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The Impact of Judicial Verdicts Regarding Patent Litigation on Stock Prices

Bachelor thesis

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Abstract

This thesis examines the impact of judicial verdicts on patent holders' stock prices. Our dataset contains 40 companies which were involved in a legal dispute concerning patent infringement or patent invalidity and which were judged by the *England and Wales High Court (patent court)*. This work states three main hypotheses which are examined within the empirical part. To understand the impact of a judgement on the stock price of the patent holder we used an event study which measures the impact of economic events on stock prices. We divided the main hypothesis into two parts. The first part examines whether the stock price increases in case of a trial victory and the second part tests whether the stock price decreases in case of a trial defeat. Our empirical analysis refused an alternative hypothesis and so the first part was confirmed. Nevertheless our results did not confirm the second part of the first hypothesis and the stock price shows the positive abnormal return even in case of a trial defeat. On the basic of these results we conclude that judgements influence the stock price in some specific cases but they are not a dominant factor. However we confirm the next hypothesis that the stock price reacts more sensitively to the judgement's announcement in a trial concerning patent invalidity than in a trial concerning patent infringement. This paper contributes to present literature about patent litigation, etc. as well as to the studies focus on factors affecting the stock price. The main goal of this work was to fill up a gap in the literature focus on this issue.

Keywords

Stock Price, Patents, Patent Litigation, Judgements, Event Study

Range of thesis: 67 564 symbols

Abstrakt

Tato práce zkoumá vliv soudních rozsudků na ceny akcií společností, které vlastní patenty. Náš soubor dat obsahuje 40 firem, které byly zapojené do soudního sporu ohledně porušení patentu nebo platnosti patentu a které byly souzené před *England and Wales High Court (patent court)*. Práce uvádí tři hlavní hypotézy, které jsou testovány během empirické části. K otestování vlivu soudních sporů na ceny akcií vlastníků patentů jsme použili metodu zvanou *event study*. Tato metoda se používá pro posouzení vlivu ekonomických událostí na cenu akcií. Hlavní hypotézu jsme rozdělili na dvě části. První část zkoumá, zda cena akcií roste v případě vítězství sporu a druhá část zkoumá, zda cena akcií klesá v případě prohry. Naše empirická analýza odmítla alternativní hypotézu, a tudíž první část byla potvrzena. Nicméně naše výsledky nepotvrdily druhou hypotézu, a dokonce i v případě prohry akcie vykazovaly pozitivní abnormální výnos. Na základě těchto výsledků jsme usoudili, že soudní rozhodnutí ovlivňují ceny akcií v určitých případech, ale nejsou dominantním faktorem. Nicméně byla potvrzena hypotéza, která testovala, zda cena akcie reaguje více na soudní rozsudek týkající se neplatnosti patentu než na rozsudek týkající se porušení patentu. Práce přispívá k současné literatuře věnující se soudním sporům kvůli patentům, atd. Stejně tak tato práce přispívá i ke studiím, které se zabývají faktory ovlivňujícími cenu akcie. Hlavním cílem této práce bylo zaplnit mezeru v literatuře zabývající se touto problematikou.

Klíčová slova

Cena akcie, Patenty, Soudní spory ohledně patentů, Soudní rozsudky, Event Study

Declaration of Authorship

1. The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague 15th May, 2015 Kateřina Vlčková

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Abbreviations

AR	abnormal return
BAILII	British and Irish Legal Information Institute
CAAR	cumulative average abnormal return
CAPM	Capital Asset Pricing Model
CAR	cumulative abnormal return
ER	expected return
ICT	information and communication technologies
IT	information technology
PTO	Patent and Trademark Office
R&D	research and development
U.K.	United Kingdom
U.S.	United States
USPTO	United States Patent and Trademark Office

Institute of Economic Studies

Bachelor thesis proposal

The characterisation

Targets and motivation

The stock price is affecting by various events and reacts sensitively to economic news, although some events have greater impact on the stock price than others (Chen *et al.*, 1986). The stock price is influence by factors which are related directly to the company as dividend announcement, earning announcement etc. (Aharony & Swary, 1980) as well as factors related to the economy as GDP, inflation etc.

The objective of this bachelor thesis is to show how juridical verdicts can influence stock prices. In our opinion, this theme is interesting because nowadays companies litigate due to various things. In view of this fact we focus only on cases regarding patents, specifically only on trials concerning patent infringement and patent invalidity.

A patent is the government licence which is granted to the holder and which allows the patent-holding company to reach some market power or become even a monopolist in some sector (Bessen, 2009). The possession of patents also contributes to the respective company´s value in financial markets (Sandner & Block, 2011) and so the protection of the company´s own patents against imitation is an important tool to maintain the market power and given market value while legal disputes are a powerful option to enforce the protection.

The hypotheses

This work contains three main hypotheses which confirm or disprove the impact of a patent-related judicial verdict on the patent holder's stock price and demonstrate the cases in which the impact is most significant.

The first hypothesis is divided into two parts. These two parts examine the impact of judicial verdicts separately for both cases - the case of a victory and the case of a defeat. The second hypothesis tests whether the effect is more significant in case of a trial defeat than in case of a trial victory. The third and the last hypothesis examines whether a juridical verdict concerning patent validity has a bigger impact on the patent holder´s stock price than a juridical verdict concerning patent infringement.

The methodology

We use an event study methodology to examine the impact of the judgement on the stock price of the patent holder. This methodology has been widely used in recent literature and is used to test the impact of economic events on the stock price. But it is possible to use this methodology for instance in the law, too.

Basic outline of this methodology is to compute an expected return of the stock price which is possible to be calculated by various methods. Having computing expected return we compute an abnormal return and evaluate the impact on the stock price.

Evaluation

The results of our observations will be discussed within the empirical part and will be presented in tables and graphs.

The expected structure

- **I. Introduction**
- **II. Literature review**
  - a. Patent background
  - b. Patent-related benefits
  - c. Patent court
  - d. Hypotheses
- **III. Practical part**
  - a. Sample selection, dataset and methodology
  - b. Results
  - c. Discussion
- **IV. Conclusions**

Basic literature and references

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1 Introduction

In their study *Economic Forces and the Stock Market,* Chen *et al.* (1986) stated that the stock price reacts sensitively to economic news and is influenced by various unanticipated events. They also mentioned that some events have greater impact on the stock price than others. Based on a study by Aharony & Swary (1980), the stock price is influenced for example by earning announcement, dividend announcement, etc. Besides factors that are related directly to the company, the stock price is also affected by long-term economic factors such as the GDP, inflation etc.

Based on the previous studies, this thesis provides evidence whether judgements belong to the factors influencing the stock price or not. Due to many different cases about which companies litigate, we only concentrate on the disputes which concern patents. Although there are works focused on patent litigation, patent importance and the relationships between patent citations and the company´s market value etc. (see e.g. Bessen & Meurer 2005, Cohen *et al.* 2000, Connolly & Hirschey 1988, Hall *et al.* 2005), there is a gap in the literature which we intend to fill up. That is why the goal of this thesis is to confirm or disprove the relationship between publishing of a judgement and the patent holder's stock price.

The Unites States Patent and Trademark Office (USPTO) defines the patent as a territorial right which excludes others from for instance making, using or selling the patented invention during a limited period of time. The patent has two parts – the specification and the claims. According to Moore (2001), the claims should be defined clearly for better determination of which zone of competition is permitted by the given patent. In their study, Sandner & Block (2011) mention that R&D, patents and trademarks contribute to the company´s market value in financial markets and Chen & Chang (2010) stated in their work that effective patent protection is a source of gaining a competitive advantage. This protection is very important, especially if related to more valuable patents, and taking legal action against another company is a tool to enforce non-infringement.

Besides patent infringement cases, we also focus on cases concerning patent invalidity because Bessen & Meurer (2005) consider patent infringement and patent invalidity to be the two biggest reasons for a patent lawsuit. We could suppose that if a patent is granted it must be valid. Nevertheless, according to Long (2002), the PTO is an imperfect mechanism in relation to proving whether information contained in a patent is credible. This statement is also supported by Ford (2013) who thinks that the PTO grants too many invalid patents and therefore litigation due to patent invalidity is the key defence against bad patents.

Although the legal action should be an effective tool to enforce the given company´s rights, an empirical study by Moore (2001) proved that almost one third of the cases which were appealed to the court of appeals were judged incorrectly. Inefficiency of a district court was one of the reasons for establishment of special courts which try only patent cases. These courts exist for instance in the United Kingdom or in the United States.

The central hypothesis is divided into two parts and it examines whether judgements have an impact on the stock price of the patent holder. Specifically, we focus on the effects of two cases - if a company wins the trial and if it is defeated. Shafran *et al.* (2009) stated that investors make decisions based on expectation about future prices. Because judgements represent additional information links to the company, we expect a significant movement of the stock price after the judgement is published; to be more precise, we expect a positive reaction of the market in case of a victory and a negative reaction of the market in case of a defeat. These two hypotheses are also based on a study by Chen & Chang (2010) which stated that effective patent protection could mean a competitive advantage for the given company. This implies that the victory could strengthen the market position of the patent holder and increase its stock price. By contrast, the defeat could weaken this position and reduce the company´s stock price.

The second hypothesis considers whether the effect of judgements is larger in case of a defeat than it is in case of a victory. Because patent possession contributes to the company´s market value and reputation (see Sandner & Block 2011, Long 2002), we expect that the defeat has a bigger impact on the stock price than the victory. This hypothesis is also supported by Veronesi (1999) who proved that stock prices overreact to negative news during good times and underreact to positive news during bad times. Being based on studies by Sandner & Block (2011) and Long (2002), the third and last hypothesis looks into whether the judgement is more significant in case of patent invalidity than it is in case of patent infringement. We presume that judgements about patent invalidity have a greater impact on the stock price of the patent holder because patent invalidity damages the company´s reputation and could reduce its market value.

The thesis is organized as follows: the next chapter lays out the basis concerning patents themselves and provides information on their benefits for the company, on patent-related litigations and on patent courts. The chapter also states the main hypotheses which are examined during the empirical part. Chapter 3 describes the selection of samples, the dataset and chosen methodology. Chapter 4 is the empirical part and it focuses on examination of the stated hypotheses, on the results and final discussion. Finally, in Chapter 5 there is the conclusion of the whole work and suggestions for further studies.

2 Background information on patents

This section provides background information on patents and examines their value. The first part provides basic information on patents themselves and deals with their benefits, which are the main reasons why firms patent their inventions. The second part concerns the patents´ values as well as their contribution to the market value of the company. The third part is focused on patent litigation and, by contrast to the first part, on the major reasons why firms refuse patenting. The fourth part provides information on patent courts including their pros and cons and the final part brings a summary and states the main hypotheses.

2.1 Basic information on patents and their benefits

2.1.1 Patent definition

The term patent means exclusive rights which exclude others from making, using, offering for sale, selling or importing the inventions without the patentee's permission during a limited period of time. Basically it is the government licence which is granted to the holder and the infringement of which is punished in case it is proved[1]. This licence allows the patent-holding company to become a monopolist in some branch or to reach some market power. This market power enables the company to gain supra-normal profits or "rents" (Bessen, 2009, p. 1604).

A patent is a territorial right so the permission is effective only within the state which issued the patent. Under certain circumstances, it is possible to extend the terms of a patent[1]. Another option is to ask patent offices in the individual countries for the protection abroad or to apply through the international patent system which is called *Patent Cooperation Treaty*[2] and which provides protection in almost 150 countries throughout the World[3]. In the European Union, it is possible to fill in an application under the *European Patent Convention* to get patent protection in most European countries[2]. Applications for patents are chargeable and the final

[1] See http://www.uspto.gov/patents-getting-started/general-information-concerning-patents#heading-4
[2] See http://www.out-law.com/page-5699
[3] See http://www.wipo.int/pct/en/

charge depends for example on the length of the patent´s validity or on the type of the invention[4].

There exist various types of patents but different countries have different patent systems and therefore also different types of patents. For instance in the U.S. we distinguish three types of patents: utility patents, design patents and plants patents[4]. But in Australia there are only two types of patents: standard patents and innovation patents[5].

Patentable things are specified in detail in the patent law of the given country. Generally, an invention is patentable if it is new, non-obvious and useful (Hall *et al.*, 2005, p.18). For example it is possible to patent new inventions and technologies, medicaments, etc. By contrast, it is not possible to patent mere ideas or suggestions[6]. The innovator must apply for the patent, disclose required information and its application must be approved by a relevant institution (Oxford Business English Dictionary, 2005, p.396-397). For instance, in the U.S., the relevant institution is *The United States Patent and Trademark Office*, in the U.K. it is *Intellectual Property Office* and in the Czech Republic it is *Úřad průmyslového vlastnictví.* An extensive public document is created after the patent is granted (Hall *et al.*, 2005, p.18).

The patent is divided into two parts – the specification and the claims. The specification represents the body of the patent document and in this part the innovators have to describe their inventions in detail. For instance the innovator has to state how the invention should be produced or used etc. The claims describe the scope of the patented invention and they are placed at the end of the patent document (Long, 2002, p.647). The patent claim terms should be defined ex ante and clearly to better decide which zone of competition is permitted by the given patent and what kind of behaviour infringes the patent (Moore, 2001, p.5).

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[4] See http://www.uspto.gov/patents-getting-started/general-information-concerning-patents#heading-4
[5] See http://www.ipaustralia.gov.au/get-the-right-ip/patents/types-of-patents/
[6] See http://www.upv.cz/cs/prumyslova-prava/vynalezy-patenty.html

2.1.2 Patent-related benefits

Patents belong to intellectual property of the respective company (Bessen & Meurer, 2005, p.1) and their importance is huge in theoretical level. Innovation is a dominant precondition for productivity growth and it is greatly encouraged by providing patent protection (Lanjouw & Schankerman, 2001, p.130).

The main benefit of patents is prevention of copying by other companies (Cohen *et al.*, 2000, p.17) during a limited period of time. By contrast, previous empirical work demonstrated that patents provide effective protection during a term which is shorter than their legal life and they are imitated often and quickly (Mansfield, 1984, p.143). This means that although patenting should be a kind of protection against copying by competitors, the existence of legal disputes due to patents proves that it is definitely not a perfect protection and companies do infringe the patents. The simple reasons for starting imitation are profit increase and conviction that the patent owner does not oversee the market and will not discover the infringement of the patent. The frequency of market entry and infringement of the patent also increases if justice is not very efficient. On the other hand, the frequency of market entry is decreasing with the respective settlement cost growing. And generally speaking, the higher the penalty for infringement, the lower the probability of market entry (Crampes & Langinier, 2002, p.270).

Another benefit of patenting is that the patent also prevents the rivals from patenting similar inventions which is known as *patent blocking* (Cohen *et al.*, 2000, p.1). If a company has not patented their invention, another company would do it and then accuse the true innovator of infringing their patent. Consequently, the original innovator company would have to stop using and selling their own invention.

One of the good reasons for patenting also consists in the prevention of suits (Cohen *et al.*, 2000, p.1). Among others things, on the front page of a patent there is detailed information on the technological precursor, including references to the previous patents (Hall *et al.*, 2005, p.18).

Patents are also used in negotiations with other companies (Cohen *et al.*, 2000, p.1). Holders can profit from owning the patents if they allow other companies to use their inventions for a license fee or if they sell them (Long, 2002, p.639). However, the companies still rely on other mechanisms to recoup their investments in R&D. These mechanisms include for example lead-time, high quality production or design capabilities (Hall & Ziedonis, 2011, p.125). To obtain a patent it is necessary to disclose some specific information about the patent itself. Rational inventors are usually unwilling to provide more than necessary information and consider whether the expected profit which is connected with the patent rights is higher than the costs related to disclosing the information. If the inventors expect that the protection provided by trade secret is equal to or greater than the protection ensured by the patent right, then they should consider their patent application and maybe prefer to keep the invention in secret (Long, 2002, p.626).

Last but not least, other reasons for patenting which were mentioned by various companies are to enhance the company´s reputation and earn licensing revenue. However, the licensing revenue is the least important reason, which is confirmed by the fact that only a minority of companies expect to sell their innovations (Cohen *et al.*, 2000, p.18). Detailed information on the reasons mentioned by companies in Cohen *et al.* (2000) research, including the weight of these reasons in percent, is in Appendix 1.

2.2 Patent value and its impact on the market value

Patents have an impact on the market value of the respective company. The market value of a firm is influenced by those factors which affect expected future profits (Connolly & Hirschey, 1988, p.83, 87). Apart from tangible assets, which also belong to these factors, the firm has intangible assets, too. Intangible assets include for example brands, customer networks or knowledge assets such as R&D investments and patents. The knowledge assets also contribute to the company´s value in financial markets (Sandner & Block, 2011, p.969). Although R&D contributes much more than patents do (Hall *et al.*, 2005, p.34), previous analyses confirmed that the patent scope has a significant effect on the company´s value, too (Lerner, 1994, p.330).

Although it might seem that the higher the number of patents held by a company, the higher the overall value of these patents, but in fact there is only poor correlation. This is due to the fact that distribution of the value of patented innovations is skew. Basically there exist a few patents which are very valuable but there are also many patents which have almost null value (Hall *et al.*, 2000, p.6). In his study, Trajtenberg (1990) also pointed out that the importance and value of patents differ from one another and so patent counts are not much informative about the innovative output. A paper written by Bessen (2008) also proved this claim and showed that there are huge differences in patent values across various patentees. Small entities such as individual non-profit organizations or companies with less than 500 employees hold patents the value of which is considerably lower than the value of patents owned by larger companies.

There is also a relationship between the patent citations and market value of the respective company. Research performed by Chen & Chang (2010) demonstrated that the number of patent citations is positively related to the market value of a given company.

The information contained in a patent represents, to some degree, credibility of the company´s research, which has a certain value for investors. Mere announcements about the research in the media do not guarantee credibility of the information and investors do not have many possibilities to verify it. Granting of the patent to the company eliminates this risk partially and the investors usually suppose that the information contained in the patent is credible. Nevertheless, they are still motivated to verify patent-related information and its accuracy because the company may state in its patent some hardly verifiable or misleading information in order to increase its value (Long, 2002, p.650, 665, 669).

2.3 Patent litigations

As mentioned earlier, patents are not perfect protection against imitation by other companies and so there are legal disputes due to patents. Because of insufficient patent protection, the holders should oversee the market and in case of imitation they should sue the infringers of their patent. Nonetheless, this is not done by an overwhelming majority of the holders. In some infringement cases, the patent holders prefer to conclude an agreement or accept a license fee rather than to go to the court and prove the infringement (Crampes & Langinier, 2002, p.258).

This claim is supported by numbers. In practice 95% of patents are either never used, or used in the cases which do not radically require the patent's validity (Lemley, 2001, p.15). Broadly speaking, an overwhelming majority of patent holders never file a suit to enforce their rights and so the importance of patents in practise seems to be questionable. In fact this is because some patents are more valuable than others (Allison *et al.*, 2003, p.1-3), as mentioned above. In most cases, patented inventions represent the outcome of costly R&D carried out by profit-seeking companies. And if the innovation is cited and if the company continues in its further development, it signifies a higher economic value of the cited innovation (Hall *et al.*, 2005, p.18). Sandner & Block's research (2011) also proved that investors primarily value those patents which are often cited.

On the other hand, enforcing of many patents is often senseless. Sometimes a new invention turns out to be worthless or it has an economic value but not a patent value. This situation may occur if the patent is specified too narrowly and its infringement requires inclusion of an element which can be easily substituted or designed (Allison *et al.*, 2003, p.1-3). Patents are also undermined if the holders cannot oversee the infringement, if it is difficult for them to identify the infringers or if enforcement of their rights is too costly (Crampes & Langinier, 2002, p.258).

Most often, the reasons for patent lawsuits are challenging of the patent's validity or infringement of the patent. Sometimes, patents have uncertain validity due to various legal changes (Bessen & Meurer, 2005, p.27). In some cases, the holder does not want to sue the infringer because of the risk that the court would consider the patent invalid (Landes & Posner, 2003, p.299). A court may find out that a patent claim is invalid for example due to publishing of the claimed invention in a book, magazine or other published work before the date of the claimed invention[7]. Sometimes the boundaries of patents are defined improperly. Then it is difficult to determine whether some technology infringes the patent's boundaries or not. A rival company can also use the patented technology for many justified reasons. For example, a relevant patent has not been issued yet or the patent's rights and boundaries are unclear (Bessen & Meurer, 2005, p.1).

[7] See http://www.uspto.gov/patents-maintaining-patent/patent-litigation/about-patent-infringement

If a patent holder sues the opposite company for infringement of its patent, the accused company can defend in two main ways – to prove non-infringement of the patent or to prove the patent´s invalidity. The non-infringement defence is based on proving that the scope of the patented invention is not infringed by the defendant's product or method concerned. By contrast, the invalidity defence is based on proving that the patentee company did not satisfy the basic requirements to be able to patent their invention, for instance that the patented invention was not novel (Ford, 2013, p.73). According to a study by Ford (2013), accused companies rely more on proving non-infringement rather than invalidity.

It might seem that once a patent has been granted, the information contained in it is credible and it is not possible to challenge the patent´s validity. But Long (2002) stated in her research that the PTO is not a perfect mechanism to prove whether information contained in a patent is credible. This office only rarely verifies whether the assertions made by the respective patent applicant are true. In most cases the office relies on faith in the assertions. That is why complaints against the office´s ability to verify patent applications are increasing (Long, 2002, p.668). This statement is also proved by Ford (2013) who mentioned in his study that the PTO grants too many invalid patents and the use of courts which can invalidate patents is the main defence against bad patents.

Although patents should prevent suits and although the majority of inventors never file a suit, the number of legal disputes due to patents is still rising. The dominant factor behind the increasing number of patent-related lawsuits consists in legal changes. These changes encourage companies to infringe patents by questioning the patent's validity (Bessen & Meurer, 2005, p.28). For example, the number of judgements which were issued by the England and Wales High Court (Patents Court) was only 16 in 2004. In the year 2013, this number was more than doubled, the court tried 42 cases[8]. The total number of patents in force remains nearly constant in the U.K. In both 2004 and 2014, this number was around 470,000[9]. And for instance the number of lawsuits about patents in the whole U.S. was around 1,600 in 1999 (Bessen & Meurer, 2005, p.1) whereas the total number of existing patents was around 1,500,000[10].

[8] See http://www.bailii.org/ew/cases/EWHC/Patents/
[9] See http://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=GB
[10] See http://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=US

This implies that although the number of lawsuits is rising, it is still negligible in proportion to the number of all existing patents.

Although the number of patent lawsuits is minimal, there is a relationship between certain characteristics of the patents and their risk of being exposed to litigation (Lanjouw & Schankerman, 2001, p.147). For instance, the patents originally issued to individual inventors and small businesses have higher probability of being litigated than the patents originally issued to large corporations. Considering the industry sector, the highest probability of being sued is connected with patents in the area of medicaments and ICTs (Allison *et al*., 2003, p.40-41; 49). The number of patents held by a given company is another reason which also increases the probability of being litigated (Bessen & Meurer, 2005, p.24-25). Although all patents have fulfilled the same criteria to be granted, their technical scope is different as well as their economic significance (Hirschey & Richardson, 2004, p.93). The broader the patent's scope, the higher the number of competitors and competing products as well as probability of the patent's infringement (Merges & Nelson, 1990, p.839). A majority of suits also occur between firms which patent similar technologies or which are close to each other in the market. Although it might seem that the defendants in lawsuits concerning patent infringement are mere pirates and imitators, in fact they are, in most cases, innovators themselves and their R&D expenditures are similar to those of the plaintiffs (Bessen & Meurer, 2005, p.18-19, 28). Previous research came to a conclusion that the most valuable patents are the most highly cited (Hall *et at.*, 2005, p.19). A study performed by Bessen (2008) proved the opposite implication and showed that patents which are litigated are worth much more than those which are not. However, Bessen (2008) also pointed out that although there is correlation between a patent´s value and its citations, the patent´s citations are not reliable criteria of its quality.

Insufficient patent protection also discourages some companies from patenting their inventions. Many previous works demonstrated that the patent protection is important in only few industries, most notably in pharmaceuticals (Cohen *et al.*, 2000, p.2). This confirms the situation when, excluding drugs-related inventions, many patentable innovations have been introduced without patent protection (Mansfield, 1984, p.145). Other reasons why companies do not patent their inventions consist mainly in demonstration of novelty, disclosure, the application costs and ease of inventing (Cohen *et al.*, 2000, p.16). Information on the reasons including their percentage weights by Cohen *et al*. (2000) is provided in Appendix 1.

2.4 Patent court

In case of infringement or challenging of a patent´s validity etc., the company concerned should file a suit in order to enforce its rights, especially in case there is no agreement with the opposite company. Then legal action goes to the district court, which has to try it. Although patent claims define the bounds of the respective inventor's rights, the first step in any infringement analysis or validity analysis is to define the meaning and scope of the claim. If the terms of a patent claim are not defined precisely ex ante, as mentioned in the first part, they must be defined ex post by the court to determine whether the patent has been infringed or not. Determination of the patent scope is the most important part in patent litigation (Moore, 2001, p.5, 8). There is also a relationship between a patent´s scope and probability that the court finds its infringement. The court probably proves patent infringement if the patent claims are broad enough to include the accused process or product. By contrast, it is hard to prove infringement when the patent is constructed too narrowly (Ford, 2013, p.85).

The importance of correct determination of the patent scope gives rise to doubts whether district court judges have an appropriate ability to adjudicate complex technical patent cases (Moore, 2001, p.3). An empirical study performed by K. Moore proved that district court judges interpreted or defined patent claim terms incorrectly in almost one third of the cases which were appealed to the court of appeals. That is why suggestions appeared to create a special court for patent cases. According to these suggestions, patent litigation would improve if the judges specialized in patent cases (Rifkind, 1951, p.425).

As stated above, the PTO is an imperfect mechanism in relation to verification of the information contained in patent claims (Long, 2002, p.667). That is why companies sometimes apply for a patent even though the invention is not really new. In some cases, the patent is granted and then the patent holder goes after potential infringers. Invalid patents are probably one of the biggest problems in modern patent law (Ford, 2013, p.74).

Nowadays, there are special courts focused on patent cases in some countries. For instance, in the U.K. there is the *Patents County Court* which was set up in 1990 and which only deals with cases related to intellectual property. This court is focused on intellectual property litigation for small and medium-sized enterprises. In addition, there is the *High Court* which hears appeals from other courts and it also tries first-instance cases but for bigger enterprises. The High Court has three divisions and the division called *Chancery* contains the patent court[11].

In the U.S., a patent holder can sue another company in the federal district court for patent cases; it is not possible to file a suit to the state court[12]. In the past, in case of appeal, the company had to appeal against the judgement to the regional court of appeals according to the location of the district court. Due to criticism of this system, *The U.S. Court of Appeals for the Federal Circuit* was established in 1982 (Landes & Posner, 2004, p.111) to centralize patent appeals. This court is unique in the U.S. because it has nationwide jurisdiction in a diversity of subject areas, including patent cases[13]. Although it is not the only reason, research carried out by Landes and Posner (2004) proved that establishment of a court with nationwide jurisdiction for patent appeals has had a significant effect on patent activity.

Establishment of special courts which only focus on patent cases has also its opponents. The specialization gives rise to a monopoly system which is separated from the rest of the law. This separation immunizes the patent sector against regeneration which is connected with new suggestions, ideas, etc. Another argument is against patent judges, asserting that they should be specialists in patent cases. According to S. H. Rifkind (1951), it is hardly possible that the members of patent courts will be omniscient. There are a lot of patent variations, some patents are based in chemistry, others in IT etc., and the patent judges probably do not have specialized skills in all these branches (Rifkind, 1951, p.425-426).

[11] See https://www.judiciary.gov.uk/you-and-the-judiciary/going-to-court/
[12] See http://www.uspto.gov/patents-maintaining-patent/patent-litigation/about-patent-infringement
[13] See http://www.cafc.uscourts.gov/the-court/court-jurisdiction.html

2.5 Summary and hypotheses

To summarize, while in the economic literature patents are viewed as a perfect tool to protect the company´s own inventions against imitation, in the real world their value depends mainly on their idiosyncratic characteristics and on the ability of their holders to enforce their rights in case of infringement (Crampes & Langinier, 2002, p.259). In addition, the importance of patent rights and their exercise differ among various companies even within one branch (Hall & Ziedonis, 2001, p.125). Finally, the patent system is sometimes compared to a lottery. The largest compensation is paid to a small minority of winners, while the majority of innovators must be content with a modest or null reward (Scherer, 1999, p.6-8). Owning a patent is then similar to owning a lottery ticket: *"unlikely to pay off, but very valuable if it does"* (Allison *et al*., 2003, p.2).

2.5.1 Hypotheses

This work contains three main hypotheses which are examined within the empirical part. These hypotheses confirm or disprove the impact of a patent-related judgement on the stock price of the patent holder and demonstrate the cases in which the impact is most significant. Aforementioned previous studies showed that the stock price is influenced by many factors like earning announcement, dividend announcement, etc. (Aharony & Swary, 1980, p.1). Investors look for information about companies in which they invested and predict the future movement of their stock price. On the basis of expectations about future prices they decide whether to buy, hold or sell their shares (Shafran *et al.*, 2009). The possession of patents also contributes to the respective company´s value in financial markets (Sandner & Block, 2011, p.969) and the holding of patents and its effective protection offers the patent holder a competitive advantage in the given branch (Chen & Chang, 2010, p.21). For this reason, the protection of the company´s own patents against imitation is an important tool to maintain the competitive advantage and given market value while legal disputes are a powerful option to enforce the protection. Because judgements are additional information links to the respective company, we will examine the impact of a judgement on the stock price of the patent holder after the judgement is published.

For clarity we describe all four different situations which could happen to the patent holder in our research, including their consequences, i.e. a victory or defeat in the trial concerning patent infringement and a victory or defeat in the trial concerning patent validity. In a patent infringement case, the patent holder is most often the claimant and the victory in this trial means that the opposite company has infringed the patent and in some cases the patent holder could receive some compensation. On the other hand, the defeat proves non-infringement of the patent. In a patent validity case, this validity is challenged by the opposite company, either as a way of defence (as was explained earlier), or in an individual trial. The victory in this trial means that the patent is valid while the defeat leads to invalidation of some claims or the whole patent[14].

The first hypothesis to be examined concerns the impact of judgements and it is divided into two parts. These two parts test the impact of judgements separately for both cases, i.e. the case of victory and the case of defeat. We suppose that announcement of the judgement has a significant impact on the stock price because investors follow new information on the company and make decisions based on expectations about future prices (Shafran *et al.*, 2009). Our hypothesis is also based on *Franz et al.* (1998) whose research was described in *The Impact of Litigation against an Audit Firm on the Market Value of Nonlitigating Clients.* This research proved that even the clients who are not embroiled in the litigation show a significant negative return if litigation against their audit firm is announced (Franz *et al.*, 1998). Although this research is not focused on the impact of litigation on a directly-involved company, we still expect that litigations and final judgements have a significant impact on the stock price, in our case on the stock price of the patent holder. The first part of the first hypothesis is the following:

Hypothesis 1a: *The stock price of a patent holder increases significantly in case of victory in a trial concerning patent infringement or patent invalidity after the judgement is published.*

[14] In some cases the patentee may be required to correct the patent information and so avoid patent invalidation (Long, 2002, p.650) but we do not consider these cases as defeat because patent is still valid

On one hand, patents represent a limited government grant of monopoly for the given company (Connolly & Hirschey, 1988, p.83). Its effective protection gives the company a competitive advantage (Chen & Chang, 2010, p.21) and so a victory in a trial about patent infringement strengthens the company´s position and probably moves the stock price up. Also a victory in a trial about patent validity clearly proves this validity and it partially protects the company against other litigations.

On the other hand, if the patent holder does not prove the infringement, the opposite company can continue producing its goods and the patent holder loses a part of its market position and competitive advantages, which could be reflected in its stock price. If the patent holder loses the trial about patent validity, its market value can drop because the patent represents investment in the company´s reputation (Long, 2002, p.650) and its invalidity damages this reputation. To test this reaction, the second part of the first hypothesis is the following:

Hypothesis 1b: *The stock price of a patent holder decreases significantly in case of defeat in a trial concerning patent infringement or patent invalidity after the judgement is published*.

The result of these two examinations should be whether a victory in the trial has a positive influence on the stock price of the patent holder and whether a defeat in the trial has a negative influence on the stock price.

The second hypothesis is focused on significance of both cases. According to Howe (1986), investors most likely overreact to dramatic and unexpected events. Veronesi (1999) also dealt with the market´s reaction and proved that the stock price overreacts to negative news during good times and underreacts to positive news during bad times. On the basis of these findings, we assume that a defeat has a greater impact on the stock price of the respective patent holder than a victory, even though we do not differ between good times and bad times. Our expectation is also supported by the studies published by Sandner & Block (2011) and Long (2002). They stated that patents contribute to the company´s market value and also to its reputation.

Due to this we suppose that the trial defeat influences the market value and reputation much more than the trial victory does. To prove or disprove this assumption, the second hypothesis is the following:

Hypothesis 2: *The impact of the judgement on the patent holder is more significant in case of a trial defeat than it is in case of a trial victory after the judgement is published.*

The result of this hypothesis should be whether the trial defeat influences the company and therefore its stock price more than the trial victory does or if there is no difference.

The third hypothesis examines the impact of the trials concerning patent infringement or patent invalidity on the stock price and compares them. In this case we test whether a judgement concerning patent validity has a bigger impact on the patent holder´s stock price than a judgement concerning patent infringement. This hypothesis is also based on Sandner & Block (2011) and Long (2002). We suppose that patent invalidity reduces the company´s market value and damages its reputation. That is why we expect a bigger impact on the stock price in case of a trial about patent validity than in case of a trial about patent infringement. The third hypothesis is:

Hypothesis 3: *The impact of a judgement on the patent holder´s stock price is more significant in case of a trial about patent validity than it is in case of a trial about patent infringement.*

3 Sample selection, dataset and methodology

In this section, we cover selection of the sample in detail and describe the criterions which have to be fulfilled. Then we provide information on the dataset and at the end of this chapter we focus on description of the selected methodology.

3.1 Sample and data collection

3.1.1 Sample selection

In our sample there are only companies which were involved in a legal dispute and which were judged by the *England and Wales High Court (patent court)*. In all cases, a patent was the subject of the dispute and we selected only cases that took place between 1996 and 2014[15]. The cases are available from the British and Irish Legal Information Institute (BAILII) database. We selected this database due to its public availability.

We chose companies from the database which were either claimants or defendants; any other third parties and interested parties were rejected. Then we selected companies which are traded in the stock market and we excluded those which are not. We limited the subject of the dispute exclusively to infringement or validity of the patent. The trials which concerned for example reopening of a trial, some compensation or provision of further information were eliminated. The company also must be a patent holder; all the other companies were crossed out. The last criterion concerned the results of the cases. To target the sample, we only include cases with clear decisions. It must be obvious from these cases whether the patent is infringed or invalid. The cases which were postponed to another date were removed.

Briefly, the company in our target sample must fulfil the following criterions:

- the company must be involved in a legal dispute before the England and Wales High Court (patent court)
- the case must have been tried between 1996 and 2014
- the company must be either a claimant or a defendant
- the company must be traded in the stock market
- the subject of the case must be either infringement or validity of the patent

[15] Available from database in *British and Irish Legal Information Institute* - www.bailii.org

– the company must be a patent holder

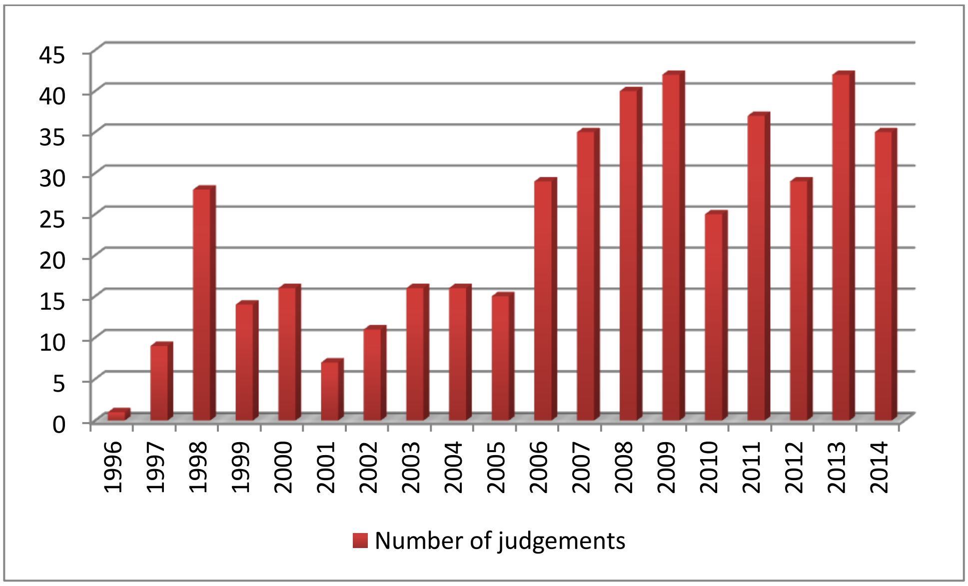
– it must be obvious from the result of the trial whether the patent is infringed or invalid

In our sample we do not consider if it is the first-time lawsuit or if there were any trials about this case before. Clarity and obviousness of the result are most important for the target sample.

3.1.2 Dataset

During the years 1996 – 2014, the England and Wales High Court (patent court) issued almost 450 judgements in various patent cases. Although we considered all the data available from the BAILII database, only 40 companies meet our criterions which are stated above. With these criterions being met, it is the highest number of companies which we can obtain from the given database. Figure 1 shows the number of judgements during the years and confirms our previous statement that the number of legal disputes due to patents is rising.

Figure 1: Number of judgements during 1996 - 2014



Having looked up the date the judgement was issued, we specified the subject of the trial (infringement/invalidity) for each company in our target sample. In some cases, determination of the subject is quite tricky. We found out by observation during the data collection that in most cases, the defendant's defence is based on counterclaim. Although patent infringement is the subject of the trial, the opposite company defends itself by means of the counterclaim that the patent is invalid. In these cases, we determine the subject on the basis of the final result. If the trial started originally as an infringement trial, but the result was, due to the counterclaim, that the patent is invalid, we consider this case as patent invalidity. By contrast, if the trial started due to challenging the patent´s validity but the result was that the patent is valid and infringed, we consider this situation as patent infringement.

We also found out whether the company won or was defeated. The situation is also difficult in these cases. For example, if the patent holder sues the opposite company due to infringement of more than one patent, the result could be that one patent is valid and infringed but another one is invalid. We consider this situation as a victory. Within simplification we consider as victory a situation when the patent holder won at least one action.

Other information which is assigned to the company is the actual stock price on the day the judgement was issued and also one day before it and one day after it. For our calculation we also need historical stock prices of the company back to the date of the judgement´s publishing. We also add information about the stock market in which the company is traded, the currency in which it is traded and the index of the given stock market. The table below shows which indexes are used for particular stock markets.

Table 1: Stock markets and relevant indexes

Stock market	Index	Stock market	Index
Nasdaq	IXIC	*Euronext Netherlands*	AEX
Budapest	BUX	*NYSE*	NYA
Euronext Paris	N100	*OMX Nordic Helsinki*	OMXHPI
SIX Swiss	SSIR	*Korea KSE*	KS11
Oslo	OBX	*SIBE Spain*	IBEX
Tokyo Stock Exchange	TOPX	*Milan Stock Exchange*	FTMIB
OTC (Over the counter)	MSER		

The date when the judgement was issued and the result of the trial were obtained from the BAILII database. The stock prices of the company concerned and the market index were obtained from the Thomson & Reuters database. Due to availability of the two indexes – NYA and IXIC, these indexes were obtained from yahoo.finance.com.

3.2 Methodology

To understand the impact of a judgement on the patent holder´s stock prices, we use an event study which measures the effects of economic events on stock prices. Event studies are used in various research projects focused on accounting and finances. They are applied to evaluate the impacts of economic events as well as specific company events such as mergers, acquisitions etc. However, their application is also possible in other fields, for example in law (Mac Kinlay, 1997, p.13).

To examine the impact of a judgement on the stock price, we use the formula for abnormal stock returns (also called excess returns), which allows us to determine whether the company shows returns greater than those which would normally be earned (Damodaran, 2006, p.220).

Our methodology is based on work by Mac Kinlay (1997). Our event of interest is the publishing of the judgement and the event window includes the day the judgement was announced (t), the day before the announcement ($t-1$) and the day after the announcement ($t+1$). If the company was not trade at time t we take the first trading day after the judgement was published instead.

Within calculating the abnormal stock return, the first step is to calculate the *expected return* $E(R_{it})$ of the given company. To estimate the expected returns, we use the market model:

$$E(R_{it}) = \alpha_i + \beta_i \cdot R_{mt} + \varepsilon_{it}$$

where R_{mt} is the return on the market at time *t*; α_i and β_i are parameters which are estimated via the ordinary least square regression and ε_{it} is the disturbance term. This market model assumes that the market return is the only factor which determines the return on stock i at time t and it is very similar to *Capital Asset Pricing model* ($CAPM$). There is only one exception – the $CAPM$ takes as an intercept risk-free rate rather than constant[16].

The regression is carried out by the statistical software package called *Stata*. The market model parameters are estimated over a period of 180 trading days ending 10 days before the event window. The number of trading days differs from one study to another but reference windows of a similar length have been used in recent studies, for instance in Andres *et al.* (2013) working paper. We take the historical stock return of the given company as R_{it} and as R_{mt} we take the return of market index related to the stock market in which the given company is traded, as mentioned above.

We use the following formulas to compute the stock return R_{it} and market return R_{mt} for each of 180 trading days. First we calculate the return in time t where p is the price:

$$Return = \frac{p_t - p_{t-1}}{p_{t-1}}$$

Second, we use continuously compounded returns which means that these returns are used in the log form. Although it does not seem to make much difference, this log transformed returns improve the normality of the return distribution. The formula is the following:

$$R_t = \ln(1 + Return)$$

Having computed the returns we estimate the parameters via the ordinary least square regression. Then we calculate the expected return of the given company for time $t-1, t$ and $t+1$ using estimated parameters and the actual market return.

[16] See http://www.princeton.edu/~markus/teaching/Eco467/04Lecture/04Event%20Study%20Description.pdf

The second step is to calculate the *daily abnormal return (AR)* for each firm. The formula for the firm *i* and the event day *t* is the following:

$$AR_{it} = R_{it} - E(R_{it})$$

where R_{it} is the *actual return* and $E(R_{it})$ is the *expected return* which is described above. The actual return is equal to the actual stock price of the given company in day $t-1, t$ or $t+1$. We can also rewrite it into one equation:

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$$

Having calculated the abnormal returns for all three days, we calculate the cumulative abnormal return for these days. The cumulative abnormal return (CAR) is often used to evaluate the impact of extraneous events on stock prices. The formula for calculating the CAR is the following:

$$CAR_i = \sum_{t=t-1}^{t+1} AR_{it}$$

Having calculated the CAR, we examine significance of the particular events using a t-test. Because we test whether the stock price increases significantly (Hypothesis 1a) or whether the stock price decreases significantly (Hypothesis 1b) we use one tailed t-test.

To evaluate which event is more significant we calculate the *cumulative average abnormal returns (CAARs)*. The $CAARs$ represent the average stock market response to a specific event and are used in studies which have multiple observations of individual events types. The formula for $CAAR$ is:

$$CAAR = \frac{1}{n} \sum_{i=1}^{n} CAR_i$$

where n is the number of companies.

4 Empirical part and results

In this part we examine the data collected and present our results. We discuss their meaning, offer some improvements and confirm or disprove the hypotheses. We also enclosed the tables with the results in detail.

4.1 Hypothesis 1

As mentioned above the first hypothesis is divided into two parts. The first part examines the impact of judgements in the case of a victory and is the following:

Hypothesis 1a: *The stock price of a patent holder increases significantly in case of victory in a trial concerning patent infringement or patent invalidity after the judgement is published.*

From 40 companies in our target sample, 14 companies won the trial. This number represents 35% success rate for patent holders in patent litigation. To determine the impact of judgements we test the significance of the CAR. We take p-value for $H_A\!: mean > 0$ because we expected the positive effect. Table 2 presents the result:

Table 2: T-test for CAR in case of a victory

	$\boldsymbol{t-ratio}$	$\boldsymbol{p-value}$
$\boldsymbol{CAR}$	$t\ =\ $ 2.1037	$Pr\,(T\ >\ t)\ =\ 0.0277$

Because t-ratio is greater than 1,96 it suggests that our result is statistically significantly greater than 0 at the 95% confidence interval. It means that an empirical analysis fails to refuse an alternative hypothesis and we can confirm the Hypothesis 1a.

Table 3 on the following page presents the companies which won the trial and it also shows the dates when the judgements were announced, the abnormal returns for three days of the event window and cumulative abnormal return. We also state the t-ratios for all four returns but any other return except CAR is not significant at the 95% confidence level. However, the t-ratio for AR_t is 1.6703 which is greater than 1.645 and so this result is statistically significantly greater than 0 at the 90% confidence interval. It means that although the stock price reacts

Table 3: Companies which won the trial

Date	Company	Subject	AR t-1	AR t	AR t+1	CAR
28th November, 2014	VRINGO INFRASTRUCTURE INC.	Infringement	0.31961%	12.18151%	-4.74693%	**7.75419%**
20th June, 2014	KONINKLIJKE PHILIPS ELECTRONICS N.V.	Infringement	0.31207%	-0.03665%	-0.03777%	**0.23764%**
28th February, 2014	SEB SA	Infringement	-5.41994%	-0.58051%	1.74541%	**-4.25505%**
30th October, 2013	NOKIA CORPORATION	Infringement	4.53450%	2.47104%	-0.27620%	**6.72935%**
4th July, 2012	APPLE INC.	Invalidity	0.24464%	1.62499%	0.42318%	**2.29282%**
12th July, 2010	W.R. GRACE & CO.-CONN.	Invalidity	3.06690%	-2.16477%	3.44023%	**4.34236%**
27th March, 2009	ELI LILLY & COMPANY	Invalidity	0.41856%	0.61467%	0.33521%	**1.36844%**
3rd March, 2009	NOVARTIS AG	Infringement	0.50444%	-1.75740%	-1.39317%	**-2.64613%**
16th January, 2009	NOVARTIS AG	Invalidity	-0.68405%	1.17228%	1.13742%	**1.62565%**
9th January,2009	EDWARDS LIFESCIENCES PVT, INC	Invalidity	0.24968%	1.46074%	-0.10289%	**1.60754%**
15th October, 2008	DAIICHI SANKYO CO. LTD	Invalidity	6.46008%	4.05876%	-3.05548%	**7.46336%**
7th October, 2008	GEOX SPA	Invalidity	-3.86490%	1.65063%	1.00776%	**-1.20652%**
4th May, 2007	H. LUNDBECK A/S	Invalidity	-0.86240%	0.36997%	2.39792%	**1.90549%**
31st July, 1997	UNION CARBIDE CORPORATION	Infringement	0.35780%	0.54312%	0.07131%	**0.97223%**
		t-test	t = 0,5047	t = 1,6703	t = 0,1207	**t = 2,1037**

to the judgement during the whole event window, the greatest reaction is already on the announcement day.

The second part of the first hypothesis tests the impact of judgements in case of a defeat and is the following:

Hypothesis 1b: *The stock price of a patent holder decreases significantly in case of defeat in a trial concerning patent infringement or patent invalidity after the judgement is published*.

From 40 companies in our target sample, 26 companies loss the trial. This number represents 65% fail rate for patent holders in patent litigation and supported the previous claim that the holder does not want to sue the infringer because of the risk of defeat. Table 4 shows the t-ratio and p-value for CAR in case of a defeat. We take p-value for $H_A\colon mean < 0$ because we expect that the stock price decreases.

Table 4: T-test for CAR in case of a defeat

	$\boldsymbol{t-ratio}$	$\boldsymbol{p-value}$
$\boldsymbol{CAR}$	$t = 0.5905$	$Pr\,(T < t) = 0.7199$

It is obvious from this table that CAR is not statistically significant at the 95% confidence level because its t-ratio is much lower than 1.96. The high p-value signifies that we do not have enough evidence that the mean differs from the hypothetical value which is 0 in our case. Table 5 on the following page shows the companies which were defeated as well as their judgement dates, subjects of the legal dispute, abnormal returns for three days in our event window, cumulative abnormal returns and their t-ratios. However, no returns are statistically significant and so our empirical analysis refuses an alternative hypothesis and we do not confirm this hypothesis.

To summarize, we confirm the first part of the first hypothesis but disprove the second part of the first hypothesis. Because our t-ratio in case of victory is not so much greater than 1.96 we conclude that the judgement is not a dominant factor in affecting the stock price.

Table 5: Companies which lost the trial

Date	Company	Subject	AR t-1	AR t	AR t+1	CAR
22nd May, 2014	RICHTER GEDEON VEGYESZETI GYAR RT	Invalidity	1.03628%	-1.05452%	0.16431%	**0.14606%**
15th May, 2014	ELI LILLY & COMPANY	Infringement	0.42257%	-2.53340%	-0.02591%	**-2.13674%**
5th March, 2014	KENNAMETAL INC	Infringement	-0.07293%	1.07874%	0.36953%	**1.37534%**
15th March, 2013	NOVARTIS AG	Invalidity	-0.44090%	0.08489%	0.46859%	**0.11259%**
7th March, 2013	SAMSUNG ELECTRONICS CO. LIMITED	Invalidity	0.26350%	-1.31111%	-1.56246%	**-2.61008%**
9th July, 2012	APPLE INC.	Infringement	0.44042%	1.35214%	-0.10815%	**1.68441%**
30th September, 2011	NOVARTIS AG	Invalidity	-0.08709%	1.37600%	0.77624%	**2.06515%**
24th June, 2011	CEPHALON, INC.	Invalidity	0.46111%	0.60490%	-0.69265%	**0.37336%**
20th November, 2009	MERCK & CO., INC	Invalidity	1.45251%	3.50986%	-0.89388%	**4.06850%**
10th July, 2009	NOVARTIS AG	Invalidity	-0.80526%	-0.74015%	0.00549%	**-1.53992%**
23rd January, 2009	LABORATORIOS ALMIRALL S.A.	Invalidity	0.43358%	2.88362%	0.10856%	**3.42575%**
19th January, 2009	ELECTROMAGNETIC GEOSERVICES AS	Invalidity	1.87800%	0.87239%	-10.26101%	**-7.51062%**
3rd March, 2008	QUALCOMM INCORPORATED	Invalidity	0.42014%	-2.47397%	0.08802%	**-1.96581%**
6th June, 2007	MERCK & CO., INC	Invalidity	-0.19135%	-0.56186%	0.48574%	**-0.26746%**
10th October, 2007	MONSANTO TECHNOLOGY LLC	Infringement	0.66519%	-0.85794%	2.27343%	**2.08067%**
26th March, 2007	DOCUMENT SECURITY SYSTEMS INC.	Invalidity	-0.53257%	-15.02668%	26.95880%	**11.39956%**
2nd March, 2007	ABBOTT LABORATORIES	Invalidity	-1.30882%	-0.80089%	0.17225%	**-1.93745%**
16th October, 2006	NOVARTIS AG	Infringement	-0.52554%	0.62070%	0.45553%	**0.55069%**
10th April, 2006	CHUGAI SEIYAKU KABUSHIKI KAISHA	Invalidity	0.90436%	3.76392%	-1.33943%	**3.32884%**
8th June, 2005	E-DATA CORPORATION	Invalidity	27.40546%	-28.96569%	-5.33746%	**-6.89769%**
27th November, 2003	MERCK & CO., INC	Infringement	-1.33842%	-0.91244%	2.68181%	**0.43095%**
21st January, 2003	MERCK & CO., INC	Invalidity	0.16277%	-1.00284%	-0.94975%	**-1.78981%**
21st December, 2000	DSM N.V.	Invalidity	-1.72076%	1.05506%	0.44051%	**-0.22520%**
21st July, 2000	KIMBERLY-CLARK WORLDWIDE INC	Invalidity	-0.61154%	-0.41516%	1.15086%	**0.12416%**
4th February, 2000	PFIZER INC	Invalidity	-1.80325%	1.01089%	4.23197%	**3.43961%**
20th August, 1998	BRISTOL-MYERS SQUIBB COMPANY	Invalidity	1.12214%	0.32777%	1.75572%	**3.20562%**

t-test	t = 0,9936	t = 1,1415	t = 0,7057	**t = 0,5905**

However if we look at Table 4 and Table 5 we can find several companies which show either enormous increase of their stock price (e.g. Vringo Infrastructure Inc., Nokia Corporation, Daiichi Sankyo Co. Ltd) or enormous decrease (e.g. Electromagnetic Geoservices AS, E-data Corporation). This observation supports the previous claim that patents are more valuable for some companies than they are for others. There are probably companies in our target sample which appreciate the patent possession more and so they are more involved by the announcement of the judgement in case of patent litigation. We think that it is possible to estimate the importance of patents for a specific company on the basis of its R&D expenses. We expect that the higher the proportion of R&D in relation to the gross profit is, the more important the patents are for the company. It is possible to determine this proportion from the companies' financial reports and then compute the t-test again but for instance only for companies with the highest proportion. Unfortunately due to the long period during which we were collecting the data and due to various events which occurred during this period, such as mergers, takeovers etc., it is very difficult for us to find the financial reports for all companies in our target sample and so we are not able to compute it.

If we look at Table 5 again, we see that the company Document Security Systems Inc. shows an enormous increase of the stock price although it lost the trial. This specific company could mislead our result in case of a defeat. But despite removal of this company from our sample, the t-ratio for CAR is even lower and so the case of a defeat is not statistically significant.

Other option for explaining these results is to compare the probabilities of a victory and of a defeat. We have 14 companies which won the trial in our dataset out of 40 and 26 companies which were defeated. It could signify that the market expects the defeat more probably and so the trial defeat is not an unexpected event. Market could react to this already at the moment when the legal action is taken. On the other hand the victory is less probably and so it is an unexpected event for the market and market reacts not until a juridical verdict is published. This solution could explain why the Hypothesis 1a is confirmed and the Hypothesis 1b is not.

4.2 Hypothesis 2

Our second hypothesis examines whether the stock price is more influenced in case of a defeat than it is in case of a victory. The second hypothesis is the following:

Hypothesis 2: *The impact of the judgement on the patent holder is more significant in case of a trial defeat than it is in case of a trial victory after the judgement is published.*

As we stated in the previous part, the result in case of a defeat is not statistically significant and so comparing of the t-ratios does not provide a relevant result. To compare the effect of a victory and that of a defeat, we compare $CAAR$s:

$$CAAR_{victory} = +\,2{,}01\%$$

$$CAAR_{defeat} = +0{,}42\%$$

Because the $CAAR_{victory}$ is higher than the $CAAR_{defeat}$, our empirical analysis refuses an alternative hypothesis and the second hypothesis is not confirmed. To improve our results we compute $CAAR$ during the time $t-6$ and $t-4$ to determine the abnormal returns without judgement publishing, say in a “normal” period. The $CAAR$ for all companies is $+0{,}96\%$. Although the defeat decreases the $CAAR$, the victory increases the $CAAR$ much more. So we still do not confirm our hypothesis and the hypothesis 2 failed. The reason for this failure is probably the same as is stated in the previous part.

4.3 Hypothesis 3

The third and the last hypothesis tests whether a judgement concerning patent validity has a bigger impact on the patent holder´s stock price than a judgement concerning patent infringement. Our third hypothesis is:

Hypothesis 3: *The impact of a judgement on the patent holder´s stock price is more significant in case of a trial about patent validity than it is in case of a trial about patent infringement.*

There are 12 companies which were involved in the trial concerning patent infringement and 28 companies involved in the trial concerning patent validity. If we compute the $CAAR$ for both cases, we obtain the following results:

$$CAAR_{infringement} = +1{,}06\%$$
$$CAAR_{invalidity} = +0{,}94\%$$

It might seem from these results that the trials concerning patent infringement have a bigger impact on stock prices of the patent holder than the trials concerning patent invalidity. But the results which are stated above are misleading. Considering patent infringement cases, 6 companies out of 12 won the trial and 6 companies lost the trial. Nevertheless, in cases of patent invalidity, 8 companies out of 28 won the trial and 20 companies lost the trial. The proportions of a victory and that of a defeat are different and so we cannot compare the total $CAAR$.

To reduce the inaccuracy, we divide the cases not only according to the subject of the trial but also on the basis of the result. We compute the $CAARs$ again but now for all four cases:

$$CAAR_{infringement,victory} = +1{,}47\%$$
$$CAAR_{invalidity,victory} = +2{,}42\%$$
$$CAAR_{infringement,defeat} = +0{,}66\%$$
$$CAAR_{invalidity,defeat} = +0{,}34\%$$

These results are much more appropriate. We expected the stock price increases in case of a victory and so the impact of a judgement is more significant in case with the higher $CAAR$. The results which are stated above show that the $CAAR_{invalidity,victory}$ is higher than the $CAAR_{infringement,victory}$. This means that the victory in the patent invalidity trial increases the stock price of the patent holder more than the victory in the patent infringement trial does. The same results are obtained in case of a defeat. In this case, the impact of a judgement is more significant in case with the smaller $CAAR$. Comparing both $CAAR$, the $CAAR_{invalidity,defeat}$ is smaller than the $CAAR_{infringement,defeat}$

and so we conclude that the defeat in the patent invalidity trial affects the company much more. The following tables show the companies which are sorted on the basic of the subject of the trial as well as on the basic of the result.

We should also consider the company Document Security Systems Inc. which lost the trial but its abnormal return was extremely positive. Nevertheless this company lost the trial about patent invalidity and so if we cross it out and compute the $CAAR_{defeat,invalidity}$ again, we obtain the following:

$$CAAR_{defeat,invalidity} = -0{,}23\%$$

This result is even lower than the previous one and supports our conclusion more strongly.

To summarize, these results confirm the hypothesis 3 and it is proved that the patent invalidity trials affect the stock price of the patent holder more than those concerning patent infringement.

Table 6: Companies which won a patent infringement trial

Date	Company	Subject	Win	AR t-1	AR t	AR t+1	CAR
28th November, 2014	VRINGO INFRASTRUCTURE INC.	Infringement	Win	0.31961%	12.18151%	-4.74693%	**7.75419%**
20th June, 2014	KONINKLIJKE PHILIPS ELECTRONICS N.V.	Infringement	Win	0.31207%	-0.03665%	-0.03777%	**0.23764%**
28th February, 2014	SEB SA	Infringement	Win	-5.41994%	-0.58051%	1.74541%	**-4.25505%**
30th October, 2013	NOKIA CORPORATION	Infringement	Win	4.53450%	2.47104%	-0.27620%	**6.72935%**
3rd March, 2009	NOVARTIS AG	Infringement	Win	0.50444%	-1.75740%	-1.39317%	**-2.64613%**
31st July, 1997	UNION CARBIDE CORPORATION	Infringement	Win	0.35780%	0.54312%	0.07131%	**0.97223%**

Table 7: Companies which won a patent invalidity trial

Date	Company	Subject	Win	AR t-1	AR t	AR t+1	CAR
4th July, 2012	APPLE INC.	Invalidity	Win	0.24464%	1.62499%	0.42318%	**2.29282%**
12th July, 2010	W.R. GRACE & CO.-CONN.	Invalidity	Win	3.06690%	-2.16477%	3.44023%	**4.34236%**
27th March, 2009	ELI LILLY & COMPANY	Invalidity	Win	0.41856%	0.61467%	0.33521%	**1.36844%**
16th January, 2009	NOVARTIS AG	Invalidity	Win	-0.68405%	1.17228%	1.13742%	**1.62565%**
9th January, 2009	EDWARDS LIFESCIENCES PVT, INC	Invalidity	Win	0.24968%	1.46074%	-0.10289%	**1.60754%**
15th October, 2008	DAIICHI SANKYO CO. LTD	Invalidity	Win	6.46008%	4.05876%	-3.05548%	**7.46336%**
7th October, 2008	GEOX SPA	Invalidity	Win	-3.86490%	1.65063%	1.00776%	**-1.20652%**
4th May, 2007	H. LUNDBECK A/S	Invalidity	Win	-0.86240%	0.36997%	2.39792%	**1.90549%**

Table 8: Companies which were defeated in a patent infringement trial

Date	Company	Subject	Loss	AR t-1	AR t	AR t+1	CAR
15th May, 2014	ELI LILLY & COMPANY	Infringement	Loss	0.42257%	-2.53340%	-0.02591%	**-2.13674%**
5th March, 2014	KENNAMETAL INC	Infringement	Loss	-0.07293%	1.07874%	0.36953%	**1.37534%**
9th July, 2012	APPLE INC.	Infringement	Loss	0.44042%	1.35214%	-0.10815%	**1.68441%**
10th October, 2007	MONSANTO TECHNOLOGY LLC	Infringement	Loss	0.66519%	-0.85794%	2.27343%	**2.08067%**
16th October, 2006	NOVARTIS AG	Infringement	Loss	-0.52554%	0.62070%	0.45553%	**0.55069%**
27th November, 2003	MERCK & CO., INC	Infringement	Loss	-1.33842%	-0.91244%	2.68181%	**0.43095%**

Table 9: Companies which were defeated in a patent invalidity trial

Date	Company	Subject	Loss	AR t-1	AR t	AR t+1	CAR
22nd May, 2014	RICHTER GEDEON VEGYESZETI GYAR RT	Invalidity	Loss	1.03628%	-1.05452%	0.16431%	**0.14606%**
15th March, 2013	NOVARTIS AG	Invalidity	Loss	-0.44090%	0.08489%	0.46859%	**0.11259%**
7th March, 2013	SAMSUNG ELECTRONICS CO. LTD	Invalidity	Loss	0.26350%	-1.31111%	-1.56246%	**-2.61008%**
30th September, 2011	NOVARTIS AG	Invalidity	Loss	-0.08709%	1.37600%	0.77624%	**2.06515%**
24th June, 2011	CEPHALON, INC.	Invalidity	Loss	0.46111%	0.60490%	-0.69265%	**0.37336%**
20th November, 2009	MERCK & CO., INC	Invalidity	Loss	1.45251%	3.50986%	-0.89388%	**4.06850%**
10th July, 2009	NOVARTIS AG	Invalidity	Loss	-0.80526%	-0.74015%	0.00549%	**-1.53992%**
23rd January, 2009	LABORATORIOS ALMIRALL S.A.	Invalidity	Loss	0.43358%	2.88362%	0.10856%	**3.42575%**
19th January, 2009	ELECTROMAGNETIC GEOSERVICES AS	Invalidity	Loss	1.87800%	0.87239%	-10.26101%	**-7.51062%**
3rd March, 2008	QUALCOMM INCORPORATED	Invalidity	Loss	0.42014%	-2.47397%	0.08802%	**-1.96581%**
6th June, 2007	MERCK & CO., INC	Invalidity	Loss	-0.19135%	-0.56186%	0.48574%	**-0.26746%**
26th March, 2007	DOCUMENT SECURITY SYSTEMS INC.	Invalidity	Loss	-0.53257%	-15.02668%	26.95880%	**11.39956%**
2nd March, 2007	ABBOTT LABORATORIES	Invalidity	Loss	-1.30882%	-0.80089%	0.17225%	**-1.93745%**
10th April, 2006	CHUGAI SEIYAKU KABUSHIKI KAISHA	Invalidity	Loss	0.90436%	3.76392%	-1.33943%	**3.32884%**
8th June, 2005	E-DATA CORPORATION	Invalidity	Loss	27.40546%	-28.96569%	-5.33746%	**-6.89769%**
21st January, 2003	MERCK & CO., INC	Invalidity	Loss	0.16277%	-1.00284%	-0.94975%	**-1.78981%**
21st December, 2000	DSM N.V.	Invalidity	Loss	-1.72076%	1.05506%	0.44051%	**-0.22520%**
21st July, 2000	KIMBERLY-CLARK WORLDWIDE INC	Invalidity	Loss	-0.61154%	-0.41516%	1.15086%	**0.12416%**
4th February, 2000	PFIZER INC	Invalidity	Loss	-1.80325%	1.01089%	4.23197%	**3.43961%**
20th August, 1998	BRISTOL-MYERS SQUIBB COMPANY	Invalidity	Loss	1.12214%	0.32777%	1.75572%	**3.20562%**

5 Conclusions

The goal of this thesis was to examine the impact of a judgement on the stock price of the patent holder. We had three main hypotheses which tested the impact of a victory and that of a defeat as well as the significance of the trials concerning patent infringement and patent invalidity. We have found out that the trial victory has a significant impact on the stock price of the patent holder while the trial defeat has not. Nevertheless we had 14 companies out of 40 in our dataset which won the trial and 26 companies which were defeated. It means that the probability of a defeat for the patent holder is higher than the probability of the victory. So the market probably expects the defeat and reacts to the patent dispute already at the moment when the legal action is taken. The defeat is then not so unexpected event while the victory is and from this reason the market reaction in case of a victory is significant.

The second hypothesis, which follows the first hypothesis, examined whether the impact is more significant in case of a defeat than it is in case of a victory. This hypothesis was disproved nevertheless we explained the reasons for it in a previous paragraph.

Our empirical analysis failed to refuse the alternative hypothesis in case of the third hypothesis and so the hypothesis was confirmed. This hypothesis looked into whether the judgement is more significant in case of patent invalidity than it is in case of patent infringement. We proved that the stock price reacts more significantly to the judgement concerning patent invalidity than to the judgement concerning patent infringement.

To summarize, we have found out that juridical verdicts influence the stock price of the patent holder in some specific cases. Our work contributes to present literature about patents as well as to the studies focus on factors affecting the stock price.

This research has some limitations and could be improved by further studies. The biggest problem consists in a low number of companies in our dataset although it is the highest number of companies which met our criterions and which we could obtain from the given database. Within the further studies, it would be better to obtain data from a richer database although this kind of data is often not available for the public. The data availability was the reason for choosing exactly this database.

Our dataset also contains only companies judged before the *England and Wales High Court (patent court)*. The further improvement could consist in including more countries or courts.

We also did not distinguish the industry in which the company does its business. It could be interesting to observe the impact of a judgement on the stock price of the patent holder for instance in the IT or pharmaceutical sector only because, as mentioned above, the patent protection is much more important in specific sectors.

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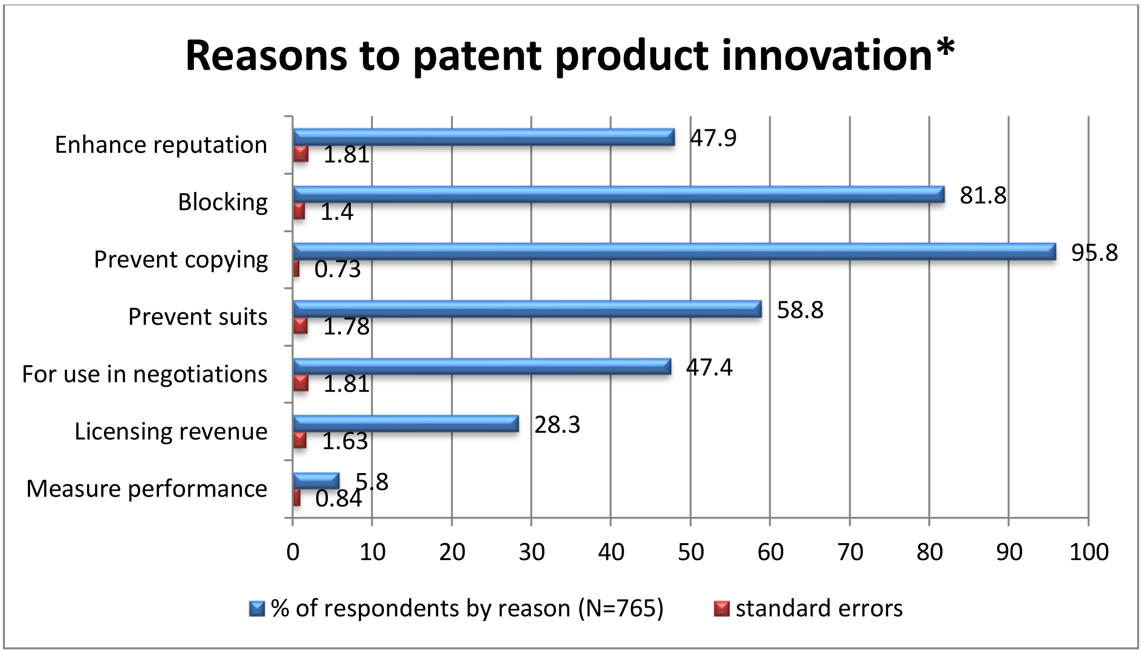
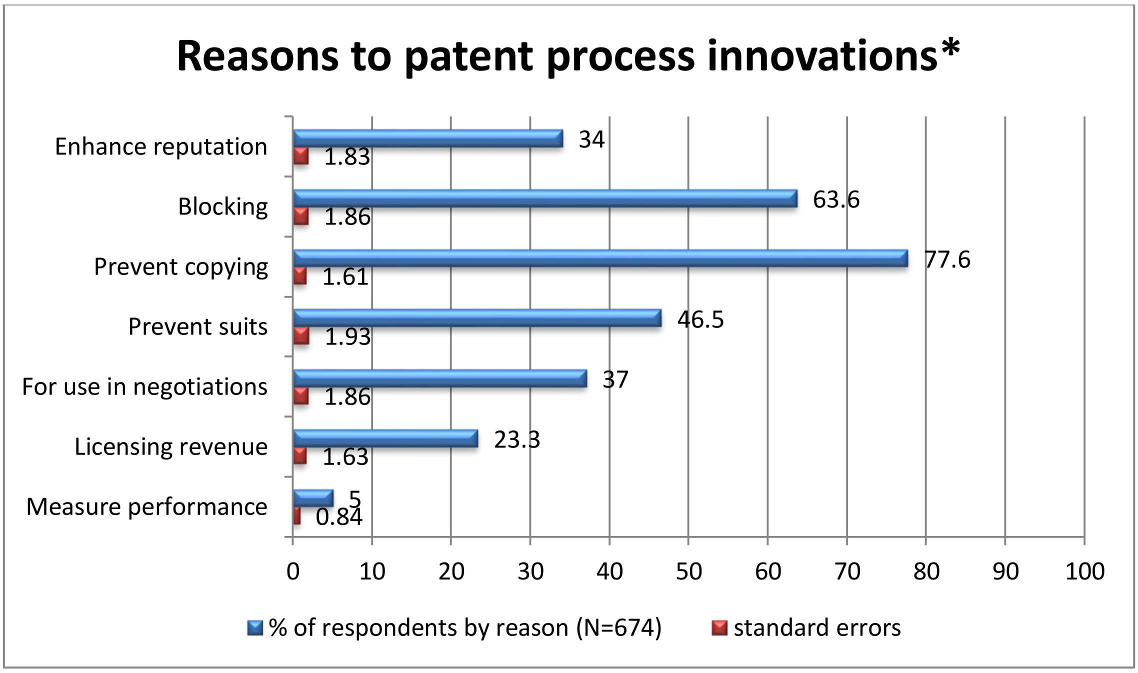
Appendix 1

Figure 2: Reasons to patent product innovation



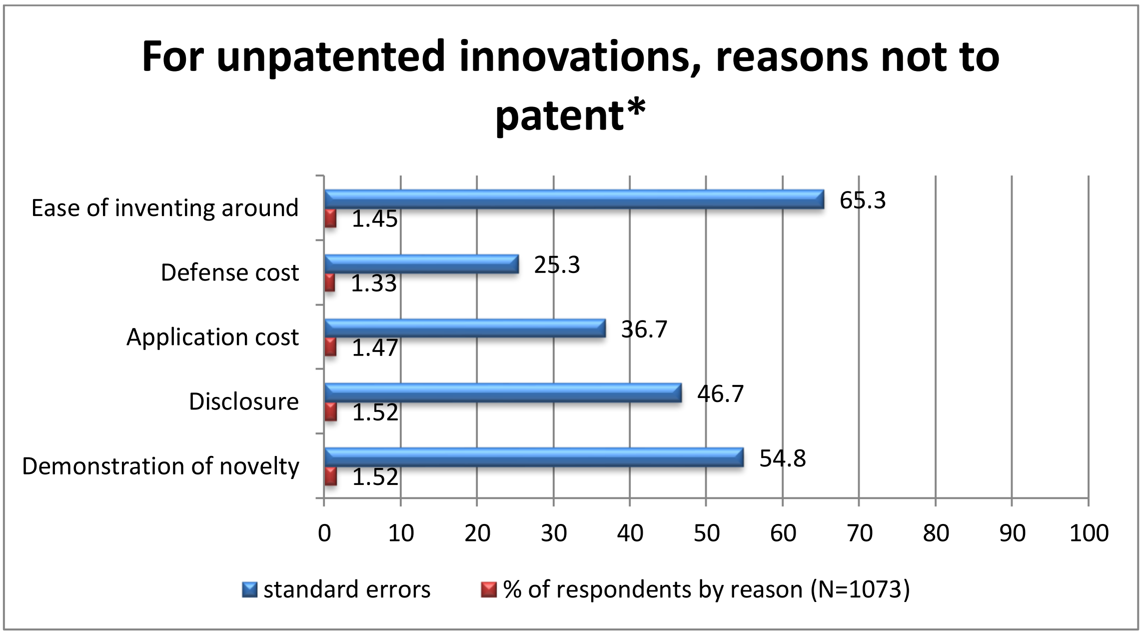
*Source: Cohen *et al.* (2000), Figure 7

Figure 3: Reasons to patent process innovations



*Source: Cohen *et al.* (2000), Figure 8

Figure 4: For unpatented innovations, reasons not to patent



*Source: Cohen *et al.* (2000), Figure 5