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Identification of Available and Desirable Indicators for Patent Systems, Patenting Processes and Patent Rights

Research Project for the German Patent and Trademark Office

by

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Preface

In 2004 the German Patent and Trademark Office commissioned the Ifo Institute to deliver a research report on the topic “Identification of Available and Desirable Indicators for Patent Systems, Patenting Processes and Patent Rights”.

The research report is part of a larger project conducted jointly by the French, German, British and European Patent Offices. The overarching aim of the project is for the Patent Offices to improve the effectiveness of the innovation process by gaining a better understanding of the role that patents play in innovation process.

The research project conducted by the Ifo Institute delivers the starting point for the larger project. It provides an overview of the existing literature using patent statistics and indicators, classified by their scope of relevance (patent system, patenting process, patent rights) and the metrics used.

I would like to thank the German Patent and Trademark Office and the involved staff, especially Hubert Rothe, and my colleagues at the Ifo Institute, especially Dr. Ludger Wößmann, Gabriela Schütz and Andreas Kuhlmann for their helpful comments and discussion.

Munich, September 2005

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1. Introduction

This report provides an extensive overview of the existing literature about the valuation of patents, mainly from an economic point of view but also giving consideration to legal and business aspects. This includes the valuation of the patent system itself, the valuation of the patenting process and the valuation of the assigned patent rights. Looking at the relevant literature, however, it reveals immediately that a quantification of these patent related issues is not easy. The economic literature relies heavily on the valuation of patent rights, as this gives a possible measurement of innovation output.

Since the patent systems are quite similar in most countries, at least in the industrialized countries, and have also been in place for a long time, it is difficult to valuate the patent system. One simply cannot compare the developments to a world where no such system existed. Thus, the role which the patent system has played in the past and still plays today is difficult to quantify. The literature therefore mainly compares the patent system to other mechanisms of protecting knowledge.

The patenting process itself is also not quantified in great detail in the economic literature. This is a process which takes place mainly inside the patent offices and only involves the patent examiner and the inventor. No data or information about this process is easily available to researchers. The lack of analyses on this topic is surprising because this process defines the breadth of the temporary monopoly of the patentee which creates economic welfare losses like every monopoly.

The vast majority of the economic literature on valuation of patent related issues deals with the quantification of the value of patent rights. It was recognized that simple patent counts are an insufficient indicator for innovative output. Thus, different weighting schemes were developed to improve the explanatory power of patent statistics.

This report first gives a theoretical reasoning for the use of patent statistics in the field of economics in section 2. Section 3 deals with the valuation of the patent system, where literature about the valuation is very rare. This is also true for the valuation of the patenting process which is the topic of chapter 4. The main focus of this study therefore

lies on chapter 5, which shows the relevant indicators for the valuation of patent rights. Different approaches are presented, giving information about their underlying ideas and their applications in economic literature as well as the problems associated with these different approaches. Sections 3, 4 and 5.1 to 5.5 end with a table listing the relevant literature. Section 6 concludes.

2. Why are Patents of Interest to Economists?

In this section some theoretical reasons are presented why economists are interested in patents as economic indicators. The model presented here was presented by Pakes and Griliches (1984). The underlying question of patent statistics is what we can measure with these data and what we would like them to measure (Griliches 1990). Griliches distinguishes between measures of input to innovation processes and measures of output. Figure 1 shows the model of Pakes and Griliches.

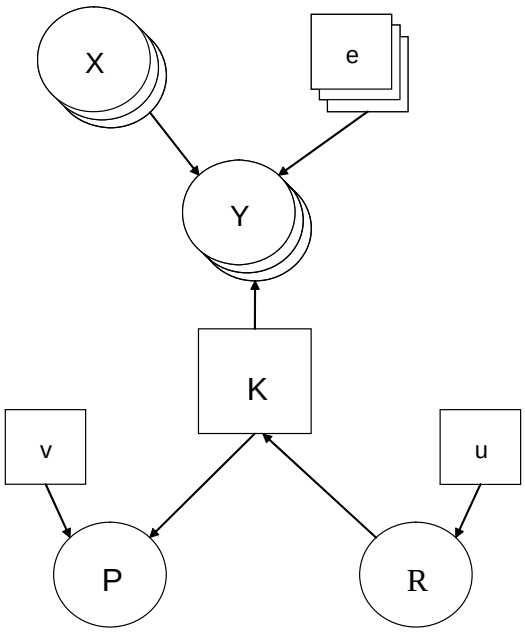

Figure 1: The Knowledge Production Function: A Simplified Path Analysis Diagram
Source: Griliches (1990)

In figure 1 the outcome variable of interest to researchers is Y. Y may be any relevant variable that economists may want to estimate. This can be a variable from the macro level like economic growth or a variable at the sector or micro level like productivity or the stock market value of a firm. The variable Y is effected by exogenous factors X, an and by knowledge K, leaving an error term e. Knowledge itself is hard to measure. Therefore, either inputs in the knowledge production or outputs are used as proxies. Variables used as input factors (R) in this context are usually R&D expenditure or similar measures for research, like the number of researchers in a firm, the number of PhD students in a firm or in an industry sector. Patents (P), in this model, are seen as a possible indicator for the output of the knowledge process. If an invention is accompanied by a patent grant it has successfully passed a specific barrier outside the firm. This fact can be used as a measure of the inventive importance of such an invention. If a patent is granted, the R&D expenses have led to a countable output. Since the patenting process is not for free, the expected returns of the patent for the inventor and patent applicant must be at least as high as the costs for the patenting process. This indicates some confidence of the inventor or the patent applicant in this invention.

According to the model presented here, patents are a measure of output, but at a second glance, there are also some restrictions to this interpretation. Griliches mentions three problems of this interpretation: First, some inventions are not patentable (because they are basic research); Second, not all inventions are patented (there might be other mechanisms which are sufficient for protection) and third, the “quality” of patents differs very widely. The first two problems are nicely illustrated by Basberg (1987). Figure 2 shows that there are four different categories of inventions.

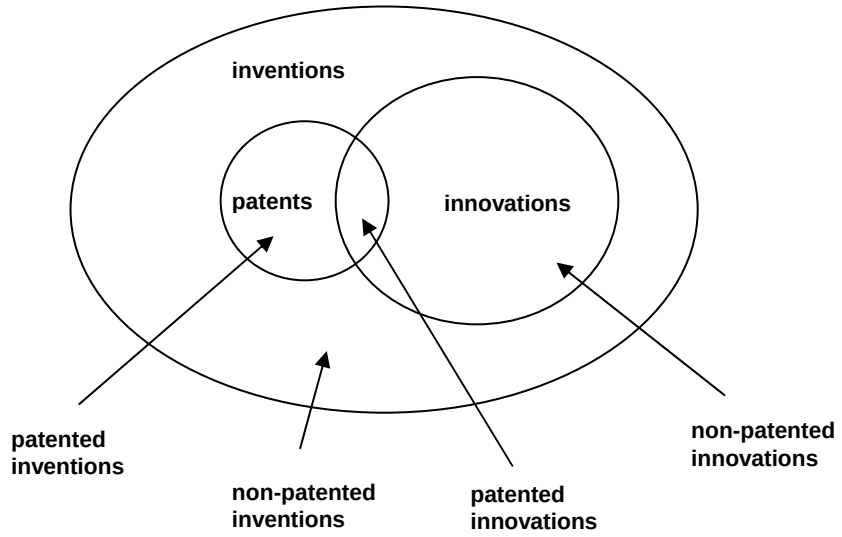

Figure 2: Relationship between patents, inventions and innovations

Source: Basberg (1987)

Note: the dimensions of Figure 2 were chosen randomly

The category researchers are interested in is the one of all innovations. But since not all innovations are patented there is a group of non-patented innovations which we ideally would also count when talking about technological progress but which is not measurable. On the other hand there are some patented inventions which are not really driving forward the technological frontier but which also were patented. For research purposes we do not want to count these inventions but they are inseparable from other innovations listed in patent statistics. The group of non-patented inventions does not impose any problems because these inventions are not that important that they should appear in patent statistics.

Griliches argues that the first two problems might partly be solved by including industry dummies that account for differences in the patenting behavior between industries. But to solve the third problem some additional measures and indicators must be matched with patent data. Several approaches have been proposed to solve or at least reduce this problem, which will be described later in this paper.

3. The Valuation of the Patent System

The original idea behind introducing the patent system is granting the patentee a reward for the efforts and for publishing the knowledge. A more detailed description on the economic ideas of a patent system is given in the annex. This original idea is still the most important reason for patent systems. But today's view and also today's use of the patent system is not that simple anymore as compared to the time of its introduction. A recent study by Blind et al. (2003) examines the new role of the patent system when examining the different developments of R&D expenses and patent applications (table 1). The number of patent applications during the nineties rose much faster than expenses for R&D. This raises the question of whether patents are still a valid innovation indicator. The authors were searching for additional reasons for the drastic increase of patent applications other than the increasing R&D expenses, because this alone could not have been held responsible for the sharp increase in patent applications. The study builds on a survey of 1500 German enterprises which applied for a minimum number of patents, of which more than 500 answered.

Besides the protection from imitation there are other reasons for the different developments in patent applications and R&D activities. First, the increase in patenting is due to increasing competition and increasing cooperation in the markets. Second, and closely related, the motivation for patenting has changed. Other motivations than the protection from imitation became important, like the blocking of competitors to sustain one's position in the market (cf. Gilbert and Newbery 1982) and to deter competitors from getting closer. Another motivation is the reputation which enterprises can gain from patenting. Finally the role of patents as exchange or currency function has increased, not only between partners and licensees but also between enterprises and capital investors. This latter result of the study is in line with a theoretical model by Ueda (2004). Ueda shows that in a model of financing young firms, venture capital plays an important role since venture capitalists may have more specialized knowledge about new technologies than banks. But to protect the young firms from being exploited the inventor must hold the right of this knowledge or there might always be the danger of being exploited by the venture capitalist. These property rights are created by the patent system.

Blind et al. (2003) state that the differences in the importance of the patent system originate mainly from the different sizes of enterprises rather than from different industry sectors. In their function as a “currency” and as internal motivation, patents matter most for large enterprises, while for small enterprises patents are very important in negotiations with capital investors. The role of patenting in small and medium enterprises was analyzed by Kitching and Blackburn (1998). A survey of 400 SMEs showed that the costs of patenting and especially the sub-sequent costs of defending the patent rights against infringement distract many managers of small firms. For that reason they often prefer informal protection mechanisms.

Thus, over time the role of the patent system has changed from merely providing an incentive for research to providing firms with strategic instruments. But this application of the patent system may lead to disadvantages in terms of economic welfare. Using patents for blocking competitors is a very useful instrument for managers seeking to maximize their firm’s value. However, since the inventor holds the monopoly right and competition is therefore not possible, this can induce welfare losses and create inefficiencies.

Another interesting issue is how the patent system compares to other systems of property rights. A recent study by Rammer (2003) gives some insight in the firms’ valuation of the different possibilities of protecting ideas. It is interesting to look at the role of patents for the industry sector, where patents have a long history, but also the service sector is examined. Rammer (2003) divides intellectual property into two subgroups: formal property rights and strategic protection mechanisms. Formal property rights are property rights granted by the legal system like patents, trademarks and copyrights. Strategic protection mechanisms are methods employed enterprises to exploit their innovations without using formal mechanisms (cf. Cohen et al. 2000). The most common example is secrecy. The firm is reluctant to reveal information about its new product, as it would automatically when applying for a patent. Therefore, instead of trying to get its innovation patented, the firm may decide to keep it secret and exploit the first mover advantage. Being the first to introduce a new product in the market may already create returns which are high enough to compensate for the research expenses of the firm. The study by Rammer (2003) uses data from the innovation survey of the

"Zentrum für Europäische Wirtschaftsforschung" of 2001, which consist of about 4700 responses. Between 1998 to 2000 slightly more than 30% of the respondents in the industry sector and slightly more than 7 % of the respondents in the service sector were using patents for protection of innovations. In accordance with Blind et al. (2003), this survey also shows that the importance of patents is increasing with the size of the firm. Within the industry sector almost 80% of the large firms (500 or more employees) that took part in the survey use the patent system as an instrument for protection compared to only 20% of the small firms. When looking at firms in the service sector the numbers are lower but the distribution between firm size is similar.

In the study by Rammer (2003) the industry sector itself is classified according to different degrees of intensities in R&D efforts. Rammer distinguishes between advanced technology (very high R&D intensity), high technology (high R&D intensity) and others (low R&D intensity). The service sector is also divided into three categories: technology orientated services (computing, telecommunications), knowledge intensive services (consulting, advertising) and other services (trade). The survey results show that patents play the most important not in advanced technology firms, but in high technology firms. A possible reason for this result is that in advanced technology incremental innovations might be more important and the technological process develops cumulatively. This would be in line with some theoretical literature about patenting in new industry sectors like software and biotechnology. Bessen and Maskin (2002) show that in a model of software patents the "stronger is always better" view of patents does not lead to efficient technological innovation in a dynamic world. The ideal patent policy in their study "limits knock-off imitation but allows developers who make similar, but potentially valuable complementary contributions" (p. 40). Encaoua et al. (2003) also question the "one size fits all" idea of the patent system. The authors suggest that a more diversified patent system could lead to more economic efficiency. However, as patent systems are very similar in this regard, empirical evidence is still lacking.

The results of Rammer (2003) for the service sector show that it is mainly the technology orientated sector where patents play an important role. The other service sectors seem to depend more on other mechanisms, e.g. personal contacts. When

looking only at those innovators who stated that patents play an important role in protecting, one can see differences between the sectors. Especially in vehicle manufacturing and chemistry patents play a very important role as about one third of these respondents claimed.

The next question answered in Rammer (2003) is what role patents play in comparison to strategic protection mechanisms. The most important protection mechanism is lead-time, which means being the first one to introduce a new product, followed by secrecy and patents ranking third (for industry sectors). Beyond these mechanisms there are complex design, trademarks, or copyrights. In addition for the high prices the first firm in the market can set, the firm also gains advantages through the reputation by introducing new products to the market. The other important strategic mechanism is secrecy, which often goes along with being the first on the market. Especially in industries where a lot of knowledge is created and the danger of imitation is not that present, i.e. in high technology and technology orientated services, this strategic mechanism plays an important role. A lot of innovators, however, have not used any protection mechanisms, more than every third innovator in industry, and every second in services. The study delivers two possible reasons for this finding: First, there are innovators which create highly specified goods or services for exclusive customers which allows them to operate as a monopolist in this specific market. Second, many of the innovators are imitators and take ideas of other innovators and take part in the distribution of new products. This is often the case with process innovations.

To conclude this chapter about the valuation of the patent system, one could state that a direct valuation of the patent system is very difficult. Since the patent system itself is not quantifiable, it can only be compared to other mechanisms of protecting innovation and protecting knowledge. Business surveys in this context showed that usually secrecy and lead-time are the most important mechanisms of protection, followed by patents. When talking about the valuation of the patent system, evaluations of optimality may differ substantially from an economic and a business point of view. (cf. Encaoua et al. 2003). Encaoua et al. point out that from an economists point of view the patent system should create an ex-ante incentive for firms to invest in R&D and the innovation process. But among business and legal persons, an ex-post perspective is

very common, i.e. the goal is to exploit the patent system in terms of receiving the maximum possible rewards. This might be inefficient in terms of the market allocation of resources and social welfare.

Table 1: Literature Overview Patent System

Authors	Year	Title	Key findings	Methodology	Dataset
Blind et al.	2003	Erfindungen kontra Patente	Strategic motivations and the increased cooperation propensity and the increased competition led to sharp increases in the number of patent applications	Analysis of business survey	Survey among patent active firms (556 observations)
Rammer	2003	Patente und Marken als Schutzmechanismen	Formal protection mechanisms are very important in large firms; strategic mechanism like secrecy and lead-time may be even more important	Analysis of business survey	Innovation survey of ZEW in 2001
Encaoua et al.	2003	The economics of patents: from natural rights to policy instruments	"One size fits all" patent has to be reconsidered	Literature survey	-
Bessen / Maskin	2002	Sequential Innovations, Patents, and Imitation	In a dynamic model other incentives than patents might be sufficient, esp. complementary innovations should be possible	Theoretical model	-

Ueda	2004	Banks versus Venture Capital	Patents provide a useful instrument for new firms to circumvent expropriation in negotiating with venture capitalists	Theoretical Model	-
Denicolo / Zanchettin	2002	How should forward protection be provided?	Novelty requirement should only be used when strong forward protection is optimal and when leading breadth is already set at its maximum feasible level	Theoretical model	-
Brusoni et al.	2002	The role of codified sources of knowledge in innovation: Empirical evidence from Dutch Manufacturing	Role of codified knowledge, e.g. patent disclosure, as innovation impulse is very low; maybe sector-specific	Descriptive and econometric analysis of survey results	Community Information Survey 2 on Dutch manufacturing
Grupp et al.	1991	Patents as Potential Indicators of the Utility of ED Research Programmes	Evaluating technological EC Research programmes can be done by the analysis of patent data	Descriptive statistics on industry and macro level	Patent Counts

Kingston	2002	Intellectual Property Needs Help from Accounting	Adding a financial dimension (compulsory licensing) to measurement of patent grants would improve patent system	Theory and calculated the optimal costs for a license	US Small Business Innovation Research Programs (SBIR)
Kitching / Blackburn	1999		Small enterprises rely heavily on informal protection mechanisms since patenting involves very high costs	Analyzing business survey	Telephone interview with 400 SME firms in UK; subsequent 101 face-to-face interviews
KPMG	2002	Intellectual Gold	In many companies IP is not a strategic issue.	Business survey in over 300 European companies	Business survey in over 300 European companies

4. The Valuation of the Patenting Process

The patenting process itself consists of several steps. The focus of this chapter lies on the changes in the claims in the patent application which are made during the patenting process in order to receive patent protection. The process of revising the claims is actually a very important process in the eye of an economist, since it defines the scope of the monopoly for the patentee - a monopoly which may last up to a period of 20 years. Since a monopoly creates inefficiency in economic terms, this process should be of particular interest to economists. But surprisingly, to my knowledge there is no empirical evidence or attempts of a valuation of this process. Encaoua et al. (2003) also mention the importance of finding the correct scope of patent protection (table 2). Especially within “new” economic sectors like software and biotechnology, where no “established tradition of patent examination” exists, it might be harmful for further development to grant broad patents.

Thus, the actual patenting process might be an interesting field for further research, which probably should be investigated by patent experts and economists together.

Table 2: Literature Overview Patenting Process

Authors	Year	Title	Key findings	Methodology	Dataset
Encaoua et al.	2003	The economics of patents: from natural rights to policy instruments	"One size fits all" patent has to be reconsidered	Literature survey	-
Lemley	2000	Rational Ignorance at the Patent Office	Strengthening the examination process (thus reducing "bad" patents) is not cost effective	Comparing (social) costs of improving patent examination process and costs by litigation	USPTO
Kesan	2002	Carrots and sticks to create a better patent system	Proposal of five strategies to improve the patenting process by creating a better informed Patent Office	-	-

5. The Valuation of Patent Rights

Patents may be a very valuable economic indicator for the innovative and technological power of firms, sectors or countries. But, as mentioned in section 2, one of the biggest problems when working with patent data is the heterogeneity between the values of patents. The distribution of the value of patents is very skewed since only very few patents are of great economic importance. This result was obtained in various studies while using different methods (e.g. Scherer 1965, Pakes 1986, Griliches 1990). Therefore, many researchers have tried to add a weighting scheme to patent counts. If one can account for the quality of patents, one could interpret the patent counts much better and add value to the analysis of patent counts. In the following sections, different approaches of patent weighting will be presented by summarizing the existing literature on this topic. Different indicators used for weighting and the main results of the existing studies will be presented.

5.1 Raw Patent Counts

Patents are regarded as being a measure of the innovative activity. The first and most simple way to work with patent data is to simply count patents, either patent applications or patent grants. The idea behind this method is that the number of patents reflects the innovative output of a firm, an industry sector or a whole country. Simple patents counts may be used for some descriptive statistics which show the importance of patents in a very general context, but may nevertheless be already informative and add support for the application of patent data in economics. There are some clear advantages of using patent data in economic analysis. First, they are available in a lot of countries, allowing an international analysis on the macro level. Second they contain information about the inventor and the applicant which makes research possible not only on the macro level but also on the micro level. Third, in many countries patent data are collected for a very long time, allowing the analysis of long time series. And most importantly, patent data is usually very easily available since the patent offices publish the patent activity in the respective countries on a regular basis.

5.1.1 Macro Level

To give an example of an international comparison with patent data, some figures published by the European Commission (2003) are presented. Figure 3 shows the number of patent applications at the European Patent Office (EPO) while figure 4 shows the number of patents granted by the US Patent and Trademark Office (USPTO). Both in figure 3 and figure 4 numbers are as of patents per million population.

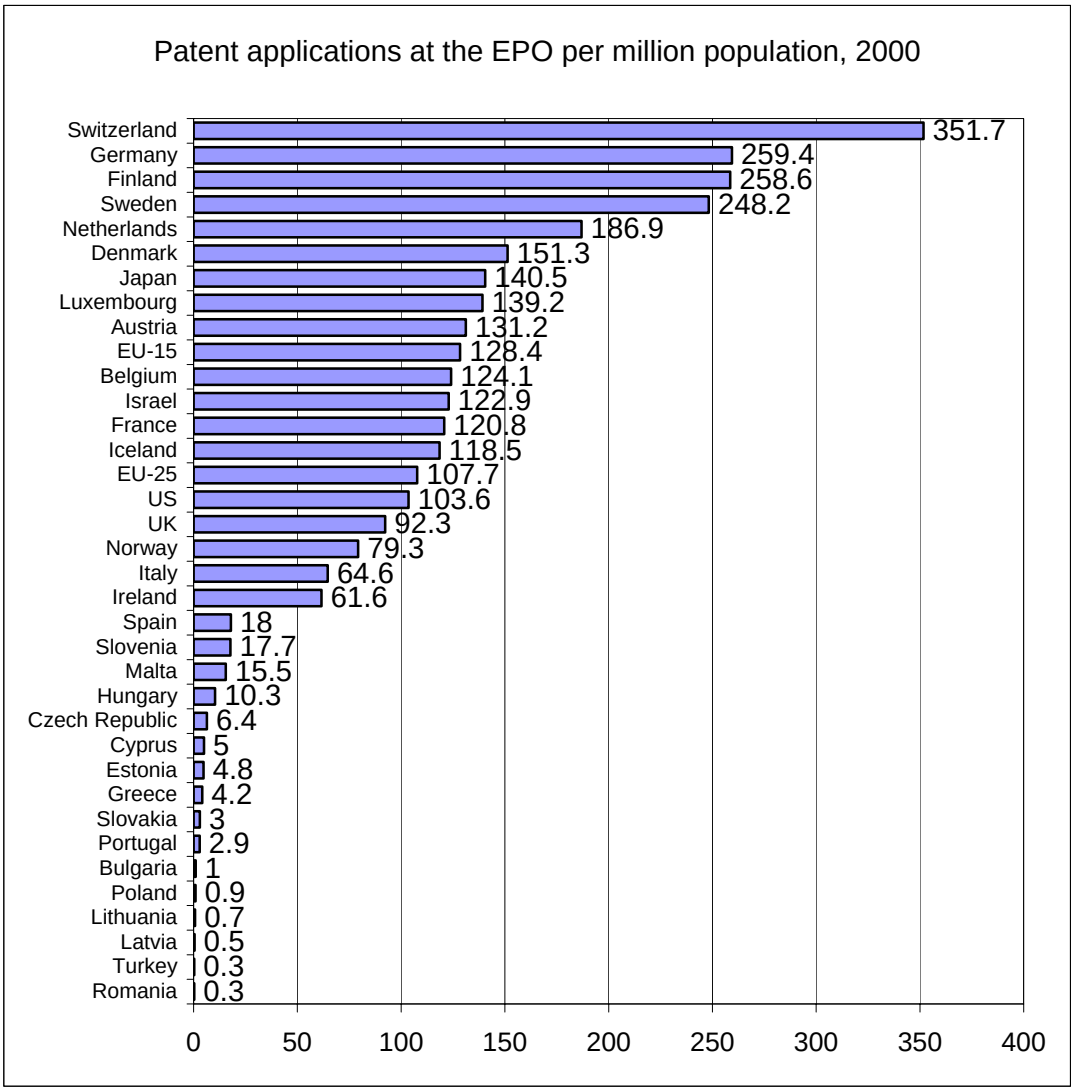

Figure 3: Patent applications at the EPO, per million population, 2000.

Source: EC (2003)

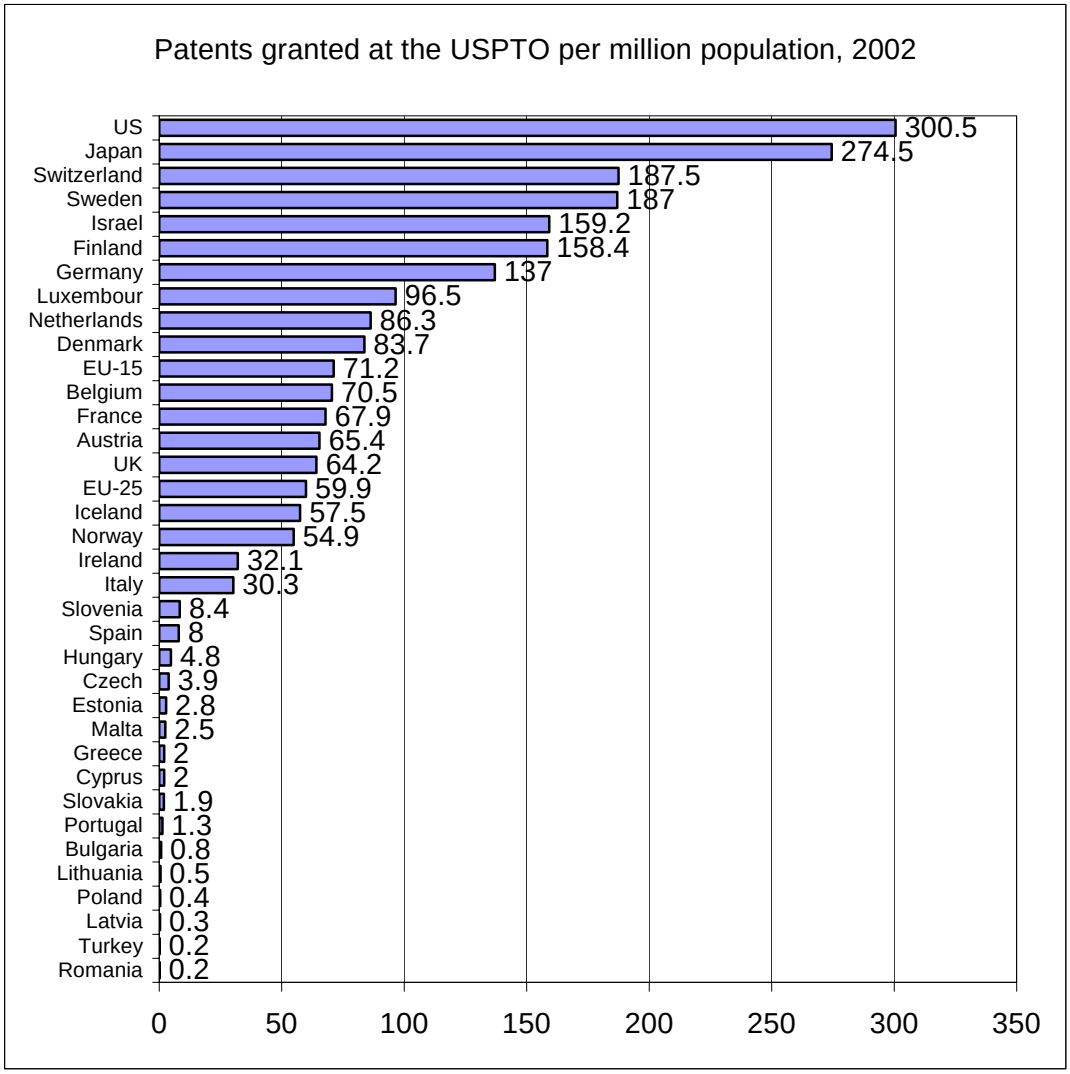

Figure 4: Patents granted at the USPTO, per million population, 2002.
Source: EC (2003)

Using these data one can identify the relatively most patent active countries. At the EPO the most patent active country, measured per inhabitants, is Switzerland, followed by Germany and Finland (figure 3). But one can see that the ranking is different when looking at the patents granted at the United States Patent and Trademark Office (USPTO, figure 4). When looking at the EPO data, European countries are leading the statistics and the US is somewhere in the middle, while the US is by far the most active country in terms of patents granted at the USPTO. It is also interesting to note that

Japan is in second place at the USPTO while only at the 7th place at the EPO, indicating that the US market seems to be more interesting for Japanese inventors.

But when using these figures, one can also clearly see the shortcoming of such statistics. First, different kinds of statistics are published by different patent offices, here the EPO and the USPTO. While the EPO publishes (mainly) the patent applications, the USPTO publishes the patents granted. Reasonable care has to be exercised when interpreting these statistics, especially if using only one data source. As can be seen in table 1, inventors apply relatively more often for patents in their home country / area, which then possibly leads to a bias commonly known as the "home advantage" (EC 2003). In accordance with this line of reasoning US inventors apply for patent protection in the US more often than for protection in the EPO countries and inventors from the EPO countries apply more often for patent protection at the EPO than elsewhere. An additional problem is raised when comparing the patent activities of small countries where quite often one or very few enterprises are the only patentees. Then the country's measured patent activity depends heavily on (or is identical with) the propensity of patenting in this major firm. This problem is hinted at by Schmoch (1994), who also provides the example of Netherlands and Sweden. In the Netherlands Philips is a company well-known for being very patent active, while in Sweden the major patentee is Ericsson which has a reputation of being very reluctant concerning patent applications.

Statistics on simple patent counts are published by the different patent offices and are presented in various forms. They are mainly analyzed within reports of governments, institutions or research bureaus (e.g. EC 2003, Office of Technology Policy 1998, OECD 2002).

5.1.2 Industry Level

Another application of patent counts is found in Raymond (1996). There, patent applications are used for creating an industry-level index to identify those industries which are patent intensive. To this end , Raymond calculates the Patent Application Intensity (PAI) as the ratio of the share of patent applications in a certain industry in total patent applications and the contribution of this industry to the total GDP. This

methodology builds upon previous work by Silberston (1987). The PAI is then combined with an analogously created R&D intensity to create the so-called Combined Patent Intensity (CPI). The aim of Raymond's article is to compare the relative importance of patent intensive industries in comparison with other industries in terms of the contribution to GDP. He shows that within the UK the share of GDP of the ten most patent intensive industries has risen from 5.22% in 1985 to 7.81% in 1992.

Many economic studies dealing with patent data relate these data to the firms market value. A different approach was chosen by Greenhalgh and Longland (2001), who analyze the effects of intellectual property on the employment of a firm. Using a self-constructed dataset which was constructed by matching patent data with firm data, the authors show that the acquisition of new UK patents is associated with an increase in employment within the firm.

5.1.3 Micro Level

Simple patent counts can also be useful in microeconomic analysis. Some examples are given by Norman (2002a, 2002b, 2003), who analyzes patent data in a relatively narrow technological field, namely in therapeutic patents. He analyzes patent information for this market and also tracks firms' patent policies in the area of therapeutic patents, e.g. with regard to their merger and acquisitions activity. Norman (2002b) examines the patent portfolio of Glaxo Wellcome and Smith Kline Beecham before their merging to GlaxoSmithKline plc. (Norman 2002b). By using patent information, the author tries to locate the strengths of the two firms and forecasts their common strengths and the comparative advantages of the merger.

To sum up, raw patent counts might be useful for some analyses at the macro, industry and the micro level, but only on a descriptive basis (table 3). When applying patents as an economic indicator, simple patent counts are not detailed enough due to the high skewness of their value distribution.

Table 3: Literature Overview Raw Patent Counts

Authors	Year	Title	Key findings	Methodology	Dataset
Patent Offices		Annual Reports	-	-	-
European Commission	2003	Key figures 2003-2004	Investment in and performance of the knowledge-based economy in European countries	Analysis of descriptive statistics, mainly R&D and Human Capital related	Mainly OECD, EuroStat, also other data sources
OECD		Main Science and Technology Indicators	Tables of triadic patents and EPO patents in ICT and biotechnology	Counting Patent Applications	Triadic Patents / EPO Patents
Office of Technology Policy	1998	The New Innovators: Global Patenting Trend in Five sectors	US leading in all five sectors in terms of US patents granted; E.g. Korea or Taiwan have highly increasing patent grants	Counting US patents by country, sector and time period; descriptive statistics	US utility patents granted 1982-1996
Schmoch	1994	Messlatte mit Tücken	Difficulties in comparing international patent data	Raising possible problems	-

Greenhalgh / Longland	2001	Intellectual property in UK firms: creating intangible assets and distributing the benefits via wages and jobs	Rising R&D expenditure and the acquisition of new UK patents are associated with increased employment within the firm, subsidies can be a useful policy instrument	Panel regression analysis	Published financial accounts of 1000 UK production firms (operating between mid 80s to mid 90s), matched with Patent Data (USPTO, EPO, UK, using Dun&Bradstreet for ownership structure
Greenhalgh at el.	2001b	Protecting Intellectual Property: British, European and American Patents and Trade Marks of Selected UK Companies	Numbers of UK patents are falling, in contrast to European or American patents	Descriptive patent counts	Data from Patent Offices
Norman	2002a	Pfizer, Inc. analysis of patenting 1998-2001	Finding the company's main focus on a detailed level	Patent counts on a very detailed level	Patent databases worldwide
Norman	2002b	GlaxoSmithKline plc: analysis of patenting 1998-2001	Comparing the patent strategy before the merger	Patent counts on a very detailed level	Patent databases worldwide
Norman	2003	Merck & Co., Inc: analysis of patenting	Analysis of company patent filing and revenues	Patent counts on a very detailed level	Patent databases worldwide

Raymond	1996	The Economic Importance of Patents	The share of GDP produced by the ten most patent intensive industries by rank increased from 5.22 per cent of GDP in 1985 to 7.81 per cent in 1992	Comparing patent intensive industries to others by creating Combined Patent Intensity	5000 randomly chosen patents from UK Patent Office (applications in 1992)
Pavitt	1988	Uses and Abuses of patent statistics	Comparison based on raw patent counts	Literature survey	-
Meliciani / Simonetti	1997	Specialization in areas of strong technological opportunity and economic growth	Positive association between the quality of the technological specialization of countries and their economic growth	Estimating economic growth; investigate the effect of specialization in ICT and fast growing technological areas (indicated by fastest growing patent classes)	USPTO, SPRU

5.2 Size of the Patent Family

One way in which patents can be weighted is by using the size of the patent family. This indicators weights simple patent counts by the number of application countries. This indicator makes use of the fact that a firm can apply for a patent in several different countries. Thus, simple patent counts are weighted by the number of countries in which the inventor has applied for a patent. The basic idea of this weighting scheme is that a patent is more valuable if the inventor seeks patent protection in more countries. Since each application implicates additional costs for the inventor, he has to assess for each additional country whether his expected revenues are larger than the associated costs. He will only decide to apply for patent protection in a certain country if he thinks that he will achieve a net gain. As a possible data source there exists a database from the EPO, called EPIDOS INPADOC where the patent families are listed.

This methodology was introduced in the economic literature surprisingly late. In Putnam's (1996) model inventors apply for patent protection in a certain country if the "expected discounted value of net returns (returns minus application and renewal costs) is positive" (Lanjouw et al. 1998). This indicator has the great advantage of being available very early in the patent's lifetime and can also be used in combination with the renewal fee indicator described in the next section.

Before family size was used in the way proposed by Putnam, a related but actually easier indicator was used for the analysis of patent data. A very simple weighting was introduced by Faust and Schedl (1982) to sort out less important patents. The idea was to take only those patents into consideration which were applied for in at least one more country than the home country.

A more modern idea is the use of a statistic called "triadic patents". Triadic patents are patents which were applied for at the three major patent offices, the USPTO, the EPO and the Japanese Patent Office (JPO). Looking at triadic patents allows an international comparison of a subgroup of all patents and also overcomes the major problem connected with using only one of the patent offices as data source (see section 5.1.1). This subgroup of patents is considered to represent the most important patents, since the inventor seeks protection in the three major technology areas and therefore has

to pay fees for the application at the three major patent offices. Figure 5 shows the number of triadic patents for different countries, again measured in patents per million population.

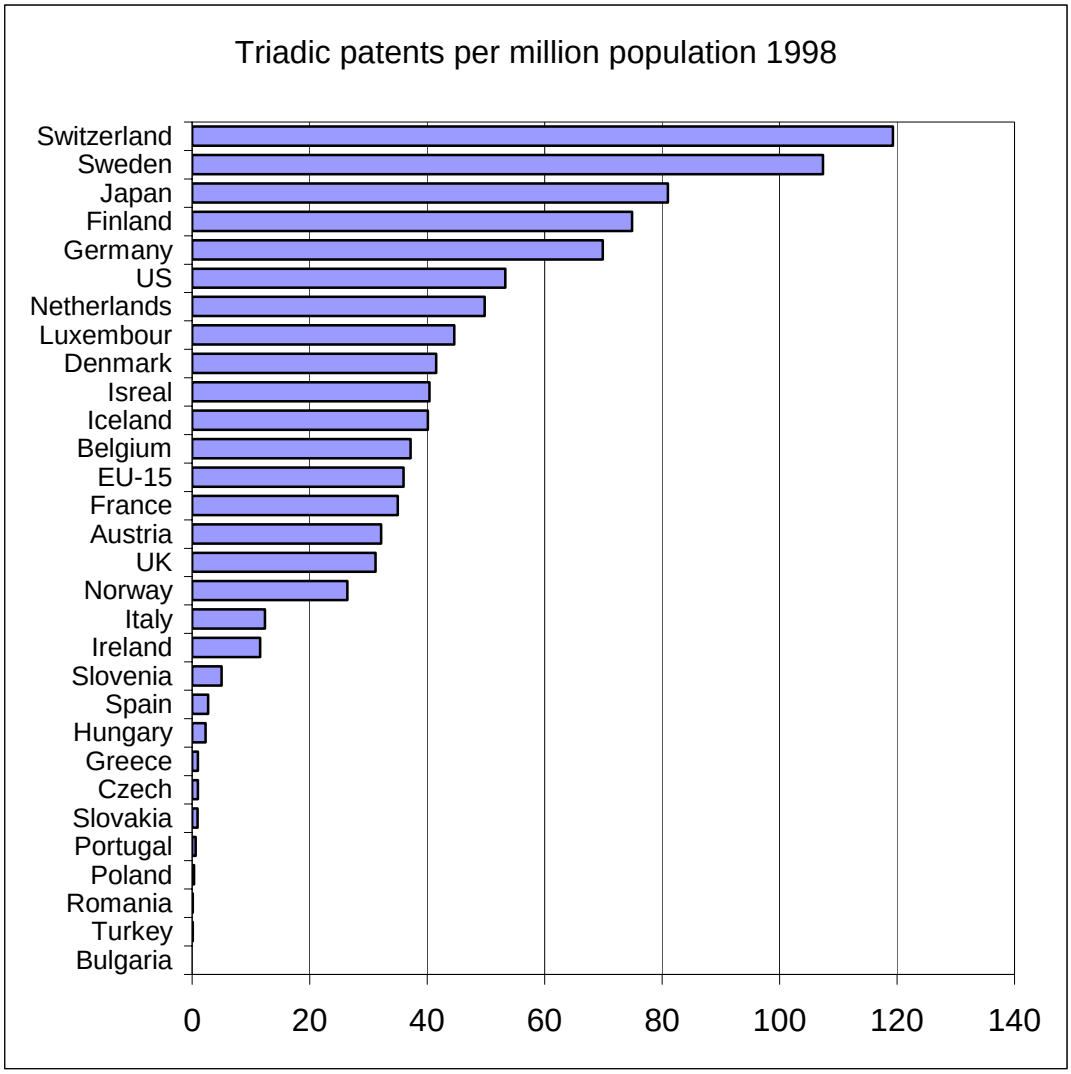

Figure 5: Triadic patents per million population, 1998.

Source: EC (2003)

Using the size of the patent family adds information about the value of patents (table 4). But there are also some drawbacks to this method. Especially small firms which are only active on the domestic market are unlikely to seek protection in foreign countries. For their business in their home country, the national patent right and the national

protection are completely sufficient. But also the patent activity of big firms is sometimes not accurately measured by the concept of triadic patents. Some firms, for example, apply for patent protection only in one or two major European countries and at the patent offices in the US and Japan. These firms are not included in the concept of triadic patents. It is up to further research to estimate how many firms are affected and thus how large the measurement error may be.

Table 4: Literature Overview Size of the Patent Family

Authors	Year	Title	Key findings	Methodology	Dataset
Putnam	1996	The Value of International Patent Protection	Extension of the patent valuation model by allowing different application countries	Theoretical model	-
Faust / Schedl	1982	International patent data: their utilisation fort he analysis of technological developments	Useful threshold is looking at patent families with at least two members	Applying new methods to patent data	Patent family data
Grupp / Schmoch	1999	Patent statistics in the age of globalization: new legal procedures, new analytical methods, new economic interpretation	Concept of triadic patents overcomes many of the problems which are arose with the increasing globalization	Comparing different filters for patent statistics	Patent data bases
Harhoff et al.	2003	Citations, family size, opposition and the value of patent rights	Positive effects of forward citations, patent families and of surviving opposition or annulment procedures on patent value	Survey to estimate patent value; ordered Probit Model	German firms which applied for a patent in 1977 and renewed the patent for the maximum length of 20 years
OECD	regularly	Main Science and Technology Indicators	Tables of triadic patents and EPO patents in ICT and biotechnology	Counting Patent Applications	Triadic Patents / EPO Patents

5.3 Renewal Fees

Another method of valuing patents was introduced by Schankerman and Pakes (1986) in the 1980s. They make use of the duty of patent holders to keep their patents in effect. In almost all countries the patent holder has to pay renewal fees after a couple of years. Therefore the patentee is faced with the recurring decision of the patentee on whether he thinks that the expected future returns are at least as high as the renewal fee. The idea is that more important patents are renewed more often, i.e. the longer the protection is kept up the more important the patent is. This mechanism is very similar for all countries, although the exact number of years and the actual costs vary from country to country. In most countries the renewal fees are increasing on a progressive scale. For example in Germany the first renewal fee which is required in the 3rd year is 70 Euros, increasing to 1,940 Euros in the 20th year.

This payment system leads to the fact that many of the patents are not renewed for the maximum possible time period, which would be around 20 years with slight differences between the countries. Schankerman and Pakes (1986) make use of this peculiarity of the patent system. In contrary to the decision about the number of application countries, the patent holder already has some information about how his product is accepted in the market when facing the decision of renewal. He can add information about the success of his own product and about new products from competitors. So this recurring decision process is a possibility to add a weighting system to the process of valuing patents. Patents that are never renewed are very likely to be less valuable than patents which are protected for the maximum time span. Schankerman and Pakes (1986) developed a model considering the renewal decision of the patent holder. This results is a very skew distribution of the value of patents. A large fraction of patents is of minor private value. Only the very upper tail of the patent distribution represents the share of the patents with high value. Moreover, Schankerman and Pakes provide new interpretation of the analysis of patent statistics of the 1970s. The prevailing interpretation was that a decline in the number of patents in the 1970s represented a decline in technological change. But adding their weighting scheme using renewal fees as a weighting factor, they show that the value of patents has actually

increased during this period. The authors find a turning point during the mid to late 1960s, when the number in patents decreased but the value of the patents increased. Table 5 contains the weighting factors calculated by Schankerman and Pakes (1986) that should be applied to patent counts. The weights are the higher the more often the patent protection is renewed. The very high values for the maximum possible protection come from the "open end" of the decision process. There is no evidence whether the patent would have been renewed again if it had been possible. For this reason the weighting factor for the maximum duration captures also the effect of patents which would have been renewed again if it had been possible which is a sign for extremely valuable patents.

Age	UK	F	GER
5	0.009	0.003	0.005
6	0.038	0.015	0.02
7	0.073	0.031	0.042
8	0.121	0.055	0.075
9	0.19	0.086	0.119
10	0.283	0.126	0.186
11	0.402	0.175	0.289
12	0.552	0.236	0.428
13	0.753	0.308	0.605
14	1.022	0.392	0.829
15	1.377	0.496	1.104
16	5.076	0.62	1.44
17		0.763	1.84
18		0.9932	5.964
19		1.139	
20		6.018	

Table 5: Weights for patents of different lengths

Source: Schankerman and Pakes (1986, table 7, p. 1073)

Another interesting approach using renewal fees stems from Barney (2001). He also tried to implement dollar values when estimating the value of patents. Using data from the USPTO and using the subsample of patents issued in 1986, he takes the maintenance rate and the dollar values of renewal fees to estimate a distribution of patent survival.

The author finds that using this weighting scheme the bottom 10% in the sample has an implied value equal to or less than 475$ and the top 10% has an implied value of equal to or greater than 74,000$. Using this patent weighting scheme as one of several weighting schemes the author creates a classification of patents ranging from C- with an implied value of $25 to A++++ with an implied value of $9,200,00.

As mentioned in section 5.1.2, Greenhalgh et al. analyze the effects of patents on employment. They also used patent counts weighted by renewal fees in one of their studies (Greenhalgh et al. 2001a). Controlling for many other factors like wages, sales raw material prices and capital costs, the authors find a significantly higher level of employment for firms which are more patent active.

The main drawback of this indicator is that it can only be used after the patent has expired. The valuation of the patent right is a suitable indicator (table 6), but not in predicting the value of a patent at an early stage in its lifetime. So for estimating the patent value at the day of its application or granting this indicator is not suitable because it only allows for an ex-post analysis.

Table 6: Literature Overview Renewal Fees

Authors	Year	Title	Key findings	Methodology	Dataset
Schankermann Pakes	1986	Estimates of the Value of patent Rights in European Countries during the post-195ß period	Weights based on renewal fees add significant information about the patent value	Parameter estimates for a patent renewal model	Patent data UK, F, GER
Pakes	1986	Patents as Options	Already in first years there is a high skewness in patent values	Theoretical model and estimation of the model parameters with patent data	Patent data UK, F, GER
Greenhalgh et al.	2001a	Technological Activity and Employment in a Panel of UK Firms	Firms which register Intellectual property via patents have higher levels of employment	Panel regression analysis using weights reflecting patent renewals	Self-constructed dataset from: Company Analysis (Extel Financial 1996), New earnings Survey, Datastream, Dun&Bradstreet, UK and EPO Patent Data
Barney	2001	A Statistical Approach For Rating and Valuing Patent Assets	Very skew distribution of Patent Value	Derive implicit probabilistic distribution of expected patent values (in % terms)	USPTO
OECD	1994	Using Patent Data as Science and Technology Indicators	Patents can be counted or weighted by citations	Huge amount of descriptive statistics; explaining facts relating to the patent system	Patent Count Data

5.4 Patent Citations

Another way of valuating patent rights was introduced into the economic literature by Trajtenberg (1990). The idea of his indicator originates from a quotation of a report by the Office of Technology Assessment and Forecast (1976): “the number of times a patent document is cited may be a measure of its technological significance”. It is another peculiar feature of the patent system that in each patent application previous patents on which the new inventions builds have to be cited. By counting the citations of a certain patent one can construct an indicator for the technological importance of this particular invention. A patent which is cited very often is likely to be very important in its field of technology. It might have been the first patent in a certain technology field or one which contains a key invention in terms of technological process. If a patent is not cited any more, one can assume that its relevance for further research is very low and its contribution to technological process is very small. If we further assume that technologically important patents are also the ones which lead to economic success, we can use the patent citations as an indicator for the value of patents. This idea comes from bibliometric studies, in which scientific literature is ranked according to their importance by counting the forward citations.

Trajtenberg explicitly tries to answer the question if patents can be used as an indicator for the value of innovations, i.e. the output or if they can only be used as an indicator for the input in innovations like R&D expenditures. Using patents of a narrow - and for his observation period also new - field of technology, he calculates the correlation coefficients of simple patent counts and weighted patent counts with value measures of innovation (stemming from another research study) and with R&D. For weighted patent counts the correlation coefficients with the innovation measure are statistically significant and very high (around 0.7), whereas using simple patent counts does not lead to statistically significant results. Using the correlation coefficients Trajtenberg can prove two hypotheses: First, “patent counts weighted by citations are good indicators of the value of innovations, but simple patent counts are not” (Trajtenberg, 1990, p. 179) and second, “simple patent counts are good indicators of the

inputs to the innovative process as measured by R&D expenditures" (Trajtenberg, 1990, p. 179).

As a more recent study applying this approach with a European context, the study by Bloom and van Reenen (2000) is summarized here. Bloom and van Reenen use the IFS Leverhulme database which contains information on 200 British firms. This database contains combined data from the Case Western Patent data (patents granted in the US between 1968 and 1996), the Datastream annual accounting data and the Datastream daily share returns data. Drawing a random sample, adding the top 100 R&D performing firms in the UK that were not already included and cleaning the data led to a sample of 404 firms, of which 185 had been granted at least one patent between 1968 and 1996. The authors use the patent numbers, weighted and unweighted, as variables for estimating the total factor productivity as well as the market value of the firm. The authors find that citation weighted patents provide significant additional information over simple patent counts.

Probably the most extensive research project regarding patent citations was undertaken by the National Bureau of Economic Research (NBER). NBER researchers created a huge dataset called the NBER Patent Citation Data File, which is described in detail by Hall et al. (2001). This database includes all utility patents granted at the USPTO during the years 1963 to 1999, which amounts to a total of 2,923,922 patents. Also included in the dataset are citations used in the description of patents granted in 1975-1999, totaling 16,522,438 citations. In addition to the patent and citation data these data are matched with information about the inventor firms. This information comes from the Compustat database.

An early application of this data set was in a study by Hall et al. (2000) The authors analyze the effect of patents on market value. The results of this study show that citation-weighted patent counts are more highly correlated with market value than patent stocks themselves. So the citation weighting can add valuable information, even after controlling for R&D in the analysis.

But, as every indicator, even patent citations are not free of potential biases. First, it might be that the patents which contain real new innovations ("key patents") are not the ones which are useful for the commercial introduction of the underlying product in the

market. It might need additional ideas or patents based on this patent which really deliver the economic importance. But the patent which is cited more often in the past is still the first one, the key patent, even if its economic value might be small. Second, citation which would appear in patents which are not granted, are not counted. That means, patents which lead to a refusal of granting a new patent are not cited in newer patents, simply because the newer patent grants are not published. So, patents which block other patents and may be very important are not cited as often as they should in this valuation scheme. Third, one has to make sure that the complete family of a patent is taken into consideration. A German patent examiner is very likely to cite the German patent whereas the UK patent examiner will cite the UK patent of the same invention and so on. So, to really assess a measure of the complete value, one would have to collect citations worldwide. Another problem with patent citations, similar to patent renewal fees, is its late availability. After a couple of years, it is still possible that the patent is cited. Nevertheless, if one looks only at the citations which are made in a certain time period after the granting (e.g. three years or five years) one can create an indicator which at least has some predictive power. The shorter the time period is chosen, the sooner this indicator will be available, but the less precise its explanatory power will be (table 7).

This chapter dealt so far with the more common mechanism of forward citations. But there exists also literature on backward citations. These citations may relate to other patents but also to citations of scientific literature. Narin und Noma (1987) show a correlation between backward citations to scientific literature and different measures of technological power. The advantage of backward citations in comparison to forward citations is its early availability.

Table 7: Literature Overview Patent Citations

Authors	Year	Title	Key findings	Methodology	Dataset
Trajtenberg	1990	A penny for your quotes	Patent citations are a useful indicator for patent value estimation	Comparing correlation coefficients of simple patent counts and weighted patent counts with innovation variable	US patents in Computed Tomography
Hall et al.	2001	The NBER Patent Citation Data File	Constructed NBER Patent Citation Data File	Presenting the database and discussing the patent citation methodology	NBER Patent citation Data File
Hall et al.	2000	Market value and Patent citations: A first look	Citation weighting adds explanatory power to the market value estimations	Estimating a market value equation	NBER Patent citation Data File (at early stage)
Hall	2000	Innovation and market value	Citation weights add information over R&D when estimating market value	Correlation coefficients, regression results	Compustat, USPTO
Bloom / Van Reenen	2000	Real Options, Patents, Productivity and Market Value: Evidence from a Panel of British firms	Patents have an economically and statistically significant impact on firm-level productivity and market value; patent citations provide significant additional information over raw patent numbers	Estimating a production function (log real output), including raw patent stock, citations weighted patent stock and both	IFS Leverhulme database: Matched data from Case Western Patent data, Datastream annual company accounting data and Datastream daily share returns data (US)

Harhoff et al.	2003	Citations, family size, opposition and the value of patent rights	Positive effects of forward citations, patent families and of surviving opposition or annulment procedures on patent value	Survey to estimate patent value; ordered Probit Model	German firms which applied for a patent in 1977 and renewed the patent for the maximum length of 20 years
Narin / Noma	1987	Patents as indicators of corporate technological strength	High correlation between citation frequency and company profits and sales	Correlation coefficients	17 US pharmaceutical companies
Deng et al.	2003	Science and Technology as Predictors of Stock Performance	Patent attributes (e.g. patent citation index) are statistically associated with subsequent stock returns and market-to-book ratios	Regressing market-to-book ratio and stock return on different patent measures	CHI Research Database
Greenhalgh et al.	2001	Technological Activity and Employment in a panel of UK firms	Employment increase from UK patenting, esp. in mature technology	Regression models for employment	Self-constructed matching patent data with New Earnings Survey, Datastream, Bun&Bradstreet, Extel Financial

5.5 Other Indicators

5.5.1 Business Surveys

Most surveys that are conducted relating to patents concentrate on the role of patents as a means of protecting innovations (e.g. Blind et al. 2003, Rammer 2003). But of course, one could also directly ask the inventor or the inventing firm explicit questions about the expected value of their patents and about the value of patents at the end of their lifespan. However such questions are very seldom part of business surveys (table 8). An exception is the survey about the value of patents by Harhoff et al. (2003a). The authors chose reviewed firms that applied for patents at the German Patent Office in 1977 and had them renewed for the maximum length of the patent lifetime, i.e. 20 years. This survey gives more insight into the upper tail of the patent value distribution by asking the inventors the following questions: *"If in 1980 you had known how its contribution to the future profitability of your enterprise would unfold, what is the minimum price for which you would have sold the patent, assuming that you had a good-faith offer to purchase?"* Testing several different distributions, the authors come to the conclusion that the most valuable five percent of all renewed German patents accounted for 46 to 61 percent of total sample value, depending upon whether the largest outlier is excluded or not.

This indicator also has its drawbacks. As every survey result, the responses are very subjective. Also, the question is very speculative. Nevertheless, business surveys might be a very useful instrument for patent valuation since the information stems directly from firms, which are the only ones who know about the commercial value of a patent.

5.5.2 Legal Indicators

A quite new indicator for the value of patents looks at the legal disputes a patent causes. There are basically two possibilities for attacking a patent right: Opposition against an issued patent or an annulment process. Information on both types of legal disputes are also available from the patent offices. The basic idea behind using this information as a valuing mechanism is that patents which are attacked (usually by competitors), are in general more valuable than patents which are not attacked. Assuming this correlation,

one implies that competitors try to prevent the inventor from getting protection more often if the competitor expects higher returns and higher competition from this patent.

Lanjouw and Schankerman (2001) combined information about patent case filings from the U.S. district courts with patent data from the USPTO. They find, among other things, that the probability of litigation rises with the number of claims and forward citations per claim. The variation in the probability of infringement can be partly explained by the value of patents. A positive correlation is also demonstrated for opposition and patent value in a theoretical model by Lanjouw and Lerner (1997) and an extension by Harhoff and Reitzig (2000).

The results of the survey by Haroff et al. mentioned in the section above (Harhoff et al. 2003a) was also used by Harhoff et al. (2003b). Their study includes many of the indicators presented so far and also adds information about opposition and annulment. The study confirms the effects of patent citations and family size. But it shows, in addition, that patents which were uphold during an opposition or annulment process are considered to be of very high value.

The legal indicator depends heavily on a firm's patent policy. For small firms or private inventors it may be out of reality to pay for an infringement process. For that reason they will never attack a patent right or might agree on an settlement out of court when being attacked. Other firms, mainly the global players, are opposing against almost every patent of competitors, not expecting to win the suit, but just to prolong the period of uncertainty for the competitor. These examples illustrate that this indicator also has its drawbacks and has to be analyzed carefully (table 8).

5.5.3 Patent Scope

The idea of this method is to include the breadth of a patent as an indicator for its importance. Lerner (1994) found a significant correlation between the scope of a patent, measured as the number of IPC classes of the patent, and the value of the relating firm. This correlation was only partly confirmed in other studies. For example, Harhoff and Reitzig (2000) did not find a significant relationship between patent scope and the probability of litigation.

5.5.4 Word Counts

On of the most recent patent value indicators makes use of the main part of a patent, i.e. the patent description. Contrary to other indicators described here, this indicator exploits the full text part of a patent application. This methodology was introduced by Reitzig (2002b). The idea is to use the information about the patent attorney's strategy via analyzing the full-text part of a patent. This is done by counting the number of words used in different sections of the full-text part (e.g. description of the state of the art, description of the technical problem, number of claims). The main advantage of this indicator is its early availability. Only family size may also be available at a similar point of time, but when using renewal data or litigation data, one can only use the data long after the application or granting of a patent. However, when testing the significance of these possible indicator, little evidence is found to prove this indicator. Only the number of application claims adds information to the other standard indicators used in this study (table 8). So this early available indicator comes at the high price of being very imprecise and needs further improvements to establish in the economic literature.

5.5.5 Patent Valuation in Business Administration

The discounted cash-flow method is constructed from and for a firm's point of view. Koruna and Jung (2001) describe this solution in order to overcome the problem of the late availability of most indicators. They describe a process of six steps for a patent valuation method which is based on the discounted cash flow. This approach combines firms' characteristics (their core competencies), a positioning of the patented innovation in the market and information about the expected future cash-flows. With these key figures the patent value is estimated. Lacavera (2001) argues that in infringement processes courts should also apply DCF methods or market based methods to estimate the damage of the patentee. Lacavera shows in some examples that in most cases courts really apply these procedures. A more detailed analysis of the DCF method is given by Reitzig (2002a). Reitzig also introduces the valuation of patents as real options. He argues that patents can be classified similar to real options and financial options. Under

this assumption, one can transfer models from the commercial financial literature to the patent valuation.

Table 8: Literature Overview Other Indicators

Authors	Year	Title	Key findings	Methodology	Dataset
Blind et al.	2003	Erfindungen kontra Patente	Strategic motivations and the increased cooperation propensity and the increased competition led to sharp increases in the number of patent applications	Analysis of business survey	Survey among patent active firms (556 observations)
Rammer	2003	Patente und Marken als Schutzmechanismen	Formal protection mechanisms are very important in large firms; strategic mechanism like secrecy and lead-time may be even more important	Analysis of business survey	Innovation survey of ZEW in 2001
Harhoff et al.	2003b	Citations, family size, opposition and the value of patent rights	Positive effects of forward citations, patent families and of surviving opposition or annulment procedures on patent value	Survey to estimate patent value; ordered Probit Model	Survey: German firms which applied for a patent in 1977 and renewed the patent for the maximum length of 20 years
Harhoff et al.	2003a	Exploring the tail of the patent value distribution	Valuation for the very important patents	Survey to estimate patent value	Survey: German firms which applied for a patent in 1977 and renewed the patent for the maximum length of 20 years

Lanjouw / Schankerman	2001	Characteristics of patent litigation: a window on competition	High-value patents have higher probability of litigation	Probit Estimation for Infringement and Invalidity Suits	Patent case filings from US district courts combined with USPTO data
Reitzig	2002b	Improving Patent Valuation Methods for Management	From different full-text indicators only the number of application claims showed a significant effect on patent value	Estimation the effects of various indicators on the likelihood of oppositions (as patent value indicator)	EUROPATFULL: patent filings in chemical industry from 1992-1994
Reitzig	2002a	Die Bewertung von Patentrechten	Different valuation methods from a firm's point of view	-	-
Koruna / Jung	2001	Patent Valuation	Construct a mechanism for creating patent values by DCF method	Propose six-step process	-
Lerner	1994	The Importance of Patent Scope: An Empirical Analysis	Positive correlation between patent scope and firm's value	Regression model	535 Biotechnology firms; data from USPTO and Venture Economics
Lacavera	2001	Making cents of Intellectual Assets	Courts should use market based or DCF methods to valuate damages (and mostly do so)	Examples	Court Cases

6. Conclusion

This study presented the existing literature regarding the valuation of the patent system, the valuation of the patenting process and the valuation of the patent rights themselves. The main goal was to find empirical evidence and methodologies how the valuation of these different patent figures can be quantified. The patent system itself is hard to quantify. In the literature, its value is mainly described by comparing the patent system to other policies of protecting knowledge. Here it was shown that usually the mechanisms of secrecy and lead time play a more important role for the firms than patenting. The remaining literature about the patent system is of theoretical nature and suggests some changes in the patent system which might be necessary especially for industries with sequential innovations, like biotechnology and software.

During the patenting process, the scope of the monopoly for the patentee is defined. This is actually an important process for an economic point of view, since in this process of defining the monopoly claims, the social welfare losses through the monopoly are determined. But despite some proposals for changes to increase the efficiency, economic literature has paid little attention to this process. This may be due to its rather qualitative nature or due to the more difficult availability of these data to researchers.

The most important and best analyzed valuation mechanisms are those dealing with the valuation of patent rights. Different approaches were developed to quantify the private value of a patent, since this is the relevant measure for the potential patentee. It was shown that simple patent counts are considered to be a very imperfect measure of the output of an innovation process because of the high skewness of the value of patent rights. But there exist different methodologies adding a weighting scheme to overcome this problem. These are the patent family size, renewal fees, patent citations, data from business surveys, legal indicators or word counts. The best analyzed and most frequently used indicators are renewal fees and patent citations. For all these valuation methods (except for word counts) a high correlation was found with either the patent value measured in a different way or with the market value of a firm. Each of these

indicators also has its drawbacks, which are seldom mentioned in economic literature but which are raised by patent experts from the patent offices. Especially when the patent valuation is performed to predict the value of a patent, there are problems with some of these measures. Early available are raw patent counts, the patent family, the relatively new legal indicators and word counts, whereas renewal fees are only available at the end of a patent's lifetime and patent citations are partly available after a short timeframe. So there is a trade-off between the point in time when indicators become available and their explanatory power. Especially for predicting a patent's value, further research is necessary including the ideas of economists as well as the knowledge and experience of the patent offices.

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ANNEX

The idea of the patent system

The underlying idea of introducing a patent system is to offer an incentive to stimulate research. Within a patent system the inventor gets a reward for his research efforts and for publishing his research results. The reward is a temporary monopoly right for his invention. In other words, the inventor makes his invention publicly known and thus delivers a technological advance. This is a contribution to the technological progress and may be used for further advances in this field of technology. As a reward the inventor obtains the right to use his invention exclusively for a certain period of time, i.e. he might introduce his invention to the market or he may sell the rights to some other person or he can sell licenses for the use of his invention. With this system his invention is protected from imitation.

Economically speaking the patent system creates property rights for ideas. Ideas are considered as being different from other economic goods in terms of rivalry. “Normal” economic goods are rivalrous, i.e. “the use of the good by one person precludes its use by another” (Jones, 1998). The same does not hold for ideas. Ideas are called nonrivalrous, because “once an idea has been created, anyone with knowledge of the idea can take advantage of it” (Jones 1998, p. 73). Another characteristic of economic goods is the degree of excludability. “The degree to which a good is excludable is the degree to which the owner of the good can charge a fee for its use” (Jones 1998, p. 74). This characteristic is affected by the patent system. The idea itself would not be an excludable good, since “imitation” or exploration of the idea might be very easy. Without the possibility of excluding others from using the idea it would not create private returns which are high enough to compensate for the expenses undertaken in developing the idea, usually R&D expenses. Since new ideas might improve social welfare, but since it is the individual and not the society who pays for their development, provision with ideas might be below the social optimum if private returns are too low. Patents are therefore “legal mechanisms that attempt to bring the private benefits of invention closer in line with the social benefits” (Jones, p. 86). Douglass

North, for example, states: ”The failure to develop systematic property rights in innovation up to modern times was a major source of the slow pace of technological change” (North, 1981 p. 164). Jones (1998) also highlights that the development of such institutions, like patents or copyrights, may have played an important role for the Industrial Revolution and the rapid development thereafter.