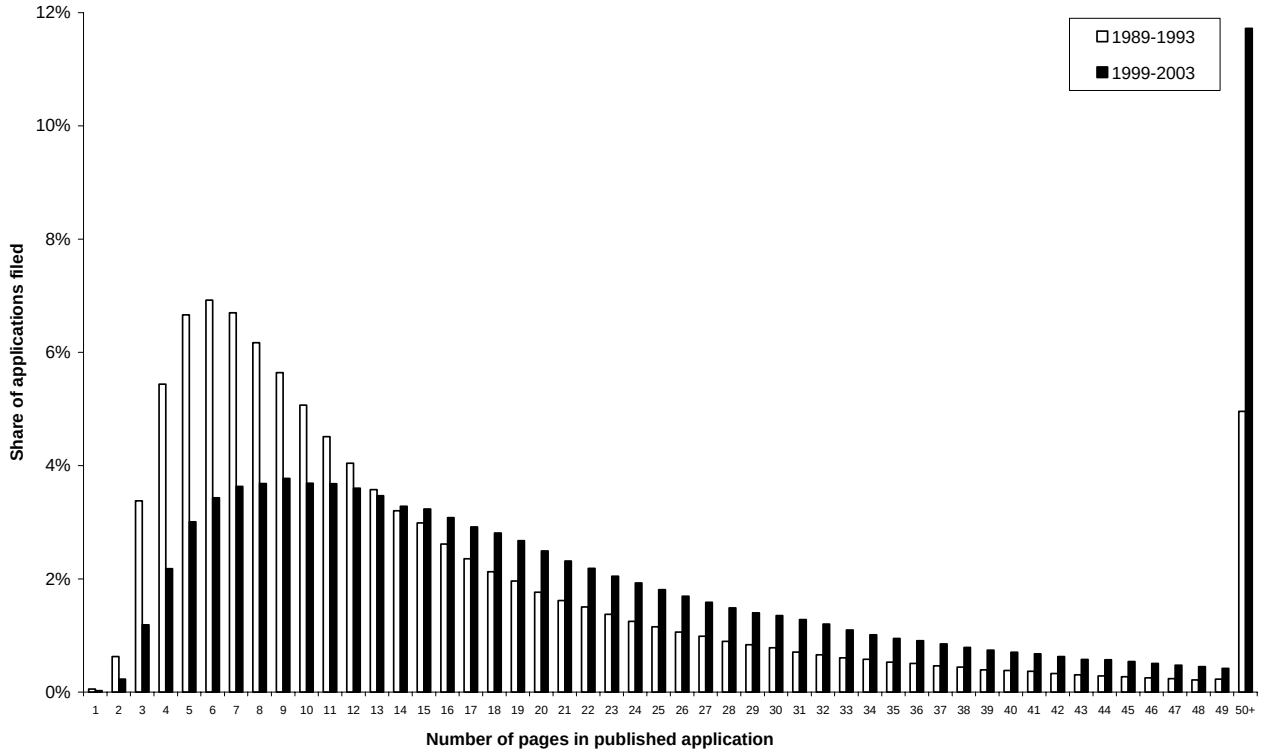
Fees

Figure 3, showing the frequency distribution of the number of claims at filing, displays an absolute mode at 10 claims and a local one at 20 claims. This bi-modal distribution is explained by the "fee" policies ruling EPO and USPTO applications respectively, which underlines the impact of administrative fees on patent drafting and suggests the existence of a price elasticity of the number of claims.[11] As an illustration, 43% of the applications in the dataset have been filed with 10 claims or less and 78% with 20 claims or less. The frequency distribution of the number of pages at filing

[11] At the EPO, the claim-based fees for the eleventh and each subsequent claim in a patent application is 45 EUR (as of April 2006), from 40 EUR before (between March 1999 and April 2006). In the US, for the twenty-first and each subsequent claim there is a fee of 50 USD (effective December 8, 2004). See also van Pottelsberghe and François (2006) for an analysis of the cost factor in patent systems.

is shown in figure 4. It clearly shows the importance of the tail of the distribution towards large applications, but contrarily to the claims, no price elasticity is visible as such.[12]

Figure 4 – Number of pages in EPO applications



Source: Own calculations based on EPO Data

Both figures further depict a strong shift of the distribution to the right over the past twenty years, confirming the broad increase in voluminosity illustrated in figure 1. They also highlight the increasing skewness of both distributions as emphasized by the very long distribution tails, especially with the number of pages where about 12% of filings account for over 50 pages in recent years against only 5% in 1989-1993.

Filing routes

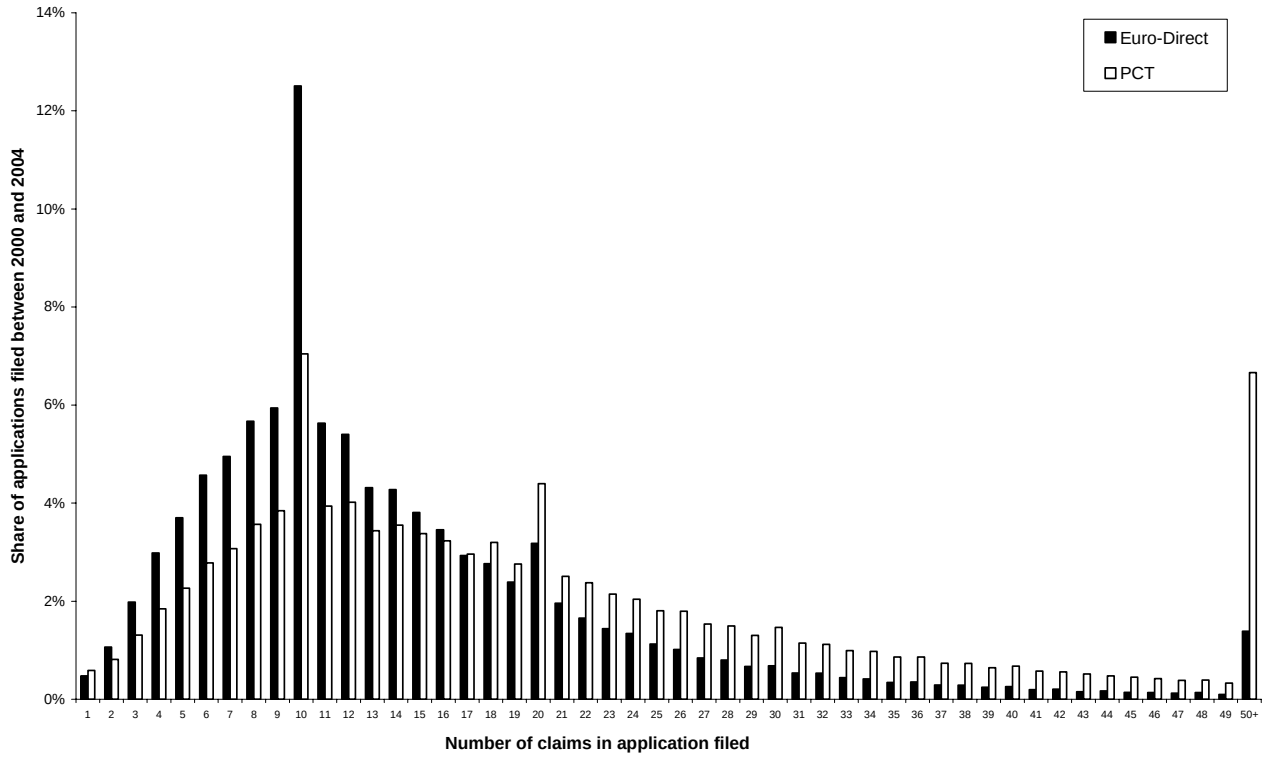
A patent application can follow different routes before it gets filed at the EPO. It may be filed directly at the EPO as a priority or after a national priority application had been filed in one specific country and possibly transferred to WIPO under the PCT option. This leaves three possible routes: a national priority filing subsequently transferred to the EPO, a first filing at the EPO and an application with a national or regional priority transferred to the EPO through the PCT process. It is important to note the strong increase of PCT applications among EPO filings, from 15% in 1985 to 50% in 2000.

The dependence of pages counts on filing routes (i.e. PCT versus Euro-Direct applications) due to the formatting issues evoked above has already been underlined. Nevertheless, granted patents – although sharing a common standardized format no matter the filing route – are on average larger for PCT (15.7 pages) than non-PCT (13.4 pages) applications. Further to this effect on pages, the average number of claims in incoming applications as well as granted patents is higher for PCT than non-PCT filings, as shown in Figure 5. This suggests that the PCT route is correlated with the increasing voluminosity of applications at the EPO. Nevertheless, non-regional Euro-PCT filings –

[12] At the EPO there is a surcharge for excess pages (calculated on the facsimile version) at the time of publication of the grant only, whereas in the PCT procedure excess page fees are to be paid at the time of filing.

i.e. PCT filings designating but not yet transferred to the EPO – have also on average more claims (24.31 claims in 2004) than regional Euro-PCT applications (21.15 claims in 2004), probably because it is only once they are transferred that EPO fees for excess claims have to be paid and that a translated version of the application has to be provided. It is hence likely that many PCT applications either never get transferred to the EPO in practice or are somewhat adapted – and supposedly reduced – prior to being effectively transferred.

Figure 5 – Number of claims in PCT and Euro-Direct applications (2000-2004)



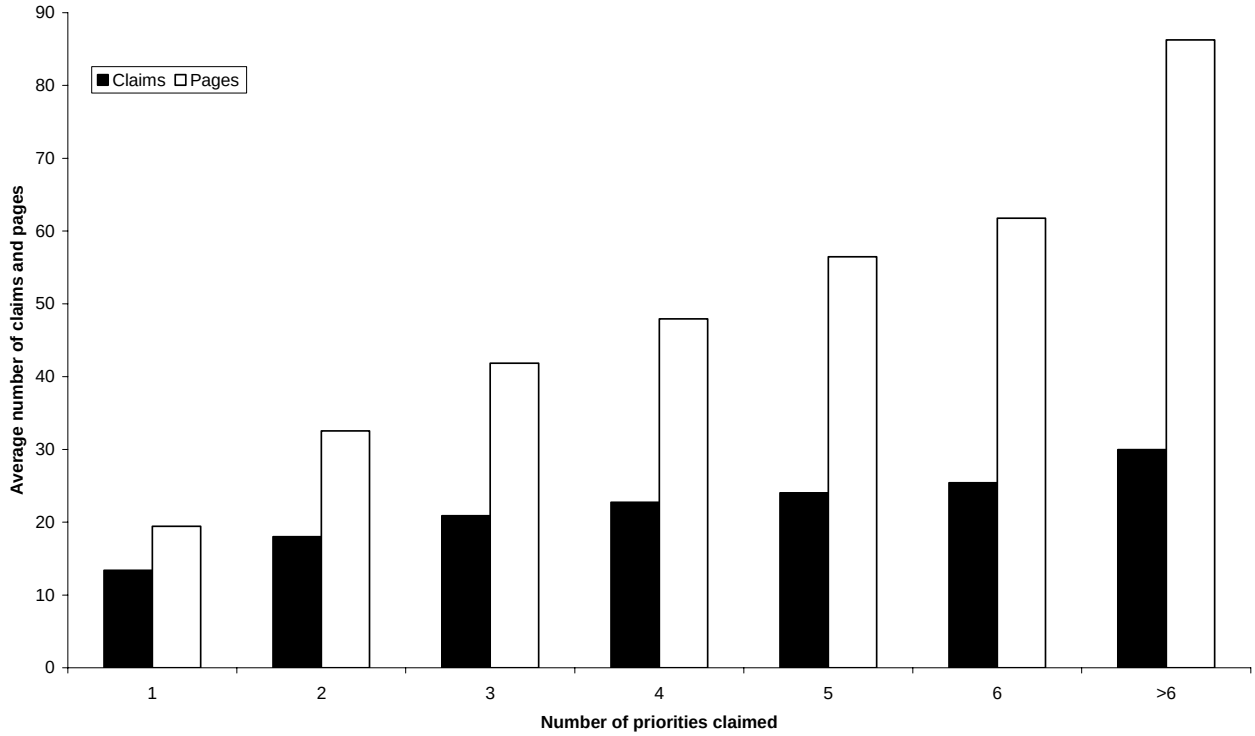
Source: Own calculations based on EPO Data

More than 95% of EPO applications were actually filed after an initial national priority had been applied for.[13] In some cases, the national priority which is claimed for an EPO filing is not unique. Sometimes because the priority application had already been transferred to other national or regional offices, sometimes because the application filed at the EPO is in fact a combination of several national priorities merged together. The average number of priorities per application has very slightly increased over the past 20 years and is just above 1. As shown by Dernis et al. (2001) applications filed by Japanese firms tend to be composed of several Japanese priority filings merged together to form a single US or European application.

Figure 6 further depicts that the number of claims and especially of pages is driven by the number of priorities claimed. This apparent linear relationship suggests that the practice consisting in merging several national priorities to form one application to the EPO leads to larger filings than applications made of only one priority filing and supposedly transferred to the EPO as such.

[13] According to the Paris Convention, for a valid priority claim, subsequent applications must be filed within 12 months from the initial application date.

Figure 6 – Claims and pages by number of priorities in EPO applications (1989-2000)



Source: Own calculations based on EPO Data

Geographical origin

The country of residence of the applicants (the assignees in the American terminology) and the country of priority of their application may influence the drafting style hence the size of patent filings. In fact, for 99% of EPO applications, the country of priority corresponds to the country of at least one of the applicants (in 85% of the cases, it is even the country of the first applicant listed), which confirms that applicants usually file their first priority in their home country.

Similarly, the language of filing is strongly related to the country of the applicant. For more than 90% of all EPO applications, the language of filing corresponds to one of the three official EPO languages: 7% in French, 20% in German and 63% in English. Opportunistically, applicants tend to file their EPO applications primarily in their home language, provided that it is one of the three EPO languages. As illustrated in table 3, about 95% of applications by firms with Germany or Austria as country of residence are filed in German, about 99% of applications originating from Anglo-Saxon countries as well as Israel or Republic of South Korea are filed in English and 88% of applications by firms with France as country of residence are filed in French. In multilingual countries, such as Switzerland and Belgium, the picture is much more balanced (62% of Belgian patents are filed in English, 25% in French, 7% in Dutch and 5% in German whereas 61% of Swiss patents are filed in German, 28% in English, 11% in French and 1% in Italian).

Countries having no EPO language tend to opt for English (Israel, Republic of South Korea, Finland, and Denmark all file at over 95% in English), with nevertheless a strong reliance on national languages in some countries (Italian applicants file about 60% in English and 40% in Italian, Dutch applicants file 75% in English and 20% in Dutch, Swedish applicants file about 70% in English and 30% in Swedish and Japanese ones file 70% in English and 30% in Japanese). Nevertheless, this preference of English over national languages seems to be increasing over time, as also depicted in table 3. One may indeed observe that from 1988-1989 to 2000-2001 many non-English countries have largely increased the share of their EPO filings in English, such as Austria (from 2% to 8%), Belgium (from 45% to 72%), Switzerland (from 14% to 38%), Sweden (from

60% to 72%) or even Germany (from 3% to 8%) and France (from 3% to 16%). The only notable exception in this respect is Japan (from 90% to 61% of EPO filings in English). This increasing success of English as language of filing is closely associated with the PCT process.

Table 3 – Languages of filing at EPO by country of applicant (%)

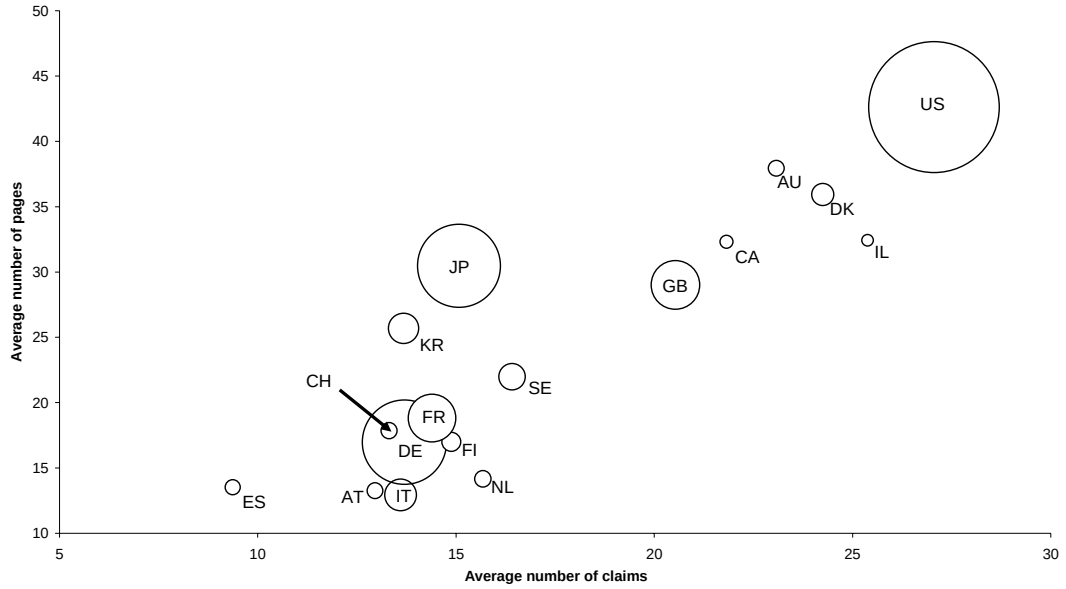
		German		English		French		Other		
Country	**Period**	**EU-D**	**PCT**	**EU-D**	**PCT**	**EU-D**	**PCT**	**EU-D**	**PCT**	**Total**
Australia	1988-1989	0	0	19	81	0	0	0	0	100
Australia	2000-2001	1	0	3	96	0	0	0	0	100
Austria	1988-1989	76	22	2	0	0	0	0	0	100
Austria	2000-2001	48	45	2	5	0	0	0	0	100
Belgium	1988-1989	4	0	39	6	31	6	13	1	100
Belgium	2000-2001	3	2	33	40	11	9	2	2	100
Canada	1988-1989	1	0	90	7	2	0	0	0	100
Canada	2000-2001	0	0	18	80	0	1	0	0	100
Denmark	1988-1989	4	0	32	34	0	0	0	30	100
Denmark	2000-2001	4	2	16	64	0	0	2	12	100
Finland	1988-1989	1	0	45	31	0	0	0	24	100
Finland	2000-2001	1	1	20	52	0	0	4	22	100
France	1988-1989	1	0	2	0	87	10	0	0	100
France	2000-2001	2	1	8	7	37	44	0	0	100
Germany	1988-1989	85	12	2	1	0	0	0	0	100
Germany	2000-2001	44	47	3	5	0	0	0	0	100
Italy	1988-1989	2	0	47	7	1	0	42	0	100
Italy	2000-2001	1	1	26	33	0	0	36	3	100
Japan	1988-1989	0	0	89	0	0	0	0	10	100
Japan	2000-2001	0	0	58	3	0	0	0	39	100
Netherlands	1988-1989	5	0	68	5	1	0	20	1	100
Netherlands	2000-2001	2	1	16	62	2	0	7	9	100
Sweden	1988-1989	2	1	34	26	0	0	7	31	100
Sweden	2000-2001	1	1	11	63	0	0	1	24	100
Switzerland	1988-1989	64	9	13	2	9	2	1	0	100
Switzerland	2000-2001	30	20	11	27	6	4	1	1	100
United Kingdom	1988-1989	0	0	73	26	0	0	0	0	100
United Kingdom	2000-2001	0	0	22	77	0	0	0	0	100
United States	1988-1989	1	0	69	30	0	0	0	0	100
United States	2000-2001	1	0	19	79	0	0	0	0	100

EU-D = Euro-Direct applications (non-PCT EPO applications) - Source: Own calculations based on EPO Data

Figure 7 strongly suggests that the size of patent applications is a result of country-specific patent drafting styles and modes. It displays the average number of claims and pages in applications filed in 1998 according to their priority countries. A clear relation between the two indicators appears and a large variation between countries such as Germany and the United States can be observed.

The case of Japan is worth noticing given that it appears slightly above the line of the abstract linear relationship, suggesting that Japanese applications have on average more pages, but not more claims, than filings issuing from continental European countries. But the most striking result is the location of the average American application on the chart with – by far – the largest number of both claims and pages. This observation gets further reinforced by table 4, which shows the share of the main priority countries among the 1000 largest applications by claims and pages. Occupying over 80% of this ranking, there is little doubt the American drafting style leads by far the voluminosity race.

Figure 7 – Average voluminosity and number of EPO applications according to priority countries (*)



(*) The size of the bubbles reflects the number of applications filed at EPO in 2002 with a priority from the corresponding country

Source: Own calculations based on EPO Data

Table 5 provides a more nuanced view on the filing route effect evoked here above. It first confirms that the PCT route has a significant effect on non-American applications (with about 3 additional claims than direct EPO applications on average). Second, the US effect appears slightly more significant, as witnessed by EP-Direct applications with a US priority having 5 more claims than EP-Direct applications with non-US priorities. Third, the most striking result is observed with the joint impact of US priorities and of the PCT option. Filings with a US priority have on average 10 more claims when they were filed through the PCT than when they were filed directly to the EPO. What is more, it seems that the US syndrome is much more pronounced with PCT than non-PCT filings (the difference between US and non-US priority applications is of 12 claims for PCT-Direct applications and 5 claims for non-PCT applications).

Table 4 – Share of priority countries in largest applications

Priority Country	% of Top 1000 filings in # of claims	% of Top 1000 filings in # of pages
Denmark	0,3%	0,6%
France	0,1%	1,2%
Germany	0,6%	1,2%
Italy	0,2%	0,0%
Netherlands	0,1%	0,0%
Spain	0,2%	0,0%
Sweden	0,1%	0,0%
Switzerland	0,0%	0,2%
Continental Europe	***1,6%***	***3,2%***
United Kingdom	1,3%	3,4%
EPO	0,2%	0,5%
Total Europe	***3,1%***	***7,1%***
Canada	0,2%	0,2%
USA	82,0%	80,5%
North America	***82,2%***	***80,7%***
Japan	4,4%	8,7%
Other	10,3%	3,5%
Total	**100,0%**	**100,0%**

Source: Own calculations based on EPO Data

This phenomenon almost surely finds its roots in the fundamental differences between civil and common law regimes, the latter leading (in many fields of activity) to much larger official documents than – for instance – in continental Europe.

Table 5 – Average number of claims and pages in PCT and non-PCT filings by country of priority

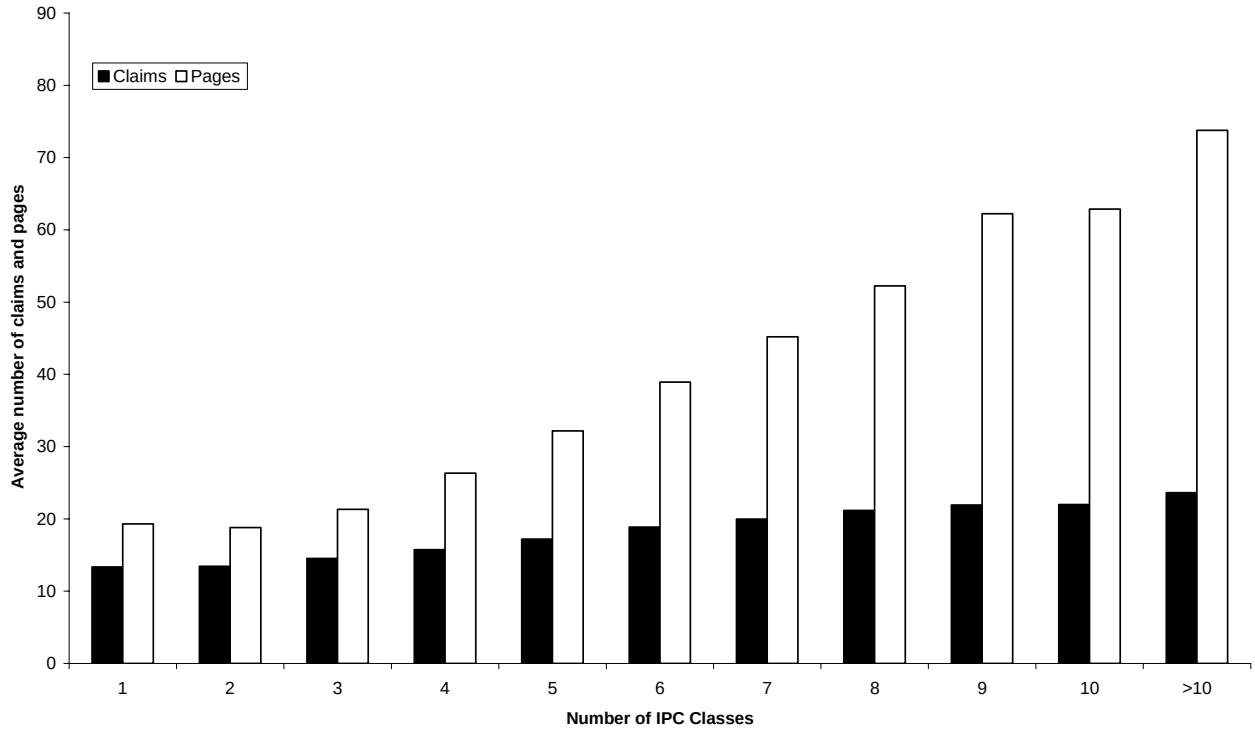
	Priority country	Claims	Filings
Euro-Direct	ROW	13.53	30,085
Euro-Direct	US	18.72	8,485
PCT	ROW	16.28	54,588
PCT	US	28.86	45,402
Overall		19.95	138,560

Applications filed to the EPO in 2002 – Source: Own calculations based on EPO Data

Technological specificities and complexity

European patents are classified according to the International Patent Classification (IPC) published by the World Intellectual Property Organisation (WIPO), a hierarchical classification with several levels of breakdown, primarily concerned with the technological characteristics of the invention.[14] Patent applications, as they enter the granting process at EPO, are assigned to specific IPC classes, of which the first is referred to as the "main" class of the application. Further classes may nevertheless be associated to the application later on. The number of IPC classes may be considered an indication of the complexity or architectural nature of an invention. Its average number (about 2 classes per application) has been fairly stable over the past 20 years. But figure 8 clearly shows that this number – as an indication of the complexity of an invention – influences the number of claims and especially the number of pages in patent applications, suggesting that more complex or architectural inventions require more claims and pages to be bounded and disclosed.

Figure 8 – Claims and pages by number of 8 digits-IPC classes in EPO applications (1989-2000)

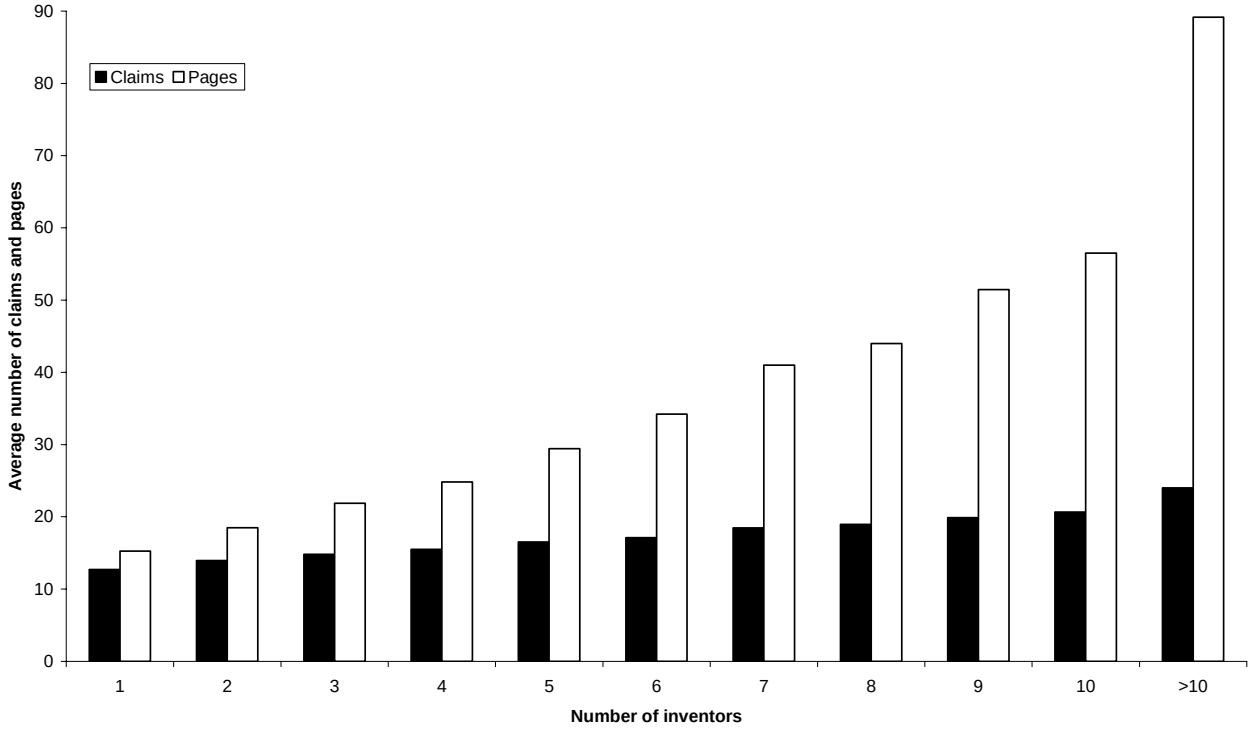


Source: Own calculations based on EPO Data

[14] See van Zeebroeck *et al.* (2006b) for an analysis of the impact of the choice of a classification on patent-based statistics.

Similarly, the number of inventors having contributed to the invention may also be seen as an indicator of the complexity of the new product or process, as more brains, skills and time have been necessary to its realization (see Guellec and van Pottelsberghe, 2000). This number has in fact increased by 25% over the past two decades, from about 2 inventors on average in 1980 to over 2.5 in 2004. Figure 9 also reveals a very clear linear relationship between the number of inventors and the number of claims or pages contained in the issuing application, suggesting that larger teams of inventors and more complex inventions lead to larger applications.

Figure 9 – Claims and pages by number of inventors in EPO applications (1989-2000)



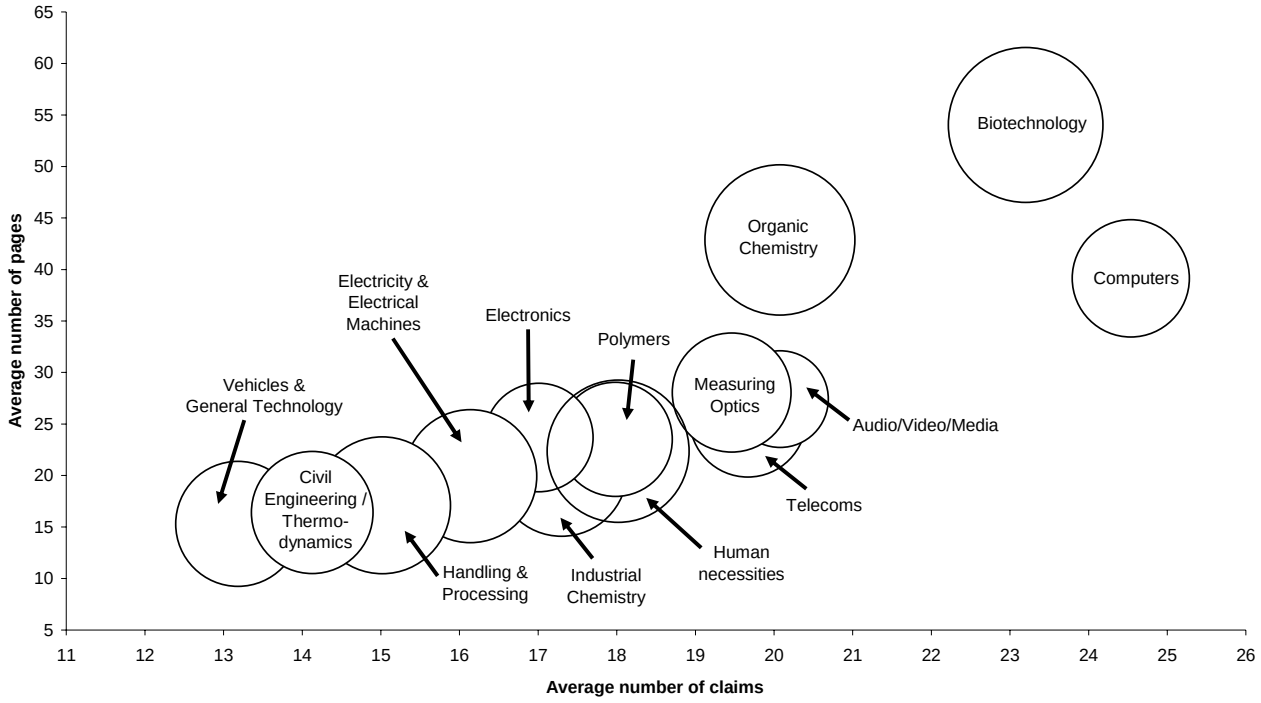
Source: Own calculations based on EPO Data

As EPO's operational units, in charge of the grant and opposition procedures, have been organised – since 2004 – into fourteen homogeneous technological areas of practice known as "Joint Clusters", it is possible to allocate the applications to the corresponding area at EPO in charge of examining them. The correspondence between IPC classes and EPO Joint Clusters is established by a correspondence table provided in table A4 in the appendix.[15]

A breakdown of average voluminosity indicators by technological field shows that all fields are not equally affecting the size of applications. Figure 10, presenting the average number of claims and pages per Joint Cluster for applications filed in 1998, shows that there may be very large differences in patent sizes between e.g. Vehicles or Civil Engineering and Biotechnology. In addition, the chart exhibits a nearly linear relation between the number of pages and the number of claims across technological sectors.

[15] Since applications may be associated to several IPC classes and since some IPC classes are split between different Joint Clusters, several applications may be associated with more than one Joint Cluster.

Figure 10 – Average voluminosity of EPO applications according to different Joint Sectors (*)



(*) The size of the bubbles reflects the number of applications filed at EPO in 2000 in the corresponding cluster

Source: Own calculations based on EPO Data

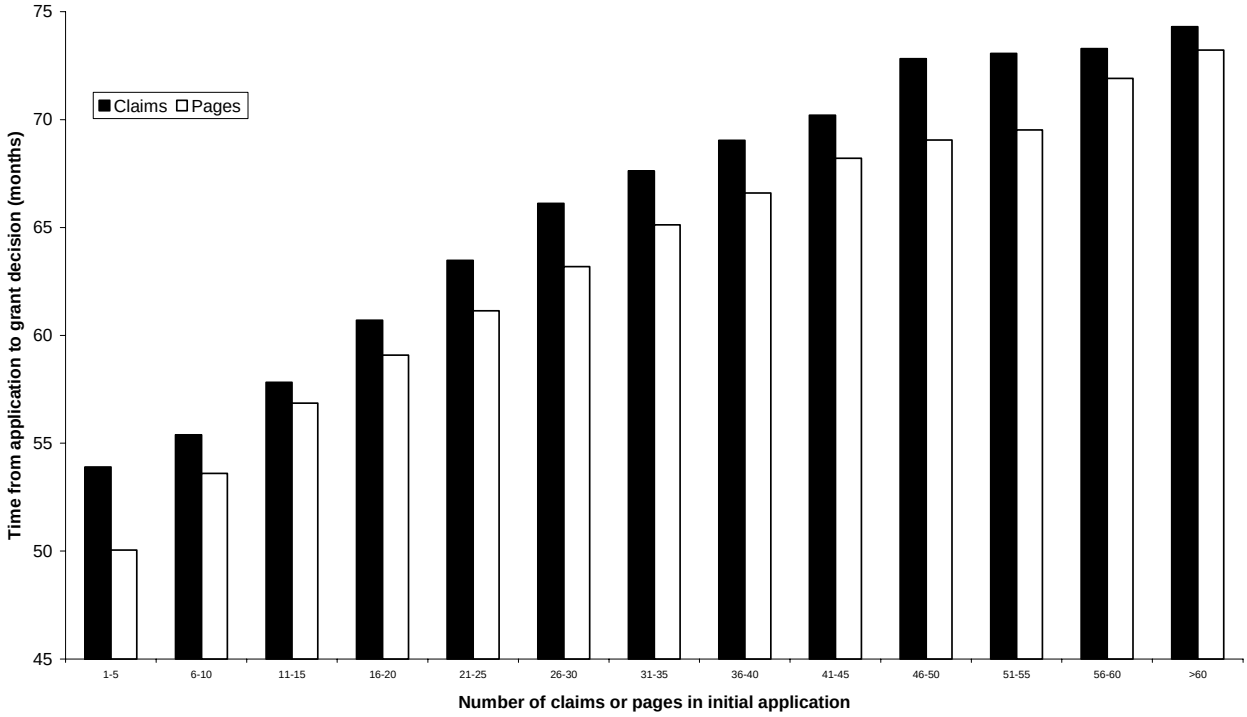
4. The social cost of patent voluminosity

The main consequence of the increased voluminosity of patent applications may be analysed through its social and procedural cost, in terms for instance of its impact on the granting process, on delays and backlogs, or on the quality and legal certainty in the patent system (see Lemley, 2000).

The time to grant is a very critical issue, not only for many patentees, but also for the society at large. Many users of the patent system regularly complain about delays in getting their or others' patents granted. Figure 2 illustrates the increasing backlog accumulated at the EPO, and similarly at other patent offices around the world. The length of the granting process, defined in terms of the number of months between the application date at the EPO and the date of the grant or no-grant decision, has been increasing over time, from 36 months in the early eighties to about 57 months in recent years.

In this respect, the question that can be raised is whether there is an influence of patent voluminosity on these delays? Do larger applications require more time for being granted? The statistical evidence depicted in Figure 11 suggests they do. A nearby linear relation can indeed be identified between the average time to grant and the number of claims and pages in the original application: it ranges from about 45 months for applications with a maximum of 5 claims and pages to 65 months for applications with more than 60 claims or pages. These results somewhat validate and reinforce the results obtained by Lazaridis and van Pottelsberghe (2007). The authors find that on average two additional claims lead to an additional communication between the examiner and the applicant, and that one additional communication induces one year of delay in the application outcome.

Figure 11 – Average time to grant decisions by # of claims and pages in initial application (1978-2004) (*)



(*) Applications filed between 1995 and 1997 which were granted by January 31, 2006

Source: Own calculations based on EPO Data

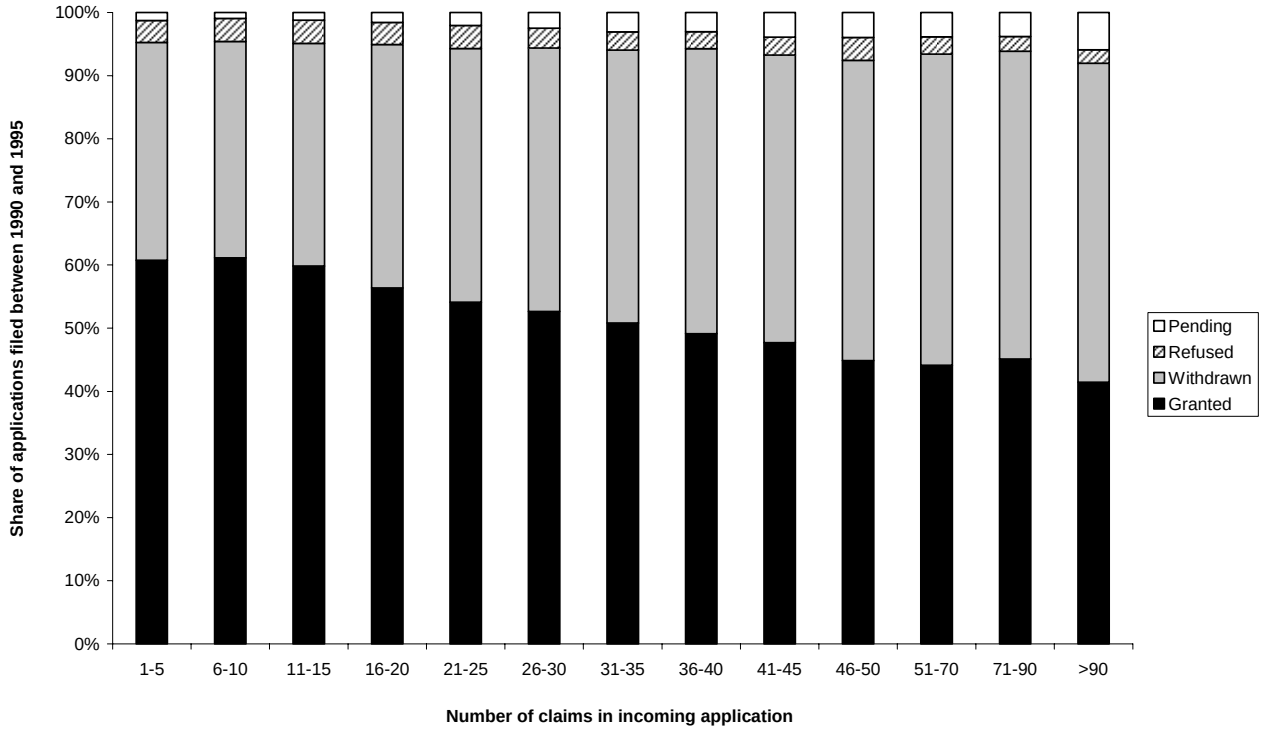
These results suggest at first sight that the EPO processes smaller applications much faster than larger ones. This is in line with intuition and common sense but it also reinforces the idea that larger applications monopolize and consume more resources from patent offices for their processing and hence contribute to the increase in granting delays and backlogs. On top of this procedural cost, patent voluminosity also has an important financial cost for patent systems, at least in terms of handling, printing and shipping the documents themselves, together with the cited prior art, both to the applicant and – in case of an application following the PCT route – to the WIPO, as well as in terms of translation when they are finally granted and become validated as national patents. Since it has indeed been observed by van Pottelsberghe and François (2006) that translation costs represent an important part of the total cost of a European patent, it is to be expected that such costs will increase in absolute terms for longer texts to be translated.

Linking the voluminosity of applications to grant decisions is yet another valuable exercise. Are larger applications more, or less, likely to be granted than smaller ones? Statistical evidences do not clearly put such relations in evidence. Nevertheless, Figures 12 and 13 show a light downward inclination in the share of filings that pass to grant as the numbers of claims, and less strikingly pages increase, which suggests that very large applications are slightly less likely to be granted.

Should they be granted or not, outrageously large applications may contribute to polluting their technological field by generating smoke screens and reducing the legal certainty of the patent system. The drafting style of a patent application – especially its claims – is very closely related to the intended use that the assignee will make of the patent grant. Factors such as the number of independent and dependent claims and the presence of fall-back positions in dependent claims or in the description and drawings have a significant impact on the legal certainty surrounding a patent application. Very lengthy applications, as they become part of the prior art, may influence anticipations of patent applications at a later stage and increase the complexity of the search phase. Furthermore, long and numerous claims supported by an overly extensive description often make it difficult to exactly evaluate the patentability requirements and, if granted, the exact scope of

protection. According to the Japanese Patent Office (2005), there are risks of technology leakage when applications are disclosed without being protected by patent rights, which imposes a careful management of all patent applications, in particular to avoid such thoughtless applications.

Figure 12 – Status of applications according to the number of claims in initial applications



Source: Own calculations based on EPO Data

In 1998, Dack and Cohen (2001) were asked to produce a report for the EPO on the growth observed at that time in so-called complex patent applications, in particular with reference to the number of claims and various problems relating to the presentation of the subject matter within claims. The authors proposed a number of possible measures to be taken, including a strict approach to the examination of clarity and conciseness, declarations of a partial search or a refusal to search, the introduction of a claims-based fee for applications filed under the PCT, a statutory limitation to the overall number of claims and the possibility to allow for amendments before search.

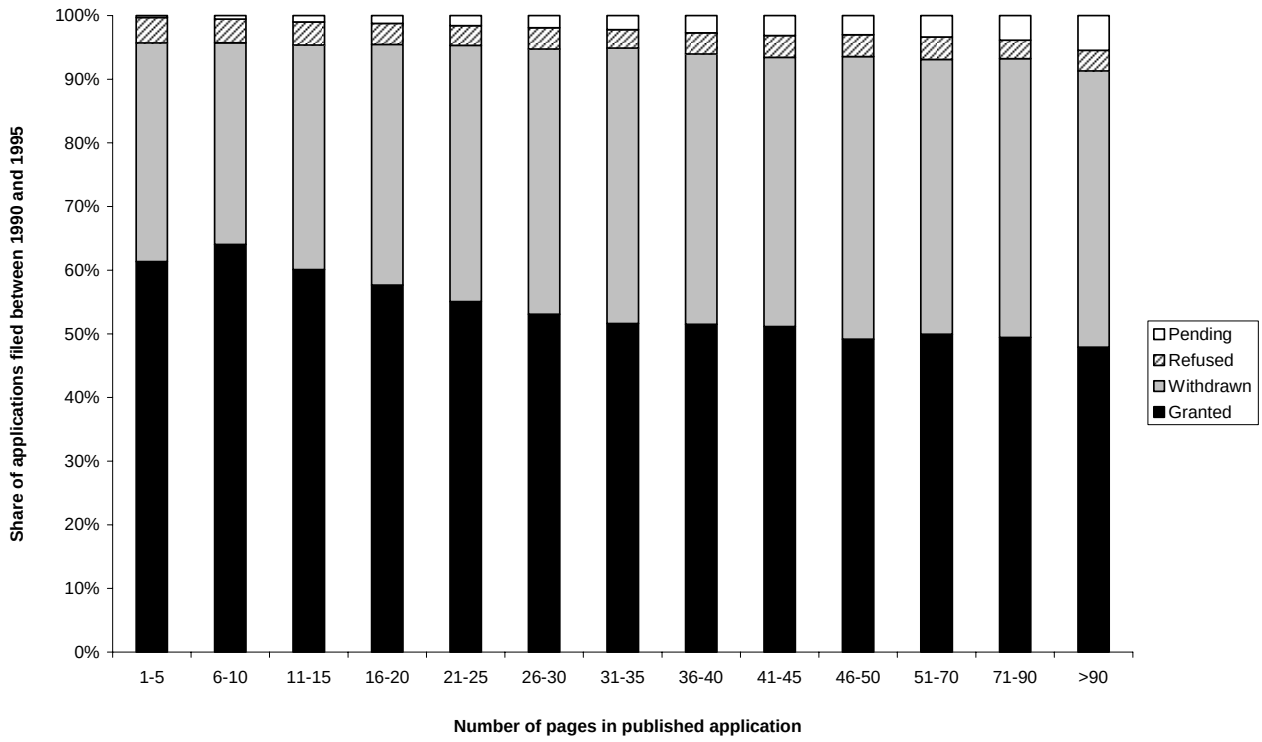
Since then, one important step has been taken by the EPO, when Rule 29(2) of the EPC was introduced in amended form with effect from January 2002 with the intention to induce applicants to file fewer independent claims within the same category. On top of these requirements, in the European procedure some fees are related to the number of claims of a patent when filed, and to the number of pages when granted. While the amounts to be paid already have a discouraging intention towards large documents, they may not be sufficient, and as these lines are written, the EPO has made it clear that it may need to review its fees policy to proactively react to the steady increase in size of patent documents (Pompidou, 2005).

Similar actions have already successfully been taken by other patent offices around the world, such as in the US in December 2004, where a new patent fee schedule was signed into law, including significantly increased fees on claims, both independent and dependent, as well as on excessive number of pages of applications as filed.[16] This new fee regime may very well encourage applicants

[16] Furthermore, as applications containing a large number of claims are difficult to process and examine properly and require excessive patent examining resources, the USPTO is further proposing changes to its practice of examination of

filing patents to the USPTO to re-think their drafting style and possibly even have a knock-on effect on follow-on patent applications filed in other patent jurisdictions such as the EPO.

Figure 13 – Status of applications according to the number of pages in initial applications



Source: Own calculations based on EPO Data

To the contrary, there have also been several important effects of changes in US substantive patent law, one being the FESTO decision, which – to many observers – is a cause for tremendous increases in the number of claims due to the need to incorporate every possible angle in the patent application at the time of filing.[17] According to Miller (2002) and Israelsen *et al.* (2002), this case may also have had an impact on the extent of disclosure, hence on the number of pages.

However, as suggested by figure 14, the recent implementation of new claim-based fees at the USPTO in early 2005 have already had a strong, and apparently persistent, effect on the average number of claims in USPTO filings.[18]

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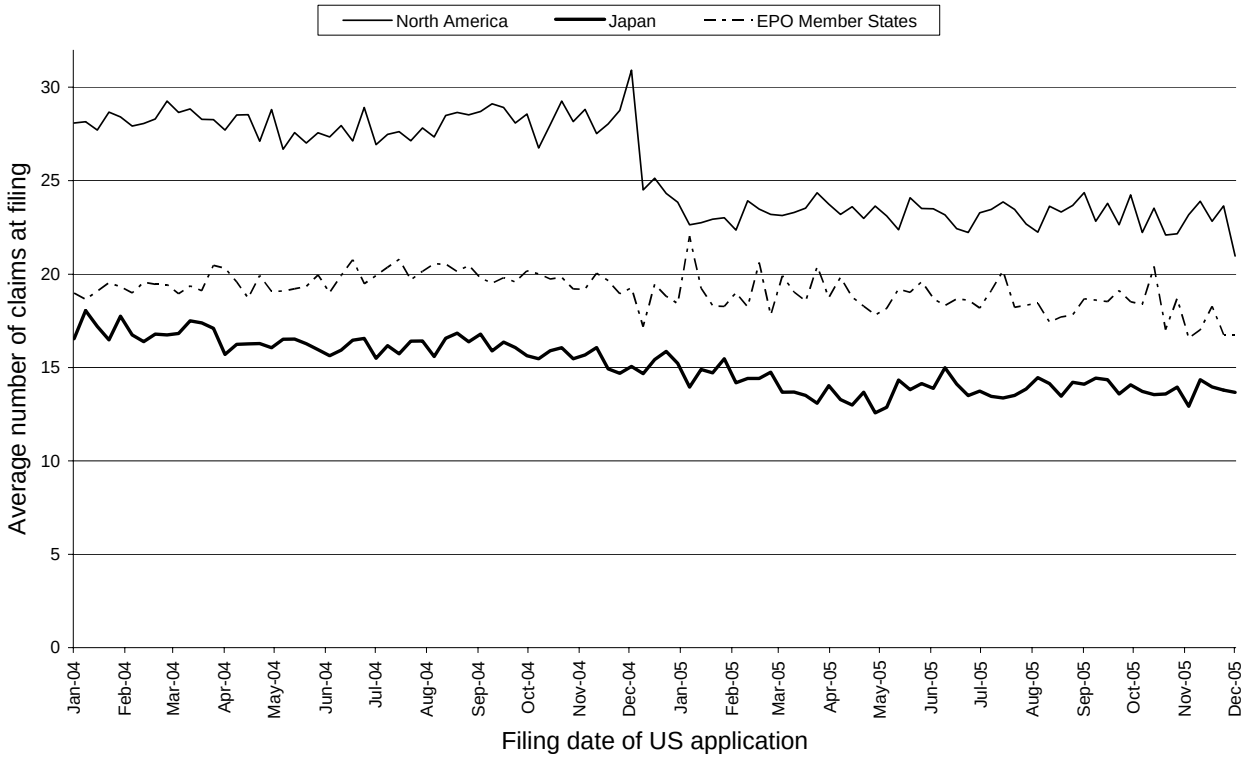
claims so that an initial examination would be performed solely on the representative claims (i.e. all the independent claims and the dependent ones expressly designated by the applicant for initial examination). If the total number of representative claims is greater than ten, then the applicant will be required by the USPTO to share the burden of examining the application by submitting an examination support document covering all representative claims. It is worth noting that it is estimated that only 1.2% of all non-provisional applications filed at the USPTO in the first ten months of 2005 include more than ten independent claims. See National Archives and Records Administration (2006).

[17] On 28 May 2002 in the court ruling in Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.

[18] The USPTO patent fee schedule effective December 8, 2004 charges 200 USD per independent claims in excess of three, 50 USD for dependent claims in excess of twenty and an additional 360 USD fee in case of multiple dependent claims, cf. http://www.uspto.gov/web/offices/ac/qs/ope/fee2004dec08.htm.

Figure 14 – Average number of claims in published applications filed at the USPTO by region of origin



Source: Own calculations based on EPO Data

5. Concluding remarks

Patent voluminosity has become a real issue for patent offices around the world and for the EPO in particular. The objective of this paper was to investigate possible measures of this phenomenon as well as its main potential drivers and broad impact on the patent system.

The most appropriate indicators of voluminosity seem to be the number of claims and the number of pages in patent applications. Both figures have experienced a dramatic increase over the past 2 decades, allowing a quantification of this evolution, and although these two indicators may diverge in their determinants, they seem to converge in their consequences.

The broad descriptive analysis of these indicators has revealed a wide range of potential drivers, from the fee structure to the complexity of inventions. Apparently driven by specific national systems (especially the American one) and industrial sectors (e.g. biotech and computers), and diffused thanks to the internationalization of patenting procedures and markets (e.g., the PCT route), this increase may be a common result of the increasing complexity of technologies and inventions and of the evolution of international patent law. More generally, it appears that any voluminosity indicator may be influenced by the geographical origin and the technological area of the patent.

No matter its roots, not only does the surge in the size of incoming applications very rapidly increase the workload of patent offices, which if not mastered will inevitably lead to increasing backlogs and delays in grants, but it also raises very important quality issues. Indeed, one may for instance question whether patent examiners, who are on average supposed to treat each application in the same amount of time, can reasonably provide the same quality in their examination on very small and on very large applications.

Yet another open question is whether disruptive patenting strategies – such as specific drafting practices creating uncertainty by polluting the technological field or circumventing the disclosure requirement by hiding major inventions (Stevnsborg and van Pottelsberghe, 2007) – are a factor behind this escalation in voluminosity, or whether the increase in the number of claims actually reveals a better and more systematic use of fallback positions and the number of pages a more thorough disclosure of inventions for which protection is being sought. Such questions are quantitatively investigated in van Zeebroeck *et al.* (2006a).

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APPENDIXES

Table A1 – Average number of pages per section in different sectors and countries of applicants (2000-2001)

	Description	Claims	Drawings	Pages
Industrial Chemistry	14,14	2,99	4,02	21,15
Organic Chemistry	33,88	5,14	4,89	43,91
Polymers	17,96	3,24	2,86	24,07
Biotechnology	39,69	4,84	12,30	56,84
Telecommunications	15,06	3,87	7,39	26,32
Audio/Video/Media	14,76	3,72	9,05	27,53
Electronics	12,85	3,24	7,75	23,85
Electricity & Electrical Machines	11,27	2,79	6,57	20,64
Computers	22,47	4,95	11,14	38,57
Measuring Optics	16,79	3,65	8,14	28,58
Handling & Processing	9,58	2,58	5,37	17,53
Vehicles & General Technology	8,11	2,29	5,22	15,63
Civil Engineering / Thermodynamics	8,87	2,49	5,41	16,77
Human necessities	13,02	3,24	6,72	22,97

	Description	Claims	Drawings	Pages
US	26,29	5,17	9,49	40,96
DE	10,94	2,48	3,59	17,02
JP	14,64	2,36	9,84	26,84
FR	11,20	2,46	4,07	17,74
GB	18,35	3,35	5,95	27,65
CH	12,91	2,78	3,82	19,51
NL	12,52	2,23	3,85	18,61
IT	8,00	2,07	4,01	14,08
SE	14,57	3,37	4,44	22,38
CA	22,50	4,68	9,10	36,29
KR	15,24	3,15	7,39	25,78
FI	11,77	3,00	4,31	19,09
AU	19,25	3,89	9,36	32,50
AT	10,27	2,24	3,79	16,29
BE	15,88	2,56	5,91	24,35
DK	21,58	3,91	7,36	32,85
IL	21,58	5,27	9,53	36,38
ES	7,74	1,79	3,71	13,24

Source: Own calculations based on EPO Data

Table A2 - Summary statistics of main dataset variables

	Type	Obs	Mean	StDev	Min	Max	Sample
Voluminosity indicators							
# Claims at filing	C	2 069 698	15.98	15.21	0	999	1978-2004
# Claims at grant	C	524 739	11.20	8.41	0	658	1990-2004
Difference # claims at grant - at filing	C	524 739	-1.56	6.17	-449	329	1990-2004
# Pages at filing	C	1 670 969	22.53	34.73	1	9786	1988-2002
# Pages of Desc. at filing	C	1 670 969	14.42	25.39	1	5503	1988-2002
# Pages of Claims at filing	C	1 670 969	2.95	5.04	1	2567	1988-2002
# Pages of Drawings at filing	C	1 670 969	5.17	15.22	0	7559	1988-2002
# Pages at grant	C	670 905	14.01	14.20	1	810	1988-2002
# Pages of Desc. at grant	C	670 905	6.27	9.24	1	694	1988-2002
# Pages of Claims at grant	C	670 905	3.86	4.34	1	485	1988-2002
# Pages of Drawings at grant	C	670 905	3.88	5.67	0	287	1988-2002
Application route							
Year of filing	C	2 069 687	1996.02	6.75	1978	2004	1978-2004
PCT	D	2 069 698	0.50	0.50	0	1	1978-2004
PCT within regional phase	D	2 069 698	0.29	0.45	0	1	1978-2004
PCT under Chapter II option	D	2 069 698	0.28	0.45	0	1	1978-2004

Source: Own calculations based on EPO Data

Table A3 – Examples of very large applications

EP Filing Year	Original Publication Number	Applicant	Priority Country	Applicant Country	IPC Class First Mentioned on "A" Publication	Total Number of Claims	Number of Description Pages	Number of Claims Pages	Total Number of Pages
1995	WO9617378	Formfactor, Inc.	US	US	G01R1/073	374	292	68	424
	WO9630822	Donald K. Forest	US	US	G06F3/00	325	112	74	260
	WO9607271	Sony Corp.	JP	JP	H04N5/91	238	166	84	302
	WO9600698	Pure Etch Co.	US	US	C01F17/00	232	55	31	104
	WO9615484	Advanced Micro Devices, Inc.	US	US	G06F3/16	212	274	55	452
1996	WO9623010	E.I. du Pont de Nemours and Co.; Univ. of North Carolina at Chapel Hill	US	US	C08F210/16	562	408	94	503
	WO9715690	Curagen Corp.	US	US	C12Q1/68	259	255	64	348
	WO9827065	Ontogen Corp.	US	US	C07D233/70	267	105	95	202
	WO9709842	Verity Group. PLC	GB	GB	H04R1/02	121	92	20	161
	WO9713501	Kevin J. Williams	US	US	A61K9/127	229	60	51	142
1997	WO9819450	Sensormatics Electronics Corp.	US	US	H04N1/00	592	238	124	521
	WO9734401	Xantel Corp.	US	US	H04M1/64	356	113	49	177
	WO9747380	Project Earth Industries. Inc.	US	US	B01J8/00	329	89	40	137
1998	WO9854727	Micron Technology. Inc.	US	US	G11C7/00	762	213	107	566
	WO9929384	Baby Think It Over. Inc.	US	US	A63H3/00	465	164	86	285
	WO9843149	Walker Asset Management Ltd. Ptns.	US	US	G06F17/60	370	142	68	290
1999	WO9964627	Genostic Pharma. Ltd.	GB	GB	C12Q1/68	559	394	348	745
	WO0068717	Steven R. Sedlmayr	US	US	G02B5/30	489	124	183	360
	WO0028518	Broadcom Corp.	US	US	G09G5/14	459	130	83	251
	WO9963805	Univ. of Saskatchewan Tech. Inc.	CA	CA	A01H4/00	437	66	62	133
	WO0028734	United Video Properties. Inc.	US	US	H04N5/445	358	72	73	212
2000	WO0106253	The University of Texas System	US	US	G01N33/53	729	73	76	218
	WO0122310	Oleg K. Zommers	RU/ US	RU	G06F17/60	505	36	58	98
	EP1045341	Fujitsu. Ltd.	JP	JP	G06T7/20	290	213	95	481
	EP1244006	The Institute of Computer Based Software Methodology and Tech.	JP	JP	G06F9/06	174	291	62	525
2001	WO0239331	Orchestria. Ltd.	GB/ US	GB	G06F17/60	923	115	208	349
	WO0229606	Computer Sciences Corp.	US	US	G06F17/00	845	47	113	223
	WO0210962	Storymail. Inc.	US	US	G06F17/00	840	215	115	342
	WO0184906	Virtual Assets Inc.	US	US	G06F17/60	818	264	118	638
	WO0243195	Metro-Logic Instruments. Inc.	US	US	G06K7/10	669	427	142	955
	WO200225708	KLA-Tencor-Inc.	US	US	H01L21/00	625	147	96	265
	WO03020200	New River Pharmaceuticals. Inc.	US	US	A61K	250	1992	60	2053
2002	WO02086018	Shell Oil Co.	US	US	C01B3/24	7441	307	677	1226
	WO03046798	Paradigm Genetics. Inc.	US	US	G06F19/00	2257	143	299	484
	WO03031565	Rosetta Genomics. Ltd.	US	IL	G01N33/48	938	441	786	1668
	WO03040513	Shell Oil Co. Shell Canada Ltd.	US	US CA	E21B	8958	91	154	284
	WO02085309	Epigenesis Pharmaceuticals. Inc.	US	US	A61K0/00	78	745	8	764
2003	WO2004011423	Hawaii Biotech. Inc.	US	US	C07C403/24	1015	78	161	277
	WO03082894	Pharmacia Corp.	US	US	C07J1/00	188	90	78	168
	WO03082895	Pharmacia & Upjohn Co.	US	US	C07J1/00	577	161	267	428
	WO03090673	RTC Research & Development. LLC	US	US	A61K9/16	5895	76	779	855
2004	WO2005051444	Angiotech International AG	US	CH	A61L27/00	19368	386	2189	2592
	WO2005049105	Angiotech International AG	US	CH	A61L31/16	17517	1745	1597	3372
	WO2005051451	Angiotech International AG	US	CH	A61L31/16	13305	450	1389	1874
	WO2005051871	Angiotech International AG	US	CH	A61L27/00	11180	457	1128	1619
	WO2005046746	Angiotech International AG	US	CH	A61L27/00	10247	1117	960	2095
	WO2005051452	Angiotech International AG	US	CH	A61L31/00	8822	1008	901	1945
	WO2005046747	Angiotech International AG	US	CH	A61L27/00	1738	327	189	541

Source: EPO

Table A4 - Concordance between the 14 EPO Joint Clusters and the International Patent Classification

Industrial Chemistry	Pure & Applied Organic Chemistry	Polymers	Biotechnology	Telecom-munications	Audio - Video - Media	Electronics	Electricity & Electrical Machines	Computers	Measuring Optics	Handling & Processing	Vehicles & General Technology	Civil Engineering - Thermodynamics
A61L	A01N	A61F	A01H,K	G08C	A63F	B61L	B03C	G06C,D,E,F	G01B,C,D,F	A41	B05B,C	A21B,C
A62D	A21D	B32B	A61K	H04B,J,K,L M,Q	G06T	F41G	B06B	G,J,M,N	G,H,J,K,L,M,	A42	B60B,C,D,F	A47H,K
B01	A23B,C,D,	C08	C07K,M		G02F	G01S	B60L,M	G07	N,P,R,T,V,W	A44	G,H,J,K,N,P,	E01
B03D	F,G,J,K,L	C09D,F,G	C12B,D,K,M,N		G09G	G05B,D,F,	B81	G09B	G02B,C	A47L	Q,R,S,T,V	E02B,C,D
B05D	A24B	H,J	P,Q,R,S		G10B,C,D,	G06K	B82		G03B,D,G,H	B01F	B61B,C,D,F,	E03 to E06
B22	A24D	C14	G01N		F,G,H,L	G08B,G	G03F		G04	B02	G,H,J,K	E21
B27K	A61K,L,P	D01C,D,F			H03M	G11B,C,D	G09C,D,F		G10K	B03B	B62 to B64	F01 to F04
C01 to C06	C07B,C,D,F	D02J			H04H,N,R,S	H01P,Q	G12B			B04	F15	F16N,S,T
C09C,K	G,H,J	D04H				H03B,C,D,F	G21B,C,D,G			B07 to B09	F16B,C,D,F,	F22 to F26
C10	C09B	D06L				G,H,J,K,L	H,J,K			B21	G,H,J,K,L,M,P	F28
C21 to C23	C11	D06M,N,P,Q				H05B	H01B,C,F,G,			B23 to B25	F17	
C25	C12C,F,G,	D21C,H					H,J,K,L,R,S,T			B26D,F	F21	
C30	H,J,L	G03C,G					H02			B27B,C,D,F,	G05G	
F27	C13						H05			G,H,J,L,M,N		
G21F										B28 to B31		
H01B,M										B60C		
H05B										B65 to B68		
										C14B		
										D01B,G,H		
										D02G,H		
										D03		
										D04B,C,D,G		
										D05		
										D06B,C,F, G,H,J		
										D07B		
										D21B,D,F,G,J		
										E02F		

Certain IPC sub-classes are split between several sectors:

A01K	Biotechnology - Human necessities	B60C	Handling - Vehicles
A61F	Polymers - Human necessities	G01N	Biotechnology - Measuring & optics
A61K	Organic chemistry - Biotechnology	G0G	Polymers - Measuring & optics
A61L	Industrial chemistry - Organic chemistry	H01B	Industrial chemistry - Electricity
A63F	Audio-video - Human necessities	H05B	Industrial chemistry - Electronics - Electricity

Source: EPO