

Determinants of Patent Litigation in Germany

by

KATRIN CREMERS

Center for European Economic Research (ZEW), Mannheim

Preliminary Version

March 7, 2003

Abstract:

In this paper a first empirical analysis of the determinants of patent litigation is carried out. Information from suits which were filed in the period 1993 to 1995 at two of three main district courts were used. A control group was constructed by drawing a random sample from PATDPA. The results of the probit estimates confirm earlier findings for the US litigation system in an way that more valuable patents are much more likely to be involved in litigation cases than the average patent. No support is found for the hypothesis that the ability to trade patents and interact repeatedly forces pretrial settlement and prevents patentees from filing suits whereas large firms measured by sales figures do use their bargaining power. The results suggest that larger technological experience measured in patent portfolio size point to a higher degree of confidence and higher filing rates whereas the economic power of a patentee prevents from filing.

address: ZEW, Center for European Economic Research,
Department of Industrial Economics and International Management
P.O. Box 10 34 43, D-68034 Mannheim, Germany
phone: +49-621-1235-297
fax: +49-621-1235-170
e-mail: cremers@zew.de

1 Introduction

The European patent is not in force yet. However, in spite of the heterogeneity of the national patent and enforcement systems and the different interests of the member states recently an agreement has been found to install the Community Patent.¹ For the enforcement of the future Community Patent an European Patent Court will be established.² Intellectual property rights (IPR) have to be enforced by an affordable way in order to make the European system work efficiently. The paper tries to shed some light on the determinants of patent litigation in Germany and throw some arguments and experiences in the debate.

The importance of the original function of intellectual property right as an instrument to ensure the inventor to recoup at least parts of the investment in research declined during the last 20 years. Other ways of appropriation such as secrecy and first mover advantage are often much more successful.³ Additionally, protected inventions help to build knowledge stock which is necessary in many technology areas to keep pace with the technological progress.⁴ Nowadays, patents are strategic weapons and so is the enforcement of intellectual property right. At least in the fast changing areas of technology the patenting behavior has a signaling character which shows new roads of development and sets the claims of technological competition.

More strategic functions of patents are widely recognized as to signal a potential in assigned fields of technology or to secure former patents by inventing around, building a patent stock which can be used as bargaining chip in negotiations about new technologies and mergers. Additionally, licensing and cross licensing evolved into a large scale profit source of innovative firms with capacity constraints.

Enforcement of IPR includes a successful application and granting procedure at the patent office, and may include the resistance against possible opposition to a granted patent, the battle during nullity suits and finally the potential litigation suit in front of a district court. The main overview and discussion about the different hypotheses on the determinants, derived from theoretical work and empirical evidence so far is given by

¹See Council minutes of the 2490th Council Meeting on Competitiveness, Brussels, 3 March 2003 on <http://uc.eu.int>

²A variety of questions are unclear in that sense, such as the language of the statement of claims and the oral hearings.

³See Cohen et.al. 2000 for survey evidence.

⁴See e.g. Hall and Ziedonis, 2001

Cooter and Rubinfeld (1989). A detailed empirical investigation of those determinants has been done for litigation cases at U.S. federal courts by Lanjouw and Schankerman (2001a), (2001b). They found a close relationship between the probability of litigation of a certain patent and its characteristics regarding the value of the innovation and the characteristics of its owner. So far, research revealed a close positive relationship between the value of an IPR and the probability of disputes about validity (opposition, nullity suits, license arguments) and infringement debates (litigation suits).

Starting this analysis from the goals and functions of patenting we then must refer to the goals of litigation. If patenting has a strategic character then enforcement of patent rights includes strategic aims as well. Patenting is a costly process, enforcing the granted property right against infringement is again associated with costs, namely time and expenditure of the legal process. Furthermore, the uncertainty during duration of the dispute is linked with opportunity cost. The real litigation rate is about 1% of all patents in force at the point of time the case is filed. This seems quite low. However, large differences between various fields of technology are observable. In this paper it is shown that furthermore only economically important patents are worth of being subject of litigation. It is expected that the probability of litigation will be higher for more valuable patents. It is well known that the distribution of the value of patents is highly skewed to the left hand: Most of the patents have only little value whereas few patents are of great value. It is therefore not surprising that the number of litigation cases is small, compared to the total number of patents in force. However, the rate of litigation remained constant even with growing application and granting numbers.

If an infringement is detected and the patentee is willing to argue with the infringer about the intellectual property right then it should come to a settlement. From the game theoretic approach it is clear that under symmetric and complete information the parties should come to a settlement solution (Bebchuck, 1984; Meurer, 1989). This result would minimize the cost of the dispute, maximize the profits from the invention and optimize the compensation payment for both parties. If this would be optimal the question arises why nevertheless at least one patent or utility suit is filed per day in Germany.

The most comprehensive studies are carried out by Lanjouw and Schankerman 2001a, 2001b. They investigated the main determinants of patent litigation suits in the U.S. and found that high valuable patents are more likely to be involved in patent litigation suits. Furthermore, they included characteristics of the patent holder in the analysis as well. The opportunity of the potential litigants to interact and trade the patents before

it comes to a suit in their sample lowers the probability of being litigated.

A new and unique data set of 715 IPR cases filed at two of the three main district courts in Germany will give new insights in the course and in outcomes of litigation disputes at court.⁵ Within these patent and utility suits 906 patents were subject of litigation. The data was combined with patent information from the German Patent Office (DPA) and the European Patent Office (EPO) located both in Munich. Furthermore a control group of 6144 German patents randomly drawn from the population of all patents ensures a comparable investigation and gives the possibility to develop a system of determinants of IPR litigation in Germany. The data set used here includes known value correlates as well. Citation data are created from the universe of all German patents applied for in the relevant time period. Citations received ("forward citations") by the patent are considered as a signal that this patent is of certain importance for the technology developed afterwards.

Evidence is found that valuable patents are much more often litigated than less valuable ones. Using value correlates tested in prior work turned out to have a positive impact on the probability of litigation. In this way the results confirm those of Lanjouw and Schankerman (2001b). The market and technological conditions are not easy to interpret. Technological stock in the sense of high portfolio sizes at the time of filing lead to a higher propensity to file suit instead of lower them because of the ability to interact and trade the patents. This contradicts prior results for the U.S. But the strenght of a patentee to threat credibly to file a suit , measured in absolute size has a negative impact on the sample filing rate.

The paper is organized as follows. In the next section the German litigation procedure is sketched. Following the main studies in this field of research a pattern of determinants of IPR litigation is derived in section 3. Section 4 contains the description of the data base and the construction of the control group. Empirical results given in section 5. Section 6 concludes with a discussion of the results.

⁵There are special chambers at district courts which are exclusively responsible for dealing with suits filed in order to solve IPR problems. They are regionally spread in order to give all possible plaintiffs the chance to file a suit in the surrounding area of the infringer.

2 German System of Patent Litigation

2.1 General issues

Patents valid in Germany can be subject of litigation at a German District court. This is the case for all patents which were filed with the German Patent Office, were filed as PCT⁶ patents, and for patents which were applied for at the European Patent Office with Germany as designated state. A special feature of the German procedure is the duality of the system. Questions of validity, such as nullity suits, cancellation of utilities and revocation of patents, are treated at the Federal Patent Court as well as appeals against decisions on opposition. Opposition itself will be filed at the patent office. Disputes about infringement of granted property rights will be brought before district courts in the first instance. They are independent of the validity procedures.

The jurisdictional responsibility for patent infringement cases is very concentrated. German law gives jurisdiction only to 11 district courts to deal with cases upon its merits of patent infringement. However, there is a even higher concentration of intellectual property right cases filed. The district courts in Duesseldorf, Munich and Mannheim cover more than 80% of all cases. Hamburg, Frankfurt and Braunschweig can be considered as experienced courts as well even though the number of cases filed is fairly low. This pattern of concentration is possible because the plaintiff can sue either at the place of the infringer's domestic place of business or in the jurisdictional area where the infringement took place. Differences in technical qualification and detailed experiences of judges at district courts are other reasons for the concentration on few courts.

Administrative details of the litigation procedure before court in Germany are necessarily to be described in order to put them into relation to the question of what determines the litigation probability. The action for intellectual property right cases starts with issuing a statement of claim which states the names of the parties, the details of the infringing action and the particulars of the property right. It also includes the relief a plaintiff is seeking including all costs and damages. The court serves the statement of claim to the defendant. Afterwards, procedures can differ from one district court to another regarding the time table of actions which is, too, a reason for forum shopping.

⁶Paris Community Treaty

2.2 Course of the case

The length of time of the case is strongly correlated with the number of instances and within those the number and length of formal legal steps taken by the parties.⁷ Thus, in order to interpret the time as an indicator for the effort undertaken to enforce this special IPR, the time per legal step should be used. Even time per instance is not suitable because there are many administrative hurdles which just take their time. Time spent per action such as answering the letter of claim is more reliable since they mirror the effort of money for attorneys, translations and so on. However, it can also be an indicator for the complexity of the infringing action or the complexity of the IPR itself. In cases where either of the parties needs a lot of time to present their arguments or the court asks for more information about the issue in question stretching the case until the other party gives up can be a profitable strategy. For requests of preliminary injunctions the duration of the suit is expected to be much shorter than it will be for a regular case. If a patent was involved in multiple litigation suits during the period 1993-1995, the total number was also counted, as this may reflect, too, the importance of the patent or utility.

Suing the potential infringer can take on various legal forms such as Step-Case (Stufenklage), Amount-Case (Betragsverfahren), or Cross-Case (Widerklage). Those differences are mainly due to jurisdictional characteristics. A legal procedure at a German district court schedules first the procedure of finding evidence and after a judgement by default a writ of inquiry. One single suit deals with the whole set of claims, starting with finding evidence for the infringement, seeking information about and removal of the infringing product or action and finally requesting an amount of compensation or indemnity. Such a case is called a "Step Case". However, the writ of inquiry and the determination of the amount of indemnity to be paid can be subject of a separate case - a so called "Amount-Suit". Another special case is the "Cross-Suit" where a former filing of a suit is answered by another filing of the former defendant. A cross-suit again can be a step-case or an amount-suit. Whereas a party filing a step-case follows a maximum strategy to reach at least some of the claims, a party which first tries to get the infringement stated and than files an "Amount case" is more of a risk averse type.

The matter of controversy can be the validity of the right in certain circumstances, the

⁷In this context, instance is the formal name of the whole process at the district court (first instance), superior district court (second instance or appeal), federal court (third instance or second appeal). A formal legal step is used for actions which also have formal rules such as filing a letter of claims, requesting an abatement of proceedings, the oral hearing e.g. correspondence, sending in necessary documents.

method of interpretation of the intellectual property right. Some suits are mainly filed in order to calculate and enforce a certain amount of damages.

Although this study investigated only patent and utility infringement cases, legal forms and matter of controversy can differ as well as the number and kind of claims set up in the letter of claim. Subject of a legal dispute can be:

- breadth of the IPR in license disputes
- interpretation of the IPR
- infringing action
- type of infringement

There is a strong relationship between the last two points. An "infringing action" is a behavior of the defendant which potentially but not necessarily leads to an infringement. This *infringement* can be *of a certain type*. After the matter of controversy is stated, the particular claims of the plaintiff to the defendant show the details of the dispute.

The claims set up in the statement of claims filed by the plaintiff clearly reveal the matter of controversy. By law only those claims will be discussed and finally (Auskunft, Unterlassung, Schadensersatz) considered in the judgement. The decision of the judges on the matter of controversy reveals which claims are declared valid and which are not. The share of claims requested and finally declared valid reflects on the one hand the interpretation of law by the judges and on the other hand the objective seriousness of the infringement. Following those, the value of damages will be stated, if it was claimed for. If the letter of claims contains a demand for indemnity then one of the three methods of calculating it is used: License analogy, the potentially lost profit of the patentee and the real loss the patentee experienced. In many cases, license analogy is used to calculate the amount of indemnity payable by the losing party.

Similar to the requested and actually paid damages the cost of a litigation case show the value of the case for the parties. The court sets the jurisdictional value of the dispute which depends on the number of IPR claims under dispute. For the court costs, there is a strong relationship between the jurisdictional amount and the costs per court action (hearings, judgement). Attorney costs are as well related to the jurisdictional amount by a schedule of fees. If it is controlled for this amount, the costs tell a lot about the

effort the parties undertook to defend the IPR or, in the case of the defendant, to litigate it. Even if there are only chargeable costs to be paid or reimbursed, those expenses are strongly correlated with the importance of the patent for the parties. Within the German jurisdictional system the British rule says that the losing party has to bear all chargeable costs of the winning party and its own expenses too. Therefore, cost variables tell something about the result of the case and who received the valid claims.

3 Analytical Aspects

In order to investigate the phenomenon of patent litigation one has to look at the behavior of patenting first. At the beginning, the assumption is made that patents and utilities are only instruments which ensure the patentee of a temporary monopoly. Thus the total costs of litigation are the loss during the infringement (monopoly profit minus duopoly profit)⁸ plus the cost of enforcement (legal costs). Those losses can be accompanied by indirect costs of lost market shares and first mover advantages.

But the aim of patents and their function have been changing over the last decade. As the empirical evidence shows, the original function of patents as a protection instrument is not of high importance because of less efficiency compared to other means of protections.⁹ Nevertheless, the patent activity has been rising in almost all large countries. For the U.S., a number of studies revealed that in fast growing industries patents have been used to build patent portfolios in order to increase bargaining power in merger negotiations or in license and cross-license agreements.¹⁰ This strategic patenting is especially effective in technology areas with cumulative innovation structure. Chemical and drug industries are not heavily dependent on cumulative research.¹¹ However, from interviews with R&D managers in the chemical industry it was obvious that even the absolute number of patents is important in cross-license negotiations. License negotiations are regularly on the time table of meetings of R&D managers of different firms. Without any weighting or counting for different values, the pure "height of the pile" of patents and utilities is compared.

⁸During the time of infringement the patentee and the infringer deal with a duopoly situation.

⁹Survey evidence for North America is shown in Cohen, Nelson and Walsh, 2000.; and a study of Janz et.al., 2002 confirms this results for German manufacturing and service firms as well.

¹⁰Hall and Ziedonis, 2001; an overview in Gallini, 2002

¹¹See Shapiro (2001), Lanjouw and Schankerman (2001a)

Enforcement of patent rights is part of the strategic patenting decision. Without enforcement the patent is useless in the case of detected infringement. First, the (potential) infringer should have taken into account the trade off between the benefit of using the patented invention and the risk of being detected and sued. Second, the patent holder after discovering the infringement has the opportunity to sue the infringer, to settle without filing a suit or to leave as it is. A decision for one of those alternatives depends on the expected probability to win, the expected stake of the suit and therefore depends on the expected value of the IPR involved.

If the patentee and the infringer are not able to settle, filing a suit is one alternative of solving the problem. A filed suit in patent infringement arguments is a result of a failure in pre-trial negotiations about a solution of an infringement. Assuming a rational behavior, the patentee and the infringer will balance the expected costs and benefits of a legal argument before court. Because expectations differ among the litigants, intrinsic and individual aspects of the parties and patent characteristics are of importance.

Both litigants face remarkable costs during a IPR suit. Obviously, the court costs have to be covered. They depend on the number of claims involved within the legal dispute and which are named in the letter of claim. Attorney fees and costs of witnesses and experts will take regularly a much higher part of the total legal expenses. Additionally to the measurable legal costs the parties have to consider that there are costs of uncertainty and lost market position during the period of infringement. Those indirect costs can be valuable as well and can be accompanied by a loss or gain of reputation depending on the outcome of the case.

Benefits in case of winning the trial are the prolonged innovation rent for the plaintiff respective the patentee from exercising the patent right. Paid indemnities can compensate for lost profits during infringement. The reputation in potential repeated litigation trials can be raised by the victory in one case. It can deter further litigation and thereby market entry. These benefits depend considerably on the value of the intellectual property right. It follows that the intrinsic value of the patent or the utility is one of the main determinants driving the probability of litigation suits.

The rationale of a potential litigant is to maximize the profit of infringing the patent. Expected profits may be the innovation rent in the "duopoly". The risk of being detected and sued leads to the uncertainty of a trial and all potential costs which are linked to it. In the case of a judgement against the infringer probably indemnities have to be paid to

the patentee. Those depend on the lost profits or the forgone license fees. Both again depend heavily on the economic value of the intellectual property right.

At this point the assumption is made that the value of a patented invention is the private value to the owner or to the potential infringer. Of course the owner puts a different valuation on the patent than the infringer will. But those differences are due to the quasi-monopoly a patentee has and a duopoly an infringer creates by his infringement. Additionally, the patentee has to consider the cost of R&D into the net valuation. Idiosyncratic characteristics of the parties will lead to diverging expectations and diverging valuations of a patent. But the general value in the sense of "importance" of a patent within a certain technological field is independent of idiosyncratic differences. Additionally, the value of the patent is used in the sense of importance. The research so far stated indicators which reveal stable correlations to the value of the patent right.¹²

Forward citations are mainly a measure for the importance of the protected invention. If an IPR has a large number of forward citations it can be regarded as a basic patent on which numerous succeeding patents build. Backward citations are also often used as a correlate for patent value. The number of citation references used as backward citations reflects which prior patents the patentee wants to refer to. They set up the neighborhood of the invention. During the examination procedure at the patent office the examiner will finally set the references to prior patents in order to delineate the scope. The effect of backward citations on the probability of litigation cases before courts is not unambiguous. Interpreting the backward citations as a value correlate there should be positive relationship between them and the likelihood of litigation. However, the examination procedure should result in a strong patent where the number of references show the differences to other patents. Harhoff and Reitzig (2002) found no significant correlation between the citations a patents receives at the European Patent Office and its likelihood to be involved into an opposition case.

The value of the IPR as such, the strength of the legal instrument, is mirrored also in the variable **opposition**. If a patent withstood an opposition against its granting than it can be regarded as an valuable invention and as a strong intellectual property right.¹³ One could argue that a strong property right would deter infringement and therefore litigation. If a patentee defeated once an attack he would fight a second time as well. It

¹²Harhoff, Scherer, Vopel (2001)

¹³For empirical evidence see Harhoff, Scherer, Vopel (2002), Graham et. al. (2002), Harhoff/Reitzig (2001)

is not clear if this effect will dominate the value effect of an opposition.

The expected value of filing depends not only on the value of a patent per se but also on the conditions the market and the innovative climate to enforce the intellectual property right and the ability to go through trial. New technologies are accompanied with a high degree of uncertainty. In those fields claims are not safe and there is no experience in suits which makes it more complicated to predict the decision of the court. Settlement will be harder to reach. Lanjouw and Schankerman (2001b) argue that the opportunity to enforce settlement will lead to less official disputes at courts and to more settlement before. This will be reinforced if new firms in will face incumbents with diverging expectations of winning probabilities and of the stakes Technological competitiveness or crowdedness is measured by the number of patents in the field of technology the infringed patent is assigned to. This characteristic of the innovative climate is probably of influence for the patenting behavior and therefore for the litigation behavior as well. As Lerner (1995) shows for new Biotechnology firms there is an observable trend to patent in subclasses of the U.S. technology classification which are not crowded by incumbents in this technology. Entry into new markets will be much easier in those technology classes and litigation less likely than in more crowded areas.

Finally, the patentee's specific characteristics leads to more or less bargaining power in pre trial negotiations to prevent litigation suits . Large firms with a strong financial background are able to threat a credibly to stand the trial. It follows that large firms will be less often involved in litigation cases. Additionally, a large portfolio a firm holds indicates a high technological competence. Following the argumentation of Lanjouw and Schankerman (2001b) and Hall and Ziedonis (2001) a high portfolio of patents will lead to a lower probability of litigation because of the bargaining chips they can put into the licences negotiations.

4 Data

4.1 General data issues

Empirical studies of intellectual property rights often rely on patent data. National patent offices and the European Patent Office provide a wide range of data bases of patents, utility patents, trademarks and copyrights applied for at their offices. Within the last years

the contents and the quality of these data bases improved considerably as well as their accessibility via computer and internet. Commercial providers such as Fachinformationszentrum (FIZ) Karlsruhe¹⁴ supply excellent research facilities for companies to monitor their markets, to keep up with the latest scientific and technological developments, and to check the opportunities of their own patents. In general, those data bases include a variety of information about the life of patents or other kinds of intellectual property right. Furthermore, data for a long period of time is accessible by now. Normally, the data files contain information about application date, the description of the claims, the IPC and information about the applicant, data on bibliographic events such as granting, opposition against the granted patent, payments of the renewal fees and lapsing into public domain are also available. Citation data are used in investigations of knowledge flows among firms or industries. The most interesting information of forward citation is accessible by inverting the information matrix.¹⁵

In contrast, within those data bases information on the enforcement of patent rights is only included if opposition against a granted patent or a nullity suit turned up. Afterwards, the patent/IPR is a civil right and has to be enforced through civil law. Information about the enforcement of IPR after infringement took place is rarely available.¹⁶ One exception is the Patent History CD-ROM produced by DERWENT using information provided by the U.S. Patent and Trademark Office (USPTO). Whenever a patent is involved in a case filed at a U.S. Federal Court this court is required to report this case to the USPTO. However, the report is normally not complete.¹⁷ For Germany there is no comparable data source available. Even at district courts with specialized chambers to deal with IPR litigation no systematic information about all suits is accessible. In order to get new insights into the process of intellectual property right litigation in Germany a new data set was developed.

Litigation in this paper is regarded as a legal argument before court. The process starts by filing a letter of claims, a correspondence among the parties and the court where

¹⁴Fachinformationszentrum (FIZ) Karlsruhe is a non-profit organization set up to provide information and information services for academic and industrial research and development, as well as for business and administration.

¹⁵A large data base which includes a weighting scheme for truncation correction has been constructed at the NBER. See Hall, Jaffe, Trajtenberg, (2001).

¹⁶During the last 5 years, some of the case records have been scanned and stored in an electronic format. But there is no systematic data base, yet. To get a systematic database on litigation the collection work was heavily built on the methodology of Stauder, 1989.

¹⁷See Lanjouw and Schankerman (2001a).

arguments and opinions are exchanged. If the parties cannot come to a settlement after an oral hearing the court renders a decision. This can be in favor of the patentee (plaintiff) and thereby confirm the infringement or in favor of the defendant. The costs will be paid by the losing party.

The following section describes the collection of the information, the structure of the data set and the variables derived. Furthermore, data bases of the German Patent Office and the European Patent Office which were used to complete the information on the patents and utilities involved in those IPR suits are introduced. The control group was also drawn from these data bases. In case the parties were no individuals but companies, additional information on size and industry were matched from firm data bases such as the Mannheim Innovation Panel (MIP) and the data bases of Creditreform.

4.2 Data collection

All large district courts with those specialized chambers for IPR suits¹⁸ were asked for access to the archives. After an intensive correspondence two of the three most important district courts –Duesseldorf, Mannheim– agreed to give access to the written case records. Since the archives contain only records of finished cases, we chose the years 1993-1995 of filing at the court. These cohorts are likely to catch as many finished cases as possible¹⁹ and are not too far in the past in order to match comprehensive information about the parties from other data bases. In Mannheim the data collection was started in May 1999 and completed in July 1999. In Duesseldorf it took from October 1999 until February 2000.

Even though the chambers at the district courts are specialized, there is a wide range of different legal arguments treated at those chambers: disputes under general contracts, license suits, IPR cases including patents, utilities, copyrights and trademarks. For IPR cases not only infringement is a subject matter within legal disputes, all kinds of contract issues have to be decided as well. Therefore, the identification of all patent and utility infringement cases out of all cases filed at those chambers was necessary. For further research the legal rights of patents and utilities are chosen because they are relatively strong compared to trademarks and copyrights and they identify technological inventions based

¹⁸Mannheim, Duesseldorf, Munich, Frankfurt

¹⁹Stauder (1989) found that more than 60% of the patent and utility cases are finished within their second year and that 95% after 6 years. For the first instance around 1 year is necessary.

on R&D efforts. The procedures of legal disputes about infringement are very similar for both types of property right. The line of subject at the front page of the files served as the main indicator. We searched for words such as "patent", "patent infringement", "utilities", "injunction", "preliminary injunction", "presentation of accounts", "license agreement", and "employee invention". The first identification revealed about 950 cases of infringement of patents and utilities. Reading the statement of claim and the defendants answers revealed whether the subject of matter was really an infringing action. For the subject of investigating intellectual property right litigation only clear cases of patent and utility infringement both with and without asking for a preliminary injunction and cases of license infringement where the matter of protected invention lead to the dispute over license fees were kept. After removing suits regarding disputes under license contracts, legal arguments about payments of employees' inventions and other cases with patents and utilities involved but where no infringement took place, 715 infringement cases were left within the sample. Those could be differentiated between pure patent infringement suits and challenge suits. According to the dual system of treating property right disputes, challenge suits deal on the one hand with license disputes where patent claims and license contracts are in question and on the other hand with unauthorized warnings and advertising with patent rights which are not actually covered by the claims.

For the second step of the detailed file investigation, 715 cases of pure patent or utility litigation had to be screened accurately. The correspondence of the parties, including the statement of claims and the response of the defendant was checked. From them information about the requested claims and the arguments of the parties evolved. The court decisions and rulings revealed the outcome and the costs of the cases.

The information which was extracted from the written case files can be divided into three main categories: the course of the suit, the parties, and the involved patent. Within the first part, a brief description of the information about the stages of the infringement case; the dates of the filing, the oral hearing and the ruling reveal this information. For almost all cases the outcomes are reported including the outcomes of the possible first and second appeal. In order to investigate the relationship between the value of the patent right and the effort for its enforcement the cost figures are very important. Those costs consist of court costs and costs for legal services by attorneys.²⁰ Additionally, paid damages are added to the costs. The second part of information is about the parties involved in the trial. Their names and their locations are observable. It can be expected

²⁰See Lanjouw and Schankerman, 2001.

that at least one party is located within the district where the court has its jurisdiction. Within the third part, information on the patents reveals the age of the patent at time of filing, as well as the field of technology (IPC). Of course, the data on the applicants and the inventors is available.

The availability of information about the patents from the court records differs between the two courts. In the Mannheim records, normally the patent document or the disclosure is included as well as witnesses' documents and expertises. At the district court in Dueseldorf only the statement of claim, the following correspondence between the parties and the court, and the judgement of the court are kept in the permanent files.

4.3 Public Data

In order to complete the information about the patents involved in the dispute, data from the German Patent Office (DPA) and the European Patent Office (EPO) were added. Information on application dates, granting dates, IPC-Classifications and on the applicants and inventors are available from the data bases PATDPA and EPIDOS: PATDPA is the data base of the German Patent Office. and lists all patent applications with all information included in the patent document. Additionally, all bibliographic data such as fee payments, oppositions and their results, changes of the patentee, and the lapsing of the patent in the public domain are visible in this file. PATDPA contains around 2.5 million patents and utilities. It covers patent data from 1976 until 1998. Beginning from 1978, the electronic form contains reliable information on patents and utilities. But still the information on the renewal data is not complete. A similar data base ELPAC is available at the European Patent office. It includes all patent applications made at the EPO with roughly the same variables and 1.2 million patent applications since 1978. The important information about the citation done and citations received within later patent documents could be extracted by searching the whole databases.²¹

Since an official business register is not available for Germany, the complementary information on the corporate parties was added using the data base of the most important German credit rating agency, the Verband der Vereine für Creditreform (Creditreform data) in Neuss. A merge of those data with the litigation data shows a more detailed picture of the involved corporations. Industry variables according to the German WZ93

²¹A detailed description of the creation of the citation data file and the correction for truncation following Hall et.al. (2001) is given in section ??variables].

industrial classification were added as well as firm size measured by the number of employees.

The ZEW Centre for European Economic Research manages two different, but complementary innovation surveys. The Mannheim Innovation Panel (MIP) and the Mannheim Innovation Survey in Service Sector (MIP-S) mainly cover a representative sample of companies from the manufacturing sector and from the service sector. Every year a core set of questions on innovation behavior, expenditures, and innovation output is sent to 10.000 corporations and on average 2200 answers are collected.

4.4 Construction of the control group

In order to investigate the differences between patents litigated and not litigated a control group of patents is necessary. Therefore a matched data set from the population of all German patent application from 1978 to 1995 has been created.

The sample has been stratified by the year of application. For each patent in the group of litigated patent 7 matched patents from the universe of German patents were chosen randomly. The matched patents were not subject of a legal litigation suit, had the same year of application and were still in force in 1993 (the first year of filing within the litigated group).

It seemed to be important to oversample the control group because no additional stratification criterion was used. The factor 7 was used to ensure that all cells were filled, that no technology classes were empty and to avoid a bias in relation of foreign and domestic patentees.²² It should be mentioned at this place that patents have the same legal power regardless if they were applied for with the German or with the European Patent Office and designated to Germany. The difference is only the way of seeking patent protection. Finally, the reference group of unlitigated patents consists of 6144 German patents. For those all relevant variables including citation data and information on patentees and technology fields are contained.

²²There is still a small probability that the patent chosen for the control group was subject of a litigation dispute at one of the other 9 district courts. But this is fairly small that it can be neglected.

4.5 Variables

4.5.1 Patents

As mentioned above, within the records of the Regional Court in Mannheim the patent files are normally included. From those files, information about the patent could be retrieved, such as the name of the applicant, IPC-classification, date of application, of granting, publishing and more. For the Duesseldorf records, the statement of claims contains most of this information, but often the records are incomplete in this matter. A patent number, either from the EPO or the DPA, was accessible in 95% of the suits. In any case where those numbers were available the information was updated by using the PATDPA data base or the ELPAC data base from the DPA and the EPO, respectively.

Ownership A set of information about the applicant such as name and address was constructed. A dummy variable (CORP) indicates if the patentee is a corporation or an individual. Additionally the country of the patentee is used to identify domestic and foreign patentees. For foreigners a further classification is made into foreigners from the US (FUS), Japan (FJP) and countries from the European Union (FEU). The probability of litigation should be higher for Germans of course and within the foreigners for European patentees because of the lower expected costs.

Portfolio size This number is created for all patentees who applied for patents at the German Patent Office (PF). It is the sum of all patents one patentee applied for until the year of filing the suit. This number is drawn from the PATDPA. At this point the portfolio which is in force and valid for Germany is calculated. Patents with an application at the EPO with designated state "Germany" were also included within this number because they become regular German patents after granting at the EPO. There is not yet such a thing as a "European Patent". Since the portfolio size should be higher for domestic patent holders an interaction term with the domestic and foreigner status was used as well (DPF, FPF respectively).

Opposition Either from the written records or from the patent office's data bases, the information about the opposition status is taken. A Dummy variable indicates if such a procedure had been filed. (OPPOS) An opposition is an official act at the patent office in order to declare the patent invalid or to amend it. If the potential infringing party has opposed the patent before the suit has started then it seems

likely that this party has an interest to use the invention itself and not to leave the right to the patentee. One reason for such an interest could be that the opposing and then infringing party has made a similar invention which it wants to file at a patent office. Another reason might be that the expected value of the invention protected by the patent or utility in question is so high that it is worth to oppose and later infringe the patent to endure at least partly some of the payoffs of the protected innovation.

Citations For a detailed analysis of the citations received and citations made (hereafter "forward citations" and "backward citations", respectively) the patent data base of the PATDPA was completely searched. The patent applicant suggests the prior patents which should be included as backward citations (BC). During the examination of the application the examiner of the patent office decides finally which patents were kept as backward citations. Forward citations are obtained the other way around, by counting the number of subsequent patent applications which cite the investigated patent as prior invention. Hall, Jaffe and Trajtenberg (2001) found for American patent citation data that some of the backward citations reach very far in the past, "[...] some even over a hundred years!". On average, 50% of the citations referred to patents which were 10 years older than the citing patent, 20% were 20 years older, and 5 percent were at least 50 years older than the citing patent. Therefore, obtaining from the documents the forward citations even for the oldest patents available in the used data set here, which were applied for in 1977, it is not sure that the full number of citations received is documented in the PATDPA. To correct for this truncation bias the method of "fixed effects" as described in detail in Hall et. al. 2001 was used. The underlying assumption of this approach is that all differences in the citation intensities over time are due to artifacts. Citation behavior does not change over time and the number of forward citations per patent and per cohort is constant.²³ Year effects are removed by dividing the number of forward citations of a patent by the mean of forward citations of this cohort. For the analysis this weighted forward citation (WFC) was used. The citation information of the EPO could not be included into this investigation because of a lack of this truncation information.

Family Size PATDPA contains a set of variables which reveal family information. Dif-

²³A cohort contains patents with the same year of application.

ferent to the variable "designated states" at the EPO the variable "Family Member Application Country" includes not only the European Community country but the countries where patent protection was sought for one invention. This conforms to the definition of family size used by Putnam (1991). After removing double counts this variable was directly obtained from PATDPA to be used in this analysis (FAMSIZE).

Way of seeking protection There are three different ways of seeking protection in more than one country. A patentee can apply in each country at the domestic patent office. The European Patent Office provides protection up to the number of member states of the European Patent Convention by filing just one application. The PCT (Patent Cooperation Treaty) application can give patent protection for all member states of the PCT treaty. In a study of Thumm (2000) the "road of application" is used to indicate the importance an invention has for the inventor or the applicant. PCT applications are similar to EPO patents seeking patent protection for more than one jurisdiction of the member states. Those patents are rare within the sample. Actually the number of PCT applications stayed very small until the end of the 1980s and grew at the beginning of the 90s. Only 1.7 per cent of patents protection was sought via PCT in 1980 but around 25% in the late 1990s. Because the main part of the patents involved within the sample were applied for during 1982 and 1987 the PCT application plays only a minor role as a way of seeking patent protection. A dummy indicates this (PCT).

Size of patentees In cases where the patentee as potential plaintiff was indicated as corporation size and industry variables from the Creditreform data were added. For the foreign corporation the data were completed by searches on internet and within the AMADEUS and COMPUSTAT data. Finally 4 size classes were constructed (DSA1 - DSA4). The first one includes all individuals, the second small firms with sales less than 1 million DM. The third is for medium size firms up to 10 million DM. The fourth size class includes all large firms with sales more than 10 million DM.

4.5.2 Technological Situation

Field of Technology It is defined by the IPC-codes used at the German and European Patent Office in the same way. Each patent will be assigned to one (principle) or

more IPC classes which contains of a 4 digit main class and a 4 digit subclass. The principle IPC class is used to categorize the patent into a technological area (drugs, chemical, mechanical, electronics, others). To be able to compare the results with the U.S. studies the data was aggregated similar to the area-definition Lanjouw used in Lanjouw and Schankerman (1997). Table ??tabarea] shows the distribution of the patents among the group differentiated by litigated and unlitigated patents.

The IPC data were aggregated into technology areas. The possibility to prove whether infringement has taken place or not depends also on the technology.²⁴

Technological Crowdedness The number of patents granted in a technological field or a broader technological area is defined by Harhoff and Reitzig (2002). They found a positive relationship between a high crowdedness and the probability of oppositions against an EPO patent. For litigation suits it is likely that more patents are subject of litigation in areas which are more crowded. (Lanjouw and Schankerman 1997)

5 Empirical results

5.1 Descriptive statistics

For the analysis of the determinants of patent litigation suits in Germany a random sample of 6144 patents applied for at the German Patent Office or at the European Patent Office is matched with the 906 patents involved in patent litigation suits at two of the three main district courts Duesseldorf and Mannheim during the period 1993 to 1995. Assuming that the affinity to other district courts did not change over the years, the district courts in Mannheim and Duesseldorf treated about 55 to 60 per cent of all patent litigation cases in Germany in the period from 1993 to 1995. Applications for preliminary injunctions are included within the group of litigated patents. They are regarded as filed suits as well. The number of applications for a preliminary injunction almost doubled from 69 in 1972-1972 and reached 109 in the period of investigation of this paper.

Table 3 shows descriptive statistics of the variables used to explain litigation. The first block contains the value correlates. On average litigated patents were cited more than twice as often as unlitigated patents. Litigated patents also tend to have more

²⁴Imitation of chemical raw material and pharmaceuticals is relatively easy to detect. Infringement of new mechanical and electronic devices is often hardly to identify (equivalent infringement).

references to prior patents. The family size of litigated patents is on average twice as high for litigated patents than for unlitigated patents. The differences are highly significant. Litigated patents resisted oppositions more frequently. Within the full sample protection was sought via PCT application in 1.9% and via EPO application in 20%. Within the litigated group of patents the shares are also significantly higher (3.4% and 33.2%).

The characteristics of the patent holder are displayed in the second block of table 3. The average portfolio size is 265. It ranges from 1 to 49477. The mean of the portfolio size is smaller for foreign firms. Table 2 summarizes the portfolio size among foreign and German firms within the group of litigated and unlitigated patents. Within the group of unlitigated patents 67.1% of the patentees have their main dependence or domicile in Germany. The foreigners are mainly from the EU (37.3%). Japanese patentees apply almost as often at the German patent office with a share of 34%. US applicants are represented with a share of 21%. The rest are from other countries. US- and EU-foreigners tend to be involved in litigation suits as often as its share of applicants suggests. The last block of table 1 shows the shares of patents in 5 main technology areas. Description does not reveal a significant difference in the crowdedness of the areas of application.

5.2 Results from probit estimation

The data used within the estimation cover all patent and utility litigation cases in between 1993 and 1995 before the district courts Mannheim and Duesseldorf. In order to test what determines the probability of patent and utility litigation in Germany a probit estimation is used. The regressors are: weighted number of forward citations, controlled for truncation (WFC), number of backward citations, a dummy variable whether an opposition was filed, a dummy for an individual, a dummy whether the applicant or plaintiff is a foreigner or not, a crowdedness measure, the size of the patentee or the plaintiff (if it is a firm), area of technology. Table ??[tabestim2] shows the regression results.

The coefficients of the value correlates of the IPR are as expected. Weighted forward citations (WFC) and overcome opposition (OPPOS) have a positive and significant influence on the probability of litigation. Opposition is a similar dispute questioning the validity of the patent. If this procedure turned out to be successful or partly successful after amendment the IPR will be very strong. Therefore the patentee has a good confidence to have a high winning probability at trial.

In the analysis an interaction term of portfolio and a dummy for foreign patentee is included to model the different portfolio sizes at the German Patent Office of foreigners and German firms. DPF indicates the portfolio of German patentees and FPF this of foreign patentees until 1993. The positive coefficient for portfolio size is somewhat surprising. For firms with large portfolio the likelihood of litigation raises. Because the portfolio is measured as number of patents a patentee holds until the date of filing at the *German* patent office only, just a part of the ability to trade is captured. For German litigation cases the portfolio counts as stock of technological experience and makes the patentee more confident in filing suits. Therefore it is not surprising that for foreign firms this effect is even larger than for domestic patentees. And it is even higher if the patentee is a foreigner. Lanjouw and Schankerman (2001b) found a significant negative relationship and Harhoff and Reitzig (2002) argued as well that a high portfolio size triggers settlement and lowers the probability of opposition. For individuals the effect compared to small firms is even larger. An interpretation of this effect is that: if interaction between firms is that not portfolio size triggers the settlement but the absolute size of the firm. The threat of going through the trial until a judgement is rendered and even through the first and second appeal more credible for financial strong firms and leads to more settlement. The probability of litigation falls with raising firm size. As the prior studies argue portfolio size captures the ability to trade patents. However, it also indicates the strong position of the firm in its technological area even independent of the crowdedness of this field.

The analysis here includes size variables (DSA1-DSA4) It is shown that firms have lower likelihood to be involved in litigation than individuals (DSA1 base category). With larger size of the firm the sample probability of litigation falls even more. Court resources are not bound at litigation cases where large firms are not using their bargaining power to find settlement solutions. The finding suggests that the pre trial bargaining power is determined more by the absolute size than by the technological experience.

Crowdedness (SHAREIC- number of patents within the 4 digit IPC-class) has no significant impact on the probability of litigation. The finding suggests that two effects cancel each other out. On the one site, in IPC-classes with many patents the conditions for repeated interaction and successful licensing negotiations are better and the propensity to litigate decreases. On the hand, in tight technology classes interactions between two firms may not be stable enough to stand the technological competitiveness. Technological competition is likely to be followed by economic competition. Infringement within those

fields will be sued immediately in order to deter further entry in the dense market.

6 Conclusion

In this paper a first empirical analysis of the determinants of patent litigation is carried out. Information from suits which were filed in the period 1993 to 1995 at two of three main district courts were used. A control group was constructed by drawing a random sample from PATDPA. Detailed information about patents came from several databases such as Creditreform and Compustat. The results confirm earlier findings for the US litigation system in an way that more valuable patents are much more likely to be involved in litigation cases than the average patent. No support is found for the hypothesis that the ability to trade patents and interact repeatedly forces pretrial settlement and prevents patentees from filing suits. The results suggest that larger technological experience measured in patent portfolio size point to a higher degree of confidence and higher filing rates whereas the economic power of a patentee prevents from filing. The German system is efficient in a way that the courts are not filled with cases where large patentees are just want to sign their strength via a court decision even if a settlement could be reached.

Further research should regard the special characteristics of dual patenting strategies (European and German) but only one enforcement strategy. An expansion of the analysis to the course of the case and the outcomes of the trials is underway and will involve information about the timing of legal actions, the outcomes and in cases of judgement - the winning rates.

7 References

Bebchuck, L.A. (1984), "Litigation and Settlement under Imperfect Information", *RAND Journal of Economics*, Vol. 15, pp. 404–415.

Cohen, W.M., R.R. Nelson and J.P. Walsh (2000), "Protecting their intellectual Assets: Appropriability Conditions and why U.S. Manufacturing Firms patent (or Not)", NBER Working Paper Series No. 7552.

Cooter, R. and D. Rubinfeld (1989), "Economic Analysis of Legal Disputes and their Resolution", *Journal of Economic Literature*, Vol. 27, pp.1067-97.

Gallini, N.T. (2002), "The Economics of Patents: Lessons from Recent U.S. Patent Reform", *Journal of Economic Perspectives*, Vol. 16(2), pp.131–154.

Hall, B.H. and R. Ham Ziedonis (2001), "The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995", *RAND Journal of Economics*, Vol. 32, pp.101–128.

Hall, B.H., A.B. Jaffe and M. Trajtenberg (2001), "The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools" NBER Working Papers No. 8498.

Harhoff, D. and M.Reitzig (2002),"Determinants of Opposition against EPO Patent Grants - The Case of Biotechnology and Pharmaceuticals", CEPR discussion paper No.3645.

Harhoff, D., F.M. Scherer and K. Vopel (2002), "Citations, Family Size, Opposition and the Value of Patent Rights", *forthcoming in: Research Policy*

Janz, N., S. Gottschalk, B. Peters and T. Schmidt (2002), "Innovationsverhalten der deutschen Wirtschaft: Hintergrundbericht zur Innovationserhebung 2001", Mimeo ZEW.

Janz, N., G. Licht and T. Doherr (2001), "Innovation Activities and European Patenting of German Firms, An Empirical Investigation Using Innovation Survey and Patent Office Data", Discussion Paper, Zentrum für Europäische Wirtschaftsforschung, Mannheim.

Lanjouw, J.O. and M. Schankerman (1997), "Stylized Facts of Patent Litigation: Value, Scope and Ownership", NBER Working Paper Series No. 6297.

Lanjouw, J.O. and M. Schankerman (2001a), "Characteristics of Patent Litigation: A Window on Competition", *RAND Journal of Economics*, Vol. 32, pp.129–151.

Lanjouw J.O. and M. Schankerman (2001b), "Enforcing Intellectual Property Rights", NBER Working Paper Series No. 8656.

Meurer, M.J. (1989), "The settlement of patent litigation", RAND Journal of Economics Vol. 20(1), pp.77–91.

Pantuliano, M., D. Harriss, A. Horton, T. Mollet-Vieville, W.V. Meibom, J. Pitz, G. Dragotti and S. de Wit (1999), "Multinational Patent Litigation", FT Law&Tax.

Putnam, J. (1991), "The Value of International Patent Rights" PhD. Dissertation, Yale.

Shapiro, C. (2001), "Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard Settings", in: Jaffe, A.B., J. Lerner and S. Stern (eds.): *Innovation Policy and the Economy*, Cambridge: MIT Press for the NBER, Vol. 1, pp.119–150.

Stauder, Dieter (1989), "Patent- und Gebrauchsmusterverletzungsverfahren in der Bundesrepublik Deutschland, Großbritannien, Frankreich und Italien. Eine rechtstatsächliche Untersuchung", Köln.

Thumm, N. (2000), "Intellectual Property Rights. National Systems and Harmonisation in Europe", Heidelberg.

7.1 Details on the string match of data from "Creditreform" and "PATDPA"

The merge of the patent applicant data with the Creditreform appeared to be not unique. For one applicant named in the "PATDPA" more than one firm listed in "Creditreform" was assigned. This is due to the diversification of corporations and their holdings with partly no productive but administrative duties. For the selection, corporations listed in Creditreform (Crefo corporation) with the newest recherche date and industry not from wz93 with numbers

- 5xxxx (Wholesale, Retail trading)
- 6xxxx (Transportation, traffic, insurance and other services)
- 7xxxx (services), 8xxxx (Education, Health sector, social sector)

were used. The remaining firms were assigned to industries: agriculture and fishery, mining manufacturing and construction industry (1xxxx, 2xxxx, 3xxxx, 4xxxx). The resulting unambiguous correspondence of applicant name and Crefo corporation was merged to the population of patents by Crefo corporation. By now the patent stock of all firms could be calculated. This calculation is not complete because the reporting in the "Creditreform" changes over time. Some crefo-id's disappear and others are newly created in later periods. Since the assignment of name of the applicants to a crefo-id within "Creditreform" data is done in years in which the litigation dispute took place. The string match of all patent applicant within the PATDPA data was done for the last wave in 2002. Due to this, not all crefo id were found. (to be done by Thorsten again with the unique crefo data without the "Beteiligungen").

Table 1: IPC-Areas According to Lanjouw

Area	litigated		unlitigated		total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Drugs & Health	69	7.62	259	4.22	328	4.9
Chemicals	72	7.95	640	10.42	712	10.2
Electronic	130	14.35	1621	26.38	1751	25.5
Mechanical	447	49.34	2717	44.22	3164	44.9
Other	188	20.75	907	14.76	1095	15.8
Total	906	100.00	6144	100.00	7050	100.0

Table 2: Portfolio Size of Foereigners and Domestic Patentees

	litigated		unlitigated	
	Portfolio (mean)	Obs	Portfolio (mean)	Obs
Foreigner	692	207	198	2024
German	353	699	261	4120
Total	431	906	241	6144

Table 3: Descriptive statistics

Variable	all		litigated		unlitigated	
	Mean	SD	Mean	SD	Mean	SD
WFC	1.220	2.652	2.195	4.804	1.076	2.124
BC	2.005	2.132	2.626	3.133	1.914	1.925
FAMSIZE	1.399	3.996	2.386	5.916	1.254	3.605
EPAPPL	.203	.402	.332	.471	.184	.388
OPPOS	.078	.268	.210	.407	.058	.234
PCT	.019	.138	.034	.182	.017	.130
PF/1000	.265	1.541	.431	2.732	.241	1.249
DPF/1000	.188	1.405	.273	2.513	.175	1.120
FPF/1000	.077	.739	.158	1.111	.065	.574
DSA1 (CORP=0)	.245	.430	.482	.500	.210	.407
DSA2 small firms	.035	.184	.031	.173	.036	.185
DSA3 medium size firms	.202	.402	.135	.342	.212	.409
DSA4 large firms	.518	.500	.352	.478	.542	.498
FOREIGN	.317	.465	.228	.420	.329	.470
FEU	.126	.332	.146	.352	.123	.329
FUS	.070	.255	.065	.247	.071	.256
FJP	.100	.300	.013	.114	.112	.316
FAN	.020	.141	.004	.066	.022	.149
SHAREIC/1000	.318	.327	.306	.290	.319	.332
DRUG	.046	.210	.076	.265	.042	.201
CHEM	.101	.301	.080	.271	.104	.305
ELEC	.248	.432	.143	.351	.263	.441
MECH	.449	.497	.493	.500	.442	.497
OTHE	.155	.362	.208	.406	.148	.355
Number of Obs.	7050		906		6144	

Table 4: Probit estimation results

lit	Coef.	SE	Marginals	SE
WFC	.074	.008	.011	.001
BC	.060	.009	.009	.001
EPAPPL	1.002	.059	.224	.017
OPPOS	.761	.067	.174	.020
FAMSIZE	.015	.005	.002	.001
PCT	.020	.135	.003	.021
FPF/1000	.140	.026	.022	.004
DPF/1000	.033	.012	.005	.002
DSA2 small firms	-.599	.120	-.062	.027
DSA3 medium size firms	-.817	.066	-.091	.016
DSA4 large firms	-.750	.051	-.008	.019
FEU	-.232	.067	-.031	.008
FUS	-.258	.093	-.034	.010
FJP	-1.030	.136	-.090	.006
FAN	-1.100	.247	-.080	.006
SHAREIC/1000	<i>-.089</i>	.071	<i>-.012</i>	.009
CHEM	-.450	.111	-.054	.010
ELEC	-.478	.099	-.063	.011
MECH	<i>-.175</i>	.091	<i>-.027</i>	.014
OTHE	<i>-.086</i>	.098	<i>-.013</i>	.014
Number of Obs.	7050			
LR $\chi^2(20)$	1066.98			
Pseudo R ²	0.19			

Coefficients in bold are significant at the 1% level, in italic at the 10% level.