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New evidence on determinants of IP litigation: A market-based approach

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Abstract

In this paper, we depart from the economic literature on patent litigation by taking a somewhat different perspective. In the past, scholars mostly focused on specific litigation cases at the patent level and related technological characteristics to the event of litigation. However, observing IP disputes at a broader level may suggest that not only technological characteristics may trigger litigation suits, but also the market positions of firms. Consequently, this paper examines the economy-wide occurrence of IP litigation cases in Flanders firms using a representative sample of firms in the manufacturing and service sector surveyed in the 2013 Community Innovation Survey about their innovative activities in the period 2010 to 2012. The rich survey information regarding firms' general innovation strategies enables us to introduce market-related variables such as sales with new products and firm-level innovation based mainly on incremental innovation and imitation. Our results indicate that while controlling for the effects of the importance and quality of a firms' IP portfolio, the composition of turnover in terms of innovations and imitations has additional explanatory power regarding litigation propensities. High value imitators are being more aggressively sued for infringement and become defendants in court. Out of court settlement propensity is influenced by the market value of imitations, high value imitators being more frequently involved.

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Abstract

In this paper, we depart from the economic literature on patent litigation by taking a somewhat different perspective. In the past, scholars mostly focused on specific litigation cases at the patent level and related technological characteristics to the event of litigation. However, observing IP disputes at a broader level may suggest that not only technological characteristics may trigger litigation suits, but also the market positions of firms. Consequently, this paper examines the economy-wide occurrence of IP litigation cases in Flanders firms using a representative sample of firms in the manufacturing and service sector surveyed in the 2013 Community Innovation Survey about their innovative activities in the period 2010 to 2012. The rich survey information regarding firms' general innovation strategies enables us to introduce market-related variables such as sales with new products and firm-level innovation based mainly on incremental innovation and imitation. Our results indicate that while controlling for the effects of the importance and quality of a firms' IP portfolio, the composition of turnover in terms of innovations and imitations has additional explanatory power regarding litigation propensities. The analysis suggests that plaintiffs are seemingly led by the market stakes they have in upholding their IPR. High value imitators are being more aggressively sued for infringement and become defendants in court. Out of court settlement propensity is influenced by the market value of imitations, high value imitators being more frequently involved.

Keywords: IP litigation, patenting, innovation

JEL Classification: O31, O34

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1. Introduction

This paper empirically re-visits the topic of IP litigation which has already been discussed in previous literature (see e.g. Lanjouw and Schankerman, 2001, 2004, Cremers, 2006, 2009, Somaya, 2003, Hall and Ziedonis, 2007, Galasso and Schankerman, 2010). The bulk of the economic literature has focused on patent litigation and related the fact of litigation to technological characteristics of the underlying patent.

IP litigation may have been regarded as a niche topic in economics in the past. For instance, the number of patent litigation cases compared to the number of issued patents is fairly low. In the United States, for example, 1,706 patent cases were filed at US district courts in 1995. Compared to 114,241 issued patents, the litigation ratio only amounts to 1.5%. In 2005, this numbers however have been rising to 2706 vs. 165,485 (= 1.6%). According to the latest figures (2013), the patent litigation cases peaked at 6,386 (compared to 290,083 patents issued yielding a litigation ratio of 2.2%. (Sources: USPTO's performance & Accountability Report¹; US Courts' Judicial Facts and Figures²) The absolute numbers even more than the ratios show the growing importance of IP litigation. Also important is to recognize the importance of IP litigation cases for the involved parties. According to PWC (2015) the annual median damage award ranged in the last 20 years between US\$ 1.9 million to US\$ 17 million (overall median = US\$ 5.4 million). On the background of the growing number of litigation cases since the 1990s, these numbers unambiguously show the importance of IP. The gravity of the matter becomes apparent when looking at the largest adjudicated damage awards in the last decades. In 2009, the damage award in the case *Centocor Ortho Biotech Inc. vs. Abbott Laboratories* concerning arthritis drugs amounted to US\$ 1,673 million, and in 2007, the case *Lucent Technologies Inc. vs. Microsoft Corporation* concerning MP3 technology amounted to US\$ 1,538 million.³ In addition, plaintiffs and defendants may often settle on their IP disputes. The most recent case reported in global news (October 1st, 2015) is, for example, Google and Microsoft who settled upon about 20 IP dispute cases in Germany and the United States.

¹ See <http://www.uspto.gov/about-us/performance-and-planning/uspto-annual-reports>

² See <http://www.uscourts.gov/statistics-reports/analysis-reports/judicial-facts-and-figures>

³ Monetary figures adjusted for inflation to 2014 US dollars. The damage awards refer to initial adjudication, i.e. these awards may have been vacated, remanded or reduced, were settled while pending appeal, or are still under appeal.

In this paper, we depart from the economic literature on patent litigation but take a somewhat different perspective than the existing literature. In the past, scholars mostly focused on specific litigation cases at the patent level and related technological characteristics to the event of litigation. However, observing IP disputes at broader level may suggest that not only technological characteristics may trigger litigation suits, but also the market positions of firms. First, it can be observed that often firms do not battle about a single specific patent, but that larger parts of market leaders' IP portfolios are challenged, as in the Google vs. Microsoft or in the Apple vs. Samsung, where in the latter case the court awarded damages of about US\$ 1,000 million to Apple in 2012. This suggests that an analysis at the patent-level may suffer from omitted variable bias, that is, firms' market positions may play a central role in IP disputes. Second, IP disputes take place at a broader level than only patents. According to the US Courts' Judicial Facts and Figures, for instance, 3,169 trademark cases and 3,666 copyright cases were filed with the US district courts on top of the 6,386 patent cases. Especially the non-negligible number of trademark cases emphasizes that market positions of firms may play an important role in the economic analysis of IP disputes. Third, we will argue that the analysis of court cases neglects a large proportion of IP disputes that are settled outside of court. Therefore, the relevance of IP and its enforcement for business in the structural change from industrialized countries towards knowledge economies has been largely underestimated in the past.

Consequently, this paper examines the economy-wide occurrence of IP litigation cases in Flanders firms using a representative sample of firms in the manufacturing and service sector surveyed in 2013 about their innovative activities in the period 2010 to 2012. In contrast to earlier studies, we can identify which firms filed IP infringement cases and which firms were accused of infringing others' IPRs. In addition, the survey data also allows to investigate which firms settled outside of court. The survey explicitly asked for settlement before firms went to court. Thus, our settlement variable allows to observe IP disputes that could never be detected with administrative data.⁴ The three IP dispute variables can be related to commonly used patent characteristics (mainly counts and forward citations, as measure of the patent portfolio value), but also to other variables collected from the survey, such as registrations of trademarks, industrial designs and copyrights. Furthermore, the rich survey information regarding firms' general innovation strategies enables us to introduce market-related variables such, as sales with new products and firm-level innovation based mainly on incremental innovation and imitation.

⁴ Note that settlement e.g. in the Google vs. Microsoft in October 2015 does not refer to outside court settlement. These firms settled on pending court cases.

Our data strongly indicates the importance of outside of court settlement for an analysis of IP infringement. 8.2 pct. of the companies in the final sample were involved in a court case whereas nearly as much, 7.0 pct., made out of court settlements. The analysis suggests that plaintiffs are seemingly led by the market stakes they have in upholding their IPR. High value imitators are being more aggressively sued for infringement and become defendants in court. Out of court settlement propensity is influenced by the market value of imitations, high value imitators being more frequently involved. As expected also patent stock matters in determining the incidence of suing for infringement and settlement, probably because companies with more and more valuable inventions are more likely to be imitated and subsequently infringed upon. Likewise, companies using trademarks and industrial designs are more often suing for infringement and settling outside of court.

The remainder of this paper is structured as follows: Section 2 summarizes the related literature on the determinants of patent litigation. Hypothesis are developed based on theory. In section 3 the method used in conducting this research is discussed. A description of the data and variables used is given and the estimation method is briefly explained. Section 4 summarizes the results from the regression analysis before they are subsequently discussed in section 5. Section 6 concludes.

2. Related literature on the determinants of patent litigation

Researcher have found that due to its non-exclusive, non-rival nature, the production of knowledge creates externalities that can reach far beyond administrative and geographic borders (Griliches, 1992). These spillovers may on one hand enhance innovation and growth through the transfer of existing knowledge and avoiding duplicate R&D. Different mechanisms through which knowledge spillovers may be enhanced are: research cooperation, worker mobility, reverse engineering, exports and foreign direct investment. On the other hand, the spillover of knowledge may also result in the infringement of intellectual property rights. By losing an infringement suit the infringer's (non-recoverable) R&D expenses cannot generate benefits and moreover legal penalties have to be paid. In this paper a firm's incoming spillover potential or absorptive capacity is proxied by its R&D investment intensity. The outgoing spillover potential is proxied by an output measure of the firm's innovative process, i.e. patent stock and the firm's (subjective) valuation of their other types of IPRs. Survey evidence has shown that motives to patent are not the same in all industries. Cohen et al. (2000) shows that the use of patents and patenting motives differ between "discrete", "complex" and "drug" product industries. While in

complex product industries patents are used to force participation in cross-licensing negotiations, competitors use patents in discrete product industries to build patent fences to avoid the introduction of substitute innovations. In the drug industry patents are primarily used in classical way to protect the ability to license or commercialize an invention. Given the diverging patenting motives it is not implausible that litigation propensities are also sector dependent. Scholars have focused on technological characteristics and (poor) economic value proxies of IPR to explain which intellectual assets may be subject to litigation, commonly using citation based measures to relate the value of a patent to litigation propensity. We contribute to the literature by using new economic proxies of the IPRs market value to explain litigation propensities.

This paper is related to the empirical literature on the determinants of patent litigation. Lanjouw and Schankerman (2001, 2004) study the determinants of patent suits by examining the characteristics of litigated patents and their owners, finding that the value of the patent measured by forward citations and claims increases the likelihood of litigation. For Germany, Cremers (2007, 2009) investigates the incidence of litigation and the determinants of settlement of patent litigation. Similar to Lanjouw and Schankerman she finds that more valuable patents are more likely to be involved in patent litigation and smaller firms are more likely to be involved in litigation cases. Somaya (2003) shows that the likelihood of settlement of patent disputes decreases with strategic stakes as measured by forward citations and self-citations. While these contributions all focus on the incidence of litigation on the patent level, only very few authors have started looking at the likelihood of being involved in litigation at the firm level; thereby focusing on the firms' entire patent portfolio and other firm characteristics. Lerner (1995) shows that new biotechnology firms will patent less likely in subclasses with many other (rival) patents when their litigation costs are high. He interprets these results stating that firms are aware of the potential to infringe upon their rivals' patents and that they are willing to take precautions. In their contribution "The Patent Litigation Explosion", Bessen and Meurer (2005) look at patent litigation hazards for public firms in the US. Consistent with their theoretical model, litigation is more likely when prospective defendants spend more on R&D, when prospective plaintiffs have larger patent portfolios and when firms are larger and closer to each other in technology space. Their contribution differs from previous studies as it also takes into account firms' strategic interactions and differentiates between the likelihoods of becoming plaintiffs and defendants. Focusing on US semiconductor firms between 1973 and 2001, Hall and Ziedonis (2007) also estimate the probability that firms will be involved in patent lawsuits, either as plaintiffs or as defendants. They find that size, patent stock and R&D intensity all

positively affect the likelihood of litigation. Comparing their results for semiconductor firms to the broad sample of Bessen and Meurer they find that the probability of being a defendant for semiconductor firms increases more strongly with a higher level of R&D intensity and size of the firm.

Summarizing the theory relevant for this paper required us to draw upon three different branches of literature. The literature covering R&D spillovers (e.g. Griliches, 1992), the appropriability literature stressing the diverging effectiveness of patent in different technological areas (e.g. Teece, 1986) and the literature on the incidence of patent infringement and litigation (e.g. Bessen and Meurer, 2006; Somaya, 2003). The two former strands enabled us to identify commonly accepted drivers of infringement and litigation which will be controlled for in the analysis. The latter serves as a starting point for the analysis. Since we look at litigation in relation to IP in general (in contrast to the literature on patent litigation in specific) we consider the importance of other IP next to patents in the firms' portfolios. In our analysis it is important to acknowledge trademarks as a proxy for innovation (Mendonça, 2004). Industrial designs, which are more frequently infringed upon (Weatherall et al., 2009), should also be considered from the broader IP perspective. Copyright disputes can be seen in the light of their industry specific use.

We argue that products that are highly valued in the market, as measured by their share in the firm's turnover, imply high strategic stakes. In a high stakes game companies will be less inclined to risk a random court outcome, they might negotiate a deal and resort to a settlement of the dispute. We hypothesize, in correspondence to Somaya (2003), that:

Hypothesis 1.

Companies that have high strategic stakes in a dispute, as measured by the market-based valuations of their innovations and imitations, are less likely to settle over IP disputes.

Moreover, highly successful innovators are more likely to be confronted with infringement of their IP and be a plaintiff in court as their technologies' success is alluring to imitators. Also as these high turnover volume innovations are pivotal to their businesses, original innovators might be more inclined to protect their turf and sue for infringement. Thus we hypothesize:

Hypothesis 2.

Companies that have a high share of innovative sales in their turnover are more likely to be a plaintiff in court cases regarding IP disputes.

Contrastingly, companies with a high share of imitative sales are more likely to infringe on extant IP and be a defendant in court. Also as imitators generate large sales volumes from their imitation, original innovators might notice they are losing out and decide to sue for infringement. From this we hypothesize:

Hypothesis 3.

Companies that have a high share of imitative sales in their turnover are more likely to be a defendant in court cases regarding IP disputes.

3. Methodology

Data and variables

The data set used to conduct the analysis originates from the Flemish Community Innovation Survey⁵, an inquiry about the innovative activity in the Flemish economy carried out bi-annually since 1993. The CIS methodological standards comprise a stratified random sampling procedure to ensure representativeness of the sample for the whole economy. The data consists of one cross-section of the Flemish economy surveyed in 2013 about their activities in the period spanning 2010-2012. We use the survey carried out in 2013 since it includes unique questions on IP litigation. The sample covers firms in the manufacturing as well as services sector. We restrict the sample to innovating firms only as the interest lies in relating turnover from market novelties and imitations to IP litigation. The definition of an innovating firm follows the international guidelines for collecting innovation data from the business sector as described by the OSLO manual (OECD Publishing, 2005). Considering item non-response on the variables used in our specifications, the final estimation sample counts 752 observations. Descriptive statistics can be found in table 1.

Insert table 1 about here

Table 2 shows the correlation matrix.

⁵ This survey is conducted by the Centre for Research & Development Monitoring (ECOOM) on behalf of the Flemish government.

Insert table 2 about here

Dependent variables: IP litigation

With regard to IP litigation we consider 3 dependent outcome variables measuring three IP infringement litigation modes that companies potentially encountered in the surveyed period. LAWOWN indicates whether the company was a plaintiff in an IP infringement case. LAWOTH indicates whether the company was a defendant in an IP infringement case. Whether the company was involved in settlement negotiations or arrangements outside the court of law with the purpose of avoiding IPR disputes is indicated by SETTLE.

From the descriptive statistics in table 1 we see that the IP infringement litigation modes considered occur for a relatively small but still reasonable proportion of the firms. 5.5 pct. of the firms go to court as a plaintiff whereas 4.7 pct. are being sued in court as a defendant. Settlement arrangements outside court happened for 7.0 pct. of the estimation sample.

Independent variables of interest: market value measures of innovation & patent portfolio value measures

The main interest of the analysis lies in relating the dependent (IP litigation) variables to market value proxies of innovation, checking whether they have additional explanatory power on top of technological value proxies of the IP portfolio.

Regarding the market value of a company's innovation portfolio three components of turnover can be identified based on the survey results: (a) sales from market novelties (i.e. products, goods or services, newly introduced to the market between 2010 and 2012), (b) sales from incremental innovation and imitation (i.e. products introduced in the period 2010-2012 that were new to the firm but not new to the market), (c) sales of unchanged products. The mean turnover per employee originating from market novelties, NOVSALES, and new-to-firm innovations, IMISALES, are respectively € 23 688 and € 18 671. From the companies in the estimation sample 48 pct. generated no sales from market novelties whereas, 52 pct. generated no sales from new-to-firm innovations.

We construct three variables which proxy the importance, quality and composition of the patent portfolio: depreciated patent stock per employee (PSPEMP), patent quality (PATQUAL) and

fragmentation of prior art (FRAGMENTATION). Patent stock (PS) for firm i in year t , was retrieved from Patstat by applying the following formula.

$$PS_{it} = (1 - \delta) PS_{it-1} + \text{patent applications}_{it}$$

Where δ , the constant knowledge depreciation rate, is set to 15%. PSPEREMP further scales the patent stock per employee. To mitigate endogeneity concerns this variable enters our specification as measured in 2010, i.e. with a lag of 2 years. From the companies in our sample about 10 pct. has a strictly positive patent stock in 2010.

PATQUAL measures patent quality as the average number of forward citations received per patent and also enters as measured in 2010.

$$PATQUAL_{it} = (\# \text{ forward citations reviewed ever by firm } i / PS_{it})$$

Ziedonis (2004) calculates a patent fragmentation index by:

$$FRAGMENTATION_i = 1 - \sum_{j=1}^J \left(\frac{nbcites_{ij}}{nbcites_i} \right)^2, i \neq j$$

Where,

$nbcites_i$ = total number of backward citations for the patent portfolio of company i

$nbcites_{ij}$ = total number of backward citations that the patent portfolio of company i makes to patents of company j .

Our fragmentation index is calculated accordingly for all patents a firm has in its portfolio.

Dummy variables indicating whether the firm used industrial designs (CMRCU), copyrights (CMCOU) and trademarks (CMTMU) as means of improving their competitive position are also available from the survey.

Independent variables: controls

The necessity of R&D intensity as a control variable is apparent as: (a) intensive imitative R&D or (b) introducing high profile innovations can both potentially lead to infringement and thus trigger litigation. We measure R&D intensity as intramural R&D spending per employee in 2012, RDINT. Further general controls on firm size and age, EMP and AGE are available. Large and established firms might be more easily involved in IP litigation given the high cost of such trials. Finally, sector dummies are available to be able to control for inter-sectorial differences. Table 3 summarizes the final sample's distribution over the sectors.

Insert table 3 about here

Estimation

As our dependent variables are binary we estimate probit models in order to take into account this property of the data. The model has the following form:

$$\begin{aligned}\Pr(\text{SETTLE} = 1 | X) &= \Phi(\beta_0 + \beta X') \\ \Pr(\text{LAWOWN} = 1 | X) &= \Phi(\beta_0 + \beta X') \\ \Pr(\text{LAWOTH} = 1 | X) &= \Phi(\beta_0 + \beta X')\end{aligned}$$

Where Pr denotes probability and Φ is the cumulative distribution function of the standard normal distribution. X includes gradually more of the independent variables from table 1.

4. Results

Table 4 contains the regression results. The first simple specification (1)-(3) only include the general firm level control variables next to our variables of interest in the regressions. In the extended specification (4)-(6) control variables for the firms depreciated patent stock, quality and fragmentation are added. The full model (7)-(9) adds further control variables reflecting the use of trademarks and industrial designs as part of the competitive strategy to the specification.

Insert table 4 about here

The results regarding our market based valuations of innovation and imitation remain largely robust over all specifications. Sales from novelties drive the propensity of suing for infringement whereas sales from imitation and incremental innovation drive the propensities of being sued for infringement and settling outside of court. All coefficient being significant at the 5 pct. level, except for the coefficient on NOVSALES in the LAWOWN regression.

The gradually added controls take on the expected signs and significance. Regarding general firm level controls, the log of employment and R&D intensity are positive and significant throughout at the 10 pct. level at the least. Firm age is insignificant throughout. In the extended specification depreciated patent stock per employee is positive and significant at the 5 pct. level in the 'suing over infringement' regression and at the 10 pct. level in the 'settling outside of court' regression. The fragmentation variable correlates positively and significantly with all three right hand side variables in the extended specification. In the full model, all but one of the coefficients concerning the relation between the litigation outcome variables and use of trademarks and industrial designs are significant and positive. The coefficient on CMTMU in the LAWOTH regression is clearly insignificant. Sector controls are jointly significant in the 'suing for infringement' regressions, whereas they are insignificant in the 'getting sued over infringement' and 'settling outside of court' regressions.

5. Discussion

The main findings from the estimations (see table 4) can be summarized as follows: Companies with a high share of innovative sales in their turnover are more likely to be a plaintiff in court of law (Confirms H2). Companies with a high share of imitative sales in their turnover are more likely to be a defendant in court of law (Confirms H3). Companies with a high share of imitative sales in their turnover are more likely to settle, for high innovative sales there is however no significant effect (Rejects H1).

The estimation results are largely in line with extant research on the topic, e.g. Hall and Ziedonis (2007). Firm size, R&D intensity contribute positively to the propensities of becoming either a plaintiff or a defendant in a litigation case. The propensity to settle over IP is also positively influenced by these factors. Our market value based measures of innovation remain significant throughout almost all

specifications, strongly indicating the importance of including market value based measures of innovation when analyzing scenarios dealing with the determinants of IP litigation at the firm level.

The 'suing over infringement' regressions showed mixed evidence that companies are acting actively on the market value of their market novelties in the decision on whether or not to sue an infringer before the court of law. The positive effect from the basic specifications fading once we control for the importance and quality of the IP portfolio. Patent stock and the importance of other IP for their competitive strategy on the other hand influence the litigation propensity positively (in accordance with extant literature). It seems that firms are acting according to the strength of their IP portfolio in making the decision to sue, market stakes only seem to matter to a lesser extent.

The 'getting sued over infringement' regressions point towards high value imitators being more aggressively sued for infringement. Competitors' market stakes in imitation are thus apparently driving IP owners to sue over infringement. Technological patent characteristics and competitive value of other IP showed up insignificant here, probably reflecting the fact that true imitations can hardly be protected with IPR. Fragmentation of IP seems to matter in determining the 'getting sued' propensity because highly fragmented IP comes with more potential instigators of lawsuits against such a company. Using industrial designs to improve competitive position makes companies more prone to get sued. Trademarks do not have this effect, probably reflecting the fact that trademarks are comparatively less prone to infringement than industrial designs.

The 'settling outside of court' regressions indicate that settlement is strongly influenced by the market value of imitations, high value imitators being more frequently involved. This means that stakes are of importance in deciding upon settlement before a case is taken to court but only for high value imitators, as the coefficient on market value of market novelties turned up to be insignificant. Patent stock and the importance of other IP for their competitive strategy are positively contributing to the settlement propensity. This can be seen in the light of them being bargaining chips in strategic interaction amongst firms. The imitator, as the infringing party, thus seems to avoid court suits by settling over IPR infringement disputes, pointing towards distrust in making a case before court against the infringed IPR. Markedly, there is no effect of innovative turnover on settlement propensity, pointing towards innovators' confidence in being able to uphold the IPRs covering valuable innovations.

6. Conclusion

This paper presents new empirical evidence on the determinants of IP litigation at the firm level based on a sample of firms covered by the Flemish part of the 2013 wave of the Community Innovation Survey. Next to commonly used citation-based technological value proxies of innovation we find that market based indicators of the value of innovation and imitation matter in determining firm level litigation propensities. We find that firms with a high turnover from innovative good and services are more likely to sue over infringement of their IP. The effect however fades once we control for the importance and quality of their IP portfolio. Firms with a high turnover generated from imitations and incremental innovations are sued more often. Having fragmented IP adds to the likelihood of these firms being sued. Also the settling propensity of firms is positively influenced by turnover from imitations and incremental innovation while controlling for importance and quality of the IP portfolio. This leads us to conclude that the innovators' decision to sue seem especially influenced by market value of the corresponding imitation. Sued infringers however seem also to settle more often when their market stakes involved are high, thereby avoiding costly litigation and uncertain court outcomes.

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Variable	Variable description	Mean	Std. Dev.	Min	Max
<i>Dependent variables</i>					
Lawown (dummy)	Indicates whether a company was plaintiff in an IP lawsuit	0.054521	0.227195	0	1
Lawoth (dummy)	Indicates whether a company was defendant in an IP lawsuit	0.046543	0.210797	0	1
Settle (dummy)	Indicates whether a company negotiated for a settlement on an IP dispute	0.070479	0.256122	0	1
<i>Independent and control variables.</i>					
Novsales	(Turnover in € 1 000 000 * pct. of innovative sales) / #employees	0.023688	0.045386	0	0.325296
Imisales	(Turnover in € 1 000 000 * pct. of imitative sales) / #employees	0.018671	0.035632	0	0.23644
Emp	# employees	113.5186	294.8007	3	3828
Age	2013- year of foundation	27.2234	18.03571	3	145
Rdint	Internal R&D expenditures / # employees	11.17913	25.54719	0	231.5
Psperemp	Depreciated patent stock per employee	0.010106	0.039439	0	0.454642
Patqual	Average # of forward citations per patent ever	3.735962	17.05057	0	205.2245
Fragmentation	Measure of patent fragmentation (Ziedonis, 2004)	0.18765	0.370785	0	0.997835
CmrcdU (dummy)	Indicates if the company used industrial designs for improving their competitive position	0.182181	0.38625	0	1
CmtmU (dummy)	Indicates if the company used trademarks for improving their competitive position	0.344415	0.475493	0	1

Table 1: Descriptive statistics for sample of 752 observations

	Lawown	Lawoth	Settle	Novsales	Imisales	Inemp	Inage	Rdint	Psp~mp	Patqual	Fragme~n	CmrcdU	CmtmU
Lawown	1												
Lawoth	0.3362	1											
Settle	0.6433	0.5557	1										
Novsales	0.1744	0.1261	0.1273	1									
Imisales	0.0817	0.1298	0.1153	0.1843	1								
Inemp	0.2214	0.1499	0.2262	-0.0388	0.0127	1							
Inage	0.0825	0.0063	0.0512	-0.0418	-0.0383	0.3427	1						
Rdint	0.2089	0.2604	0.244	0.3026	0.09	-0.0035	-0.1591	1					
Psp~mp	0.2416	0.1874	0.2078	0.2054	0.085	-0.0272	-0.0694	0.2822	1				
Patqual	0.047	0.0091	0.0527	0.0966	0.0145	0.2144	0.0927	0.0456	0.0933	1			
Fragment~n	0.2499	0.2219	0.2464	0.1257	0.0402	0.2708	0.053	0.2422	0.4934	0.4017	1		
CmrcdU	0.2812	0.2392	0.2469	0.1547	0.0493	0.1447	0.0181	0.1669	0.1485	0.0378	0.2661	1	
CmtmU	0.208	0.1321	0.2159	0.1416	0.1114	0.1162	0.0493	0.1509	0.0919	0.0492	0.1865	0.4409	1

Table 2: Pairwise Pearson's correlation coefficients for sample of 752 observations (Notes: correlations in bold are significant at the 5 pct. level)

<i>Sector variables</i>	<i>Sector description</i>	<i># Obs with Sec* = 1</i>
<i>Sec1</i>	<i>food, beverage, tobacco, textile, clothing and leather industries</i>	<i>96</i>
<i>Sec2</i>	<i>Textile, clothing and leather industry</i>	<i>34</i>
<i>Sec3</i>	<i>Manufacture of cokes, chemicals, pharmaceuticals, rubber and plastic</i>	<i>85</i>
<i>Sec4</i>	<i>Manufacture of non-ferro minerals, metals and metal products (no machinery and equipment)</i>	<i>75</i>
<i>Sec5</i>	<i>Manufacture of electrical equipment, IT-products, electronic and optical products</i>	<i>52</i>
<i>Sec6</i>	<i>Manufacture of machinery, equipment, tools and transport</i>	<i>55</i>
<i>Sec7</i>	<i>Wholesale</i>	<i>87</i>
<i>Sec8</i>	<i>Telecommunication, software design and programming, computer-consultancy, information services, architects and engineering, R&D</i>	<i>209</i>
<i>Sec9</i>	<i>Remaining sub-sectors</i>	<i>59</i>

Table 3: Distribution over sectors for sample of 752 observations

b/se	(1) Lawown	(2) Lawoth	(3) Settle	(4) Lawown	(5) Lawoth	(6) Settle	(7) Lawown	(8) Lawoth	(9) Settle
Novsales	4.169** [1.626]	1.82 [1.837]	1.805 [1.692]	3.885** [1.818]	2.146 [1.935]	1.342 [1.753]	3.210* [1.945]	1.557 [2.012]	0.249 [1.891]
Imisales	3.217 [2.145]	4.439** [1.933]	4.290** [1.852]	2.75 [2.271]	4.120** [2.021]	4.136** [1.912]	2.829 [2.497]	4.343** [2.129]	4.257** [2.030]
Lnemp	0.276*** [0.068]	0.227*** [0.069]	0.293*** [0.062]	0.264*** [0.075]	0.218*** [0.077]	0.280*** [0.067]	0.233*** [0.082]	0.186** [0.080]	0.251*** [0.071]
Lnage	0.159 [0.147]	-0.065 [0.137]	0.01 [0.123]	0.196 [0.157]	-0.036 [0.145]	0.024 [0.127]	0.194 [0.169]	-0.039 [0.152]	0.014 [0.135]
Rdint	0.010*** [0.003]	0.010*** [0.003]	0.011*** [0.003]	0.008** [0.003]	0.008*** [0.003]	0.009*** [0.003]	0.007* [0.004]	0.007** [0.003]	0.009*** [0.003]
Psperemp				4.011** [1.915]	1.445 [1.991]	3.320* [1.839]	4.717** [2.071]	1.651 [2.173]	4.098** [1.960]
Patqual				-0.011 [0.008]	-0.037* [0.021]	-0.006 [0.006]	-0.005 [0.008]	-0.028 [0.020]	-0.004 [0.005]
Fragmen- tation				0.620** [0.264]	0.950*** [0.286]	0.494** [0.239]	0.332 [0.288]	0.728** [0.301]	0.28 [0.253]
CmrcdU							0.719*** [0.215]	0.673*** [0.221]	0.464** [0.190]
CmtmU							0.549** [0.226]	0.058 [0.215]	0.595*** [0.188]
_cons	-3.897*** [0.609]	-2.621*** [0.529]	-2.984*** [0.480]	-4.014*** [0.645]	-2.735*** [0.559]	-2.986*** [0.497]	-4.471*** [0.730]	-2.749*** [0.579]	-3.236*** [0.536]
Sector- dummies	Incl.**	Incl.	Incl.	Incl.*	Incl.	Incl.	Incl.**	Incl.	Incl.
Pseudo_R-s~d	0.238	0.178	0.198	0.295	0.24	0.234	0.377	0.281	0.296
#obs	752	752	752	752	752	752	752	752	752
Wald	75.866	50.473	75.756	93.818	68.076	89.762	119.958	79.419	113.536
Sig	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4: Single equation probit estimations (Notes: Significance levels: *** 1 pct. or less; ** less than 5 pct. , * less than 10 pct.)