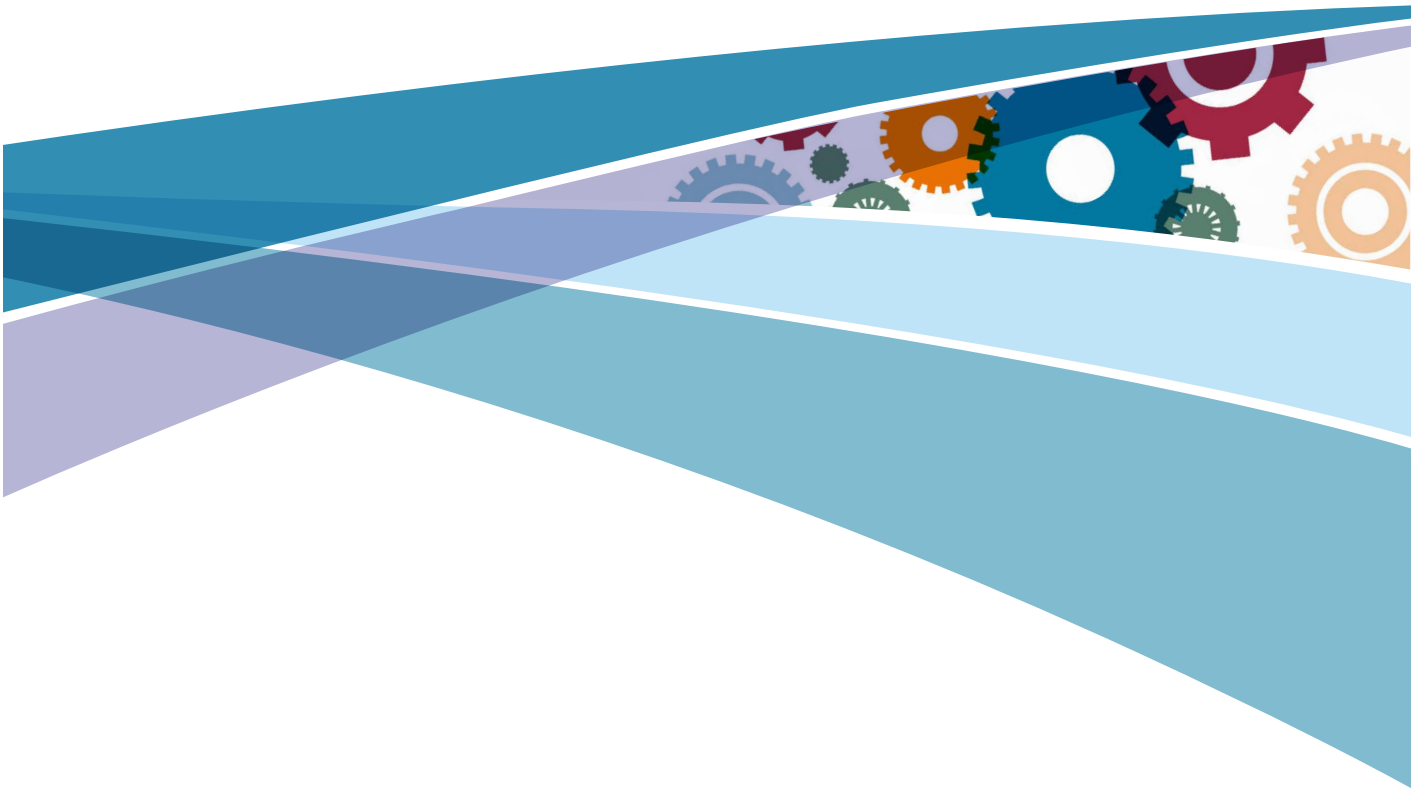
Intellectual Property Office

The use of intellectual property right bundles by firms in the UK



Report 2

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A report for the UK Intellectual Property Office

2013/28

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ISBN: 978-1-908908-55-1

Published by The Intellectual Property Office
20th May 2013

1 2 3 4 5 6 7 8 9 10

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This publication is available from our website at www.ipo.gov.uk

Executive Summary

This report presents an exploratory analysis of the use of different types of intellectual property rights for the same product (henceforth IPR bundles) by firms registered in the UK.

Data and methodology

In this report we refer to using any combination of at least two of the following IP right types for the same product as using an IPR bundle: registered design rights, patents, or trade marks.[1] We pursue different approaches to analyse the use of IPR bundles. First, we assume that firms that have applied for both, patents and trade marks, use them as bundles, i.e. to protect different features of the same product. This allows us to look at the entire set of firms owning IPRs in the UK. Second, we construct IPR bundles at the product-level using two different approaches:

- Product-centred: we start with a specific product group, in our case home-use coffee machines, and attempt to identify the corresponding IP rights.
- Firm-centred: we start with detailed information on the IP rights that a selected set of firms holds, collect information on the firms' products, and filter those products that can be matched to the firms' IP.

Third, we analyse all court cases before the Patents Court of England and Wales between 2000 and 2008 that involved IPR bundles in the form of patents, trade marks, and registered designs.

Results

Firms that apply for both patents and trade marks account for a sizeable share of total assets, employment, and turnover in the manufacturing sector. Assuming that holding both, patents and trade marks, proxies for the use of IPR bundles, this would suggest that firms that use bundles account for an important share of economic activity within industries. We also find some positive correlation between owning patents as well as trade marks and a firm's performance, which is measured by the growth of total assets between 2002 and 2009. However, the results are not particularly robust.

Our product-level analysis exposes the fact that only a small fraction of firms that apply for both, patents and trade marks, uses them as bundles. This suggests that using the joint filing of patents and trade marks as a proxy for the use of IPR bundles may be misleading and calls for caution in interpreting the macro-level results.

Analysing IPR bundles at the product-level shows that there is considerable variation across industries in the use of bundles. Our analysis of the timing of the different IPR filings that belong to a bundle suggests that firms tend to file the different IP rights closely together. Surprisingly,

1 Design rights are only available for the product-level data set.

we find firms that use bundles do worse in terms of performance (measured as growth in total assets) than firms that use patents and trade marks jointly (but not as a bundle) or individually.

Very few court cases involve IPR bundles. The large majority of cases involving bundles contain trade marks. While all different IP rights are enforced in court, all cases for which a final judgment was handed down were decided in favour of the claimant based on trade mark and design infringement, never based on patent infringement.

Contents

1. Introduction

European Patent EP0845971 protects a nursing bottle that is designed to avoid the forming of a vacuum when the bottle is inverted to feed an infant. This patent was the object of a patent dispute at the Patents Court (HC 05 C00847), a specialized court of the Chancery Division of the High Court of Justice of England and Wales, in 2005. The nursing bottle that incorporates the patented invention had considerable success in the market place (according to court records turnover in 2005 in the USA was between US$ 6-10 million) as it avoids a number of negative consequences for infants that result from a vacuum that builds in standard bottles. The bottle's name "Dr Brown's Natural Flow" is protected by a community word trade mark (CM001111418) and the corresponding logo by copyright. The manufacturer and inventors of the bottle sued a former distributor that developed a rival bottle for patent, trade mark and copyright infringement as well as passing off.[2] In the proceedings, the patent was revoked for obviousness. The claimants still succeeded with their claims for copyright and trade mark infringement. This example illustrates a situation in which a firm markets a single, technologically simple product that is protected by several types of intellectual property (IP) where different elements of the product are protected by different IP. All forms of IPRs are invoked by the firm to sue its competitor. Interestingly the case succeeds based on trade mark and copyright infringement, whereas the attack based on patent infringement fails.

The nursing bottle court case is a clear-cut example that illustrates the use of multiple forms of IPRs to protect a single product: there is a single patent associated with a product protecting the underlying mechanical invention; the trading name of the product, which is protected by a registered trade mark; and the corresponding logo, protected by copyright. This illustrates how firms can protect different aspects of the same invention by different types of intellectual property rights, a strategy we refer to as "IPR bundling." The existence of IPR bundles should not come as a surprise, because different forms of IPRs are designed to address different market failures. For example, patents are designed to address the appropriability problem inherent in intangible knowledge, i.e. the fact that without legal means, an inventor cannot always prevent others from imitating and commercialising his invention, which would often leave him with returns insufficient to recoup his investment. Trade marks, on the other hand, serve to reduce consumer search costs by uniquely identifying the source of a product or a service, and thereby lower the risk of consumer confusion.

The court case also illustrates why we might be interested in the joint use of IPRs: The success of an invention in the market place hinges on a number of factors including the underlying technology and establishing a distinctive brand. Different forms of IPRs can be used to protect these different elements from copying and imitation. The nursing bottle example suggests that firms may protect an invention and the corresponding marketed product more effectively through the joint use of different types of IPRs than by relying only on a single type. This would explain well-known survey-based evidence (e.g. Levin et al., 1987; Cohen et al., 2000), which suggests that if one type of IPR is used, another type of IPR is often employed, too.

2 The inventors formed a firm called New Vent Designs Inc which is the assignee of the IP involved in the dispute. The manufacturer, Handi-Craft Co, is the worldwide exclusive licensee.

However, when we focus on the share of IPR-active firms in the UK (where "IPR-active" refers to registered IP in the form of patents or trade marks), we see that only a small fraction (roughly 7%) registers both, patents and trade marks. On the one hand, this figure still grossly exaggerates the share of firms using IPR bundles, because firms that own several forms of IPRs may not necessarily use them to protect the same invention. On the other hand, we have no information about the number of IPR bundles that consist of a combination of owned and licensed, or exclusively of licensed IP rights.

However, can we explain the observed small share of firms using IPR bundles? Is it that most firms have inventions for which only a single type of registered IP is applicable? Or do the numbers reflect the fact that patents are not effective in protecting certain types of inventions, so that firms forgo patent protection altogether? If firms do rely on IPR bundles, are they using different forms of IPRs in a complementary way or do different IP rights overlap? Such overlap could arise if firms obtain different forms of registered IP sequentially – examination of trade marks or designs is far less complex and a lot faster than the examination of a patent application. Hence, firms may obtain protection through a trade mark while the patent is still pending. If such a strategy is the main benefit conferred by IPR bundles, their use might be profitable only in certain markets for certain products.

This report presents a number of different attempts to look into these questions. First, following up on the first stage report of this project, we pursue a macro-level approach, which relies on data on all firms registered in the UK. Second, we pursue a micro-level approach where we build a data set that contains information on IPR bundles consisting of design rights, patents, and trade marks at the product-level. We have information on whether design rights, patents, or trade marks protect the same product, as in the example of the nursing bottle given above. The data allow us to study firms' choices to protect a given product by a single form of registered IP or by an IPR bundle. Third, we look at court cases that involve IPR bundles. This approach directs our attention to a small selected number of cases where firms protect an invention through multiple forms of IPRs and seek to enforce them in court. The different approaches pursued here are complementary and above all exploratory. In combination, they provide some tentative answers to the questions raised above.

As reviewed below, there is little literature on the use of IPR bundles by firms. Our analysis extends this literature, especially because we provide for the first time results obtained using the product as the unit of analysis. Our results suggest that IPRs are rarely used in combination as a bundle. This suggests that when relying on firm-level data, using the joint filing of patents and trade marks as a proxy for bundles could be misleading.

The remainder of the report is organized as follows. The next section contains a brief review of the existing literature. Section 3 contains a description of the different methodologies pursued here. Section 4 describes the data assembled for this report. Section 5 summarizes our results and Section 6 discusses possible implications for policy and avenues for further research.

2. Literature

Parchomovsky and Siegelman (2002) offer the first analysis of the joint use of patents and trade marks. The authors argue that trade marks and patents act as complements if (a) brand loyalty can be more easily built on the back of the exclusivity awarded by a patent and (b) brand loyalty supported by trade marks helps to extend market power beyond the lifetime of a patent. To illustrate (a), the authors refer to the example of Xerox where a firm's trading name has become synonymous with its patented photocopier. Bayer's Aspirin, in contrast, serves as an illustration of mechanism (b), i.e. Bayer's ability to charge higher prices than generic competitors after the patent expired is interpreted as evidence for the ability of brand loyalty to extend market power beyond the expiration of a patent. Frey (2012) offers some interview- and survey-based evidence collected from US and European pharmaceutical firms that contradicts the theoretical arguments by Parchomovsky and Siegelman (2002). The responses suggest that combining trade marks and patents to increase exclusivity or duration thereof plays a secondary role in firms' IP strategy.

The existing empirical literature on IPR bundles is carried out at the firm-level and focuses on the interaction of different IP rights. The literature is concerned with the question of whether different forms of IPRs interact as complements (i.e. the return from using one type increases in the use of another type) or substitutes (the return from using one type decreases in the use of another type). Somaya and Graham (2006) suggest that different types of IPRs may act as complements due to market-driven factors and economies of scope. Market-driven complementarities will arise if increased enforcement of patents leads to more exclusivity of the product associated with the patent, which in turn leads to a higher value of the corresponding brand. This, on the other hand, makes imitation more attractive, thus increasing the benefit from trade mark protection. Complementarities between IP rights in the form of economies of scope will occur if the existing know-how and experience with one type of IPR simplifies the introduction of another type. In other words, compared to a firm that has no IP experience, it is cheaper for a firm to employ other types of IP rights if it is already IPR-active. Somaya and Graham report on unstructured interviews with six employees of five software firms, all of which indicate that complementarities stemming from economies of scope exist between different types of IPRs. Based on these interviews, the authors suggest that (1) the more a firm is aware of the importance of intellectual property protection and (2) the more resources a firm allocates to IP related matters, the more likely is it to employ more than one type of IPR.

Millot and Llenera (2013) develop a theoretical model in which patents create a temporary monopoly, and absent any trade mark protection, advertising by one firm benefits its competitors, too. Thus, trade mark protection is modelled to reduce positive externalities from advertisement. The model produces two effects: a substitution effect, which occurs because the patent is assumed to prevent competition and therefore renders the effect of the trade mark worthless while the patent is in force, and a complementary effect, which occurs once the patent expires. The trade mark owner then benefits from the goodwill acquired during the monopoly period, which is the same idea as in Parchomovsky and Siegelman (2002). The latter effect is based on the assumption that any goodwill acquired during the patent period is fully appropriated with a trade mark, while without the trade mark, competitors would also benefit from the goodwill if they entered the market. The model predicts that if the effects of advertisement are persistent, but advertisement itself difficult to appropriate, trade marks tend to complement patents. If, on

the contrary, advertisement depreciates quickly as for instance in fast changing industries e.g. for computers and software, trade marks and patents tend to be substitutes. The results of their empirical analysis of listed French firms suggest that overall no relationship between patents and trade marks exists with respect to market value. However, there are interesting results for the pharmaceutical and computer/electrical equipment industries, which suggest that patents and trade marks are complements in pharmaceuticals, but substitutes in computer/electrical equipment industries.

3. Methodology

This section explains the different approaches taken to analyse the use of IPR bundles by UK firms. We look at the use of bundles from three different angles:

3.1 Macro-perspective

In the first part of the analysis we take a macro-perspective. Here we investigate the importance and the performance of firms that use different types of IPRs compared to firms that are not IPR-active or use either a patent or a trade mark but not both. While we can distinguish firms that have obtained a patent as well as a trade mark, the data does not reveal whether firms use them in combination as a bundle to protect the same invention or product. Hence, the macro-level analysis assumes that owning both, patents and trade marks, proxies for the use of IPR bundles. While this may be a useful simplifying assumption in this context, the micro-level analysis shows that it is at best a noisy, i.e. not a very reliable, proxy for IPR bundles.

The objective of the macro-analysis is to reveal broad patterns in firms' use of different forms of IPRs and their joint use. These patterns serve as a starting point for a more in-depth micro-level analysis. With this in mind, we look at different industries and investigate correlations between the average growth rate of employment, turnover, and total assets with different types of IPR users, i.e. firms that do not own patents or trade marks, firms using only one of the two individually, and firms that use both forms of IPRs. To gauge the relevance of the different industries, we also provide simple descriptive statistics of each industry's share in the economy's total assets, employment, and turnover across the different categories of IPR users.

3.2 Micro-perspective

The main shortcoming of the existing literature on IPR bundles is the lack of product-level analysis. In this part of the project, we are closing in on individual bundles, i.e., we gauge to what extent it is possible to collect and analyse IP rights at the product-level. To the best of our knowledge, a comprehensive product-level IPRs database does not exist to date.[3] We pursued two different approaches as explained in detail in the Data section below. As a result of these efforts, we obtained data for a set that consists of 307 firms for which we have information on registered IPR bundles at the product-level. The data allow us to look at bundles at two levels: (1) within firms, i.e. we can compare products protected by bundles and those that are not, as well as IPRs used in bundles and IPRs used on their own. Having information on bundles at the product-level also allows us to analyse the timing of the filing of the different IP rights for a given product. Such "within firm" analysis is novel as it requires product-level information; (2) across firms using (i) IPR bundles, (ii) multiple types of IPRs but not as bundles, and (iii) only a single type of IPR. Here the distinction between (i) and (ii) is enabled by the product-level information. We also cross-tabulate the use of IPR bundles with firm-level characteristics.

3 Some private firms collect such information (see for example Legendre, 2011).

3.3 Court cases

As a third approach, we analyse all cases before the Patents Court for England and Wales between 2000 and 2008 that involved IPR bundles. As argued by Somaya and Graham (2006), using court data ensures that the IPR bundles represent valuable IP rights. Hence, an analysis of court cases where firms attempt to enforce a bundle of IP rights may provide an interesting insight into the strategic value and use of bundles relative to individual rights. It also reveals the effectiveness of the different rights in protecting certain aspects of an invention or a product.

4. Data

4.1 Macro-perspective

This part of the analysis uses the full sample of registered firms in the UK over the period 2002-2009 described in detail in the data appendix ("A2 Data"). We rely on three different variables to measure a firm's growth performance: employment, total assets, and turnover.

We compute the average annual growth rate of every firm in the sample for each of the three variables (employment, total assets, and turnover). This annual average growth rate is based on as many years as a firm reports data. This has the advantage of maximizing the number of firms available for our analysis, but also suffers from the obvious drawback that the growth figures cover a varying number of years and hence may not necessarily be comparable.

Furthermore, the availability of financial information varies substantially across firms. In the UK, the smallest firms are legally required to report only very basic balance sheet information (shareholders' funds and total assets). The largest firms provide a much broader range of profit and loss information, as well as detailed balance sheet data including overseas turnover. This implies different sample sizes for the different variables of interest, i.e. employment, total assets, and turnover.

4.2 Micro-perspective

The construction of a database that contains matched product-IPR information faces several challenges. The first, often underappreciated, challenge consists in identifying the products that individual firms sell. However, even when products are observable, matching IPR information at the product-level is difficult because IP rights usually protect only aspects or components of a product (e.g. a patent protects the embodied technology, a trade mark the name or symbol under which the product is marketed, a design the shape or the colouring of the product). This makes it generally difficult to unambiguously allocate IP rights to products, although the difficulty varies by IP right and product. Moreover, individual IP rights may often also apply to several products or an individual IP right may protect several products, which creates a many-to-many relationship in the data and may add to the ambiguity regarding the product-IPR match.

To tackle these challenges, we pursue a two-pronged approach. First, we focus on a specific product group (*product group approach*), second we limit our data collection to firms with small IPR portfolios in the manufacturing industry (*high-growth firms and small IPR portfolios*). The second approach also uses performance criteria to identify relevant firms, which provides a direct link to our analysis in the first stage of this project.

Product groups

We look for products that (i) embody patentable technology, (ii) carry trade marks, and (iii) are exposed to the eye, so that the design matters. With these criteria in mind, we decided to focus

on home-use coffee and espresso machines. Home-use coffee machines use mainly mechanical technologies, which make it more likely that the relevant technologies are contained in few, well-delineated patents. Also, the design and the brand of the coffee machines are relevant factors for determining consumer preferences.

Figure 4.1 Product evolution from an IP rights perspective

Figure 4.1 shows an ideal sample output of this approach. The figure shows the evolution of a new product reflected by its corresponding IP rights. In 2005, Italian espresso and coffee machine manufacturer Arieté patented a technology to expel used pre-packaged capsules for espresso coffee machines. Later that year, the firm filed a Community trade mark for the product line “Capricci”, which are pre-packaged, differently flavoured, coffee capsules that can only be used in coffee machines that support this technology. About a year later, Arieté registers the design rights to a coffee machine that would soon after appear on the markets for sale. This is a clear example of the use of different IP rights to protect the different aspects of the technology, design, and marketing that ultimately merge into a new product.

Another, more popular, example we picked up using this approach is Nestlé’s Nespresso product line. Nespresso coffee is prepared using ground coffee beans, which are filled into capsules that are designed to fit only in Nespresso coffee machines. Nestlé owned the patents protecting the method of producing and filling the capsules as well as the technology required to use the capsules in a coffee machine. Furthermore, Nestlé registered design rights (design patents in the U.S.) to protect the design of the machines that use their capsules and trade marks to protect their names, e.g. Le Cube, Nescafe Dolce Gusto Piccolo, Pixie etc. However, contrary to Arieté in the example above, it is other firms such as DeLonghi and Krups that manufacture the machines. The Nespresso symbol appears on the machines in a way that attracts just as much attention as the manufacturer’s label. We could not find patents held by Krups, DeLonghi, or Nestlé that could be associated uniquely with Nespresso coffee machines.

Krups' and DeLonghi's established know-how and reputation of producing high-quality coffee machines most likely are the reasons why Nestlé co-operates and co-brands with these manufacturers.

When applying this approach to UK firms, however, we were not able to find a UK coffee machine manufacturer using a combination of patents and trade marks. Most international manufacturers, on the other hand, hold large patent and trade mark portfolios, in which case the link between trade marks and patents is often not obvious. In short, while this approach seems promising in theory and did produce a few interesting case studies, it does not seem applicable to UK firms, and is generally difficult to scale up to a level that would create a sample size large enough to permit statistical analysis.

High-growth firms and those with small IPR portfolios

Since the approach to use a product as point of departure, in the examples above home-use coffee machines, did not yield any useful results beyond the examples shown, we also explored an approach that uses firms as a starting point. We extracted a list of firms from BvD's FAME database that fulfilled the following criteria:[4]

- Availability of information on total assets in at least one year between 2002 and 2009;
- A maximum of one patent and one trade mark if information was available for total assets only; between one and five patents and one and five trade marks between 2002-2009 if information was available on total assets, employment, and turnover;
- Filing of a trade mark within two years before or after a patent;
- Manufacturing firms excluding producers of pharmaceutical and chemical products.[5]

This left us with a pool of 307 firms. For each of these firms, we checked the firms' websites and other publicly available sources to compile the firms' product portfolios. We searched the IPR databases of the European Patent Office, the Office of Harmonization for the Internal Market (OHIM) and the UK IPO for patents, trade marks, and design rights associated with the product portfolio. Allocating the patents to products usually required reading the description of the invention. It is because of this time consuming activity that we chose the criteria listed above to keep the number of potential patent-product links limited. Thus, for each firm, we compiled a list of all patents, trade marks, and design rights at the product-level. Below we provide three examples that illustrate this methodology, highlighting its drawbacks, and giving the reader a better understanding of the creation of IPR bundles using this approach. Regarding design rights, their use in our analysis is limited to the set of 307 firms in our product-level sample because our FAME-IPR match does include design rights.

4 As an alternative, we also considered the list of the 100 fastest growing firms identified by BERR (see Helmers and Rogers, 2008), for which we updated the information on IPR holdings in the first stage of this project. However, we found IPR bundles for only one of the 100 firms.

5 Allocating patents to pharmaceutical drugs is very difficult for a range of reasons (for details see Abud et al., 2013) and therefore beyond the scope of this analysis.

Example 1: *Futuros Limited*

Our sampling method identified Futuros Ltd as a firm that owns one patent and one trade mark. First, we identified the firm's main product - the *amplamp* - by searching the firm's website. The *amplamp* is a product that combines a designer table lamp with a high-end speaker. Second, we looked up the detailed information on the patent and trade mark held by the firm. In addition, we also searched for design rights in the firm's name, which are not covered by FAME-IPR data. The information collected in this way revealed that the firm filed its first patent application in March 2006, followed by a trade mark application on "AMPLAMP" in January 2007. Then, the same day the trade mark application was published (March 23, 2007), Futuros Ltd filed an application for a design right on the shape of its product. Finally, the product was officially launched in September 2008. Hence, we have identified an IPR bundle consisting of a patent, a trade mark, and a design for a single product, the *amplamp*.

Example 2: *Elfab Limited*

This firm owns not only more than one patent and trade mark, but also offers a wide variety of products. This makes the approach of identifying all of the firm's products first and then allocating the corresponding IP rights less practical. Instead, we looked at the firm's patents and trade marks first. Elfab filed five patents and four trade marks - FLO-TEL, OPTI-GARD, RADIO-TEL, and TEST-TEL. The trade marks enabled us to identify the products marketed by the firm under these trade marks, namely rupture discs (Opti-Gard and Test-Tel) and burst detection devices (Flot-Tel and Radio-Tel). In order to allocate the patents to these products, we had to study the abstract, description, and claims in order to compare them to the products. We were able to allocate patent application *WO2005/054731* with priority date 12 November 2003 to the Opti-Gard rupture disc and the corresponding trade mark, which was filed on the 27. October 2004.

Example 3: *Kevington Building Products Limited*

In 1987, Kevington started off as brick manufacturer offering merely cutting services to the construction industry. Over time, the scale of their business increased, and so did the product range. In January 2008, the firm filed the trade mark application FASTWALL, under which it is selling pre-fabricated brick panels and which preceded the corresponding patent application by one month.

However, on the day the patent application was filed, the firm also filed Community design rights for the brick wall panels. This example not only illustrates the scope of IPR bundle protection in terms of technology and product space, but also that the sequence "patent - trade mark design" is not necessarily the only way bundles are created.

4.3 Court cases

The analysis uses data on all court cases filed between 2000 and 2008 at the Patents Court. The data excludes all cases that represent an appeal to an administrative decision taken by the UK IPO. The data on court cases at the Patents Court was obtained from a range of sources, including the Patents Court Diary,[6] the website of the British and Irish Legal Information Institute,[7] the case database of Lexis Nexis,[8] as well as Thomson Reuters's Westlaw database.[9] However, these sources did not offer any detailed records for a number of cases (mostly those settled at an early stage). For these cases additional information was obtained from media websites, blogs or the websites of legal representatives for information. Since the information with regard to each court case often had to be assembled relying on different sources, in many cases the available court records are still incomplete. This is a particular concern for cases that were settled early in the process. This explains why the information available varies enormously (and non-randomly) across court cases. For a more detailed description of the data collection see Helmers and McDonagh (2012), whose discussion focuses on patent cases.

6 http://www.hmcourts-service.gov.uk/cms/list_patents_diary.htm.

7 http://www.bailii.org.

8 http://www.lexisnexis.co.uk.

9 http://www.westlaw.co.uk.

5. Findings

This section discusses the main findings of our analysis at the macro- and micro-level as well as the court cases.

5.1 Macro-perspective

The analysis at the macro-level consists of (a) an assessment of the relative importance of firms that hold both patents and trade marks within industries and (b) a regression analysis that points to broad correlations between performance and the use of patents and trade marks.

Industry ranking

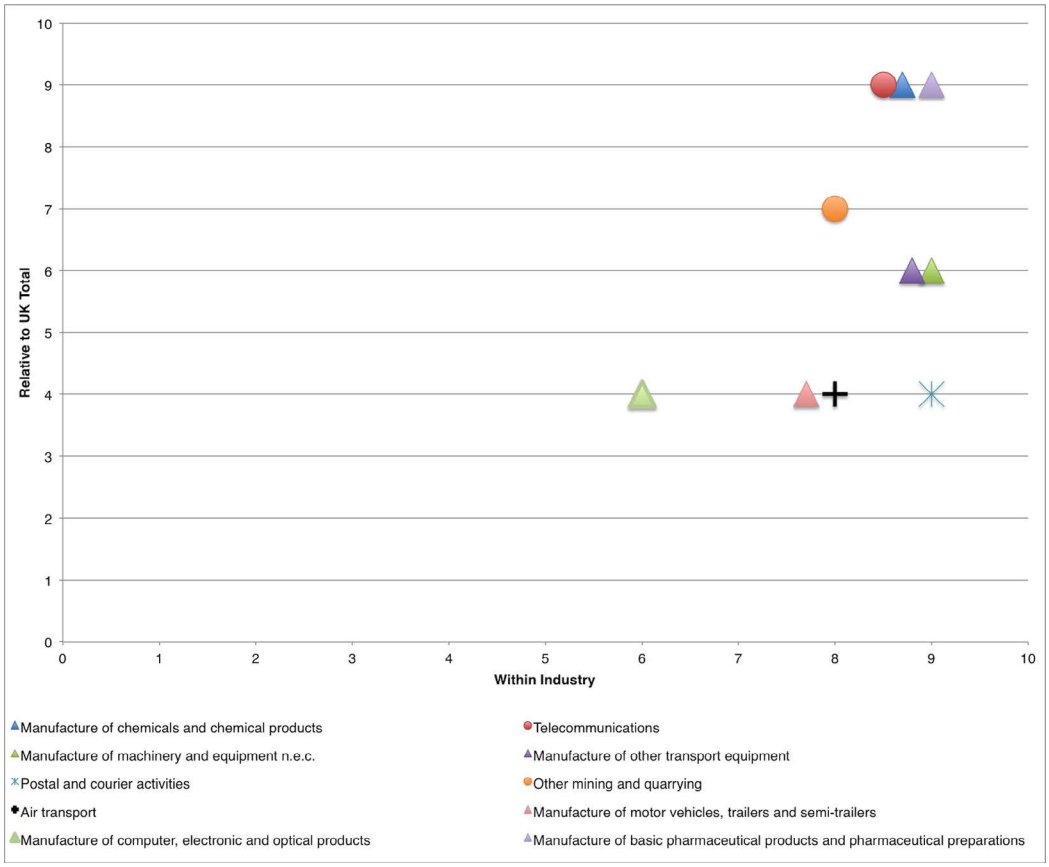

Figure 5.1 Industry ranking showing importance of firms on a 0-10 scale holding both patents and trade marks in a given industry

Figure 5.1 shows the main results of our analysis of the relevance of joint IP rights holders in a given industry in terms of their share of total assets, employment, and turnover within the industry (x-axis) and the UK (y-axis). The figure shows the top ten industries in the resulting ranking.[10] In these ten industries, firms that have both, patents and trade marks, have a significant share of assets, employ a relatively large number of workers, and generate relatively large turnover compared to other firms within the industry that either do not use IP rights or obtain exclusively patents or trade marks. Not surprisingly, the industries in which joint ownership of patents and trade marks is most common are "*Manufacture of basic pharmaceutical products and pharmaceutical preparations*," "*Manufacture of chemicals and chemical products," and "Telecommunications*." The combined use of patents and trade marks in the pharmaceutical and chemical industry is well known. The importance of the joint use of patents and trade marks in the telecommunications industry may be explained in part by the shorter product life-cycle, especially compared to the pharmaceutical or chemical industry. This may increase the value of brand recognition, which is protected by trade marks. Since the telecommunication industry is renowned for the large amount of strategic patenting, the large share of firms relying on both, patents and trade marks, may not necessarily indicate the use of IPR bundles. Among the top ten industries are another four manufacturing industries, namely "*Manufacture of machinery and equipment not elsewhere classified*," "*Manufacture of other transport equipment*," "*Manufacture of motor vehicles, trailers and semi-trailers*," and "*Manufacture of computer, electronic and optical products*." This suggests that joint IPR ownership is particularly relevant for manufacturing firms, which does not come as a surprise since most inventions in the services industry are probably not patentable, hence patenting is not very common (Hall et al., 2012).

Descriptive regressions

We employ ordinary least squares regressions on the collapsed panel data set to look for any significant correlations between the use of both IP rights together (as a proxy for bundles) and firm performance across industries. On the left hand side of the equation, i.e. the dependent variable, is the average annual growth rate of total assets, employment, and turnover, respectively, at the firm level between 2002 and 2009. On the right hand side of the regression equation are dummy variables, indicating the type of IP right user the firm is, i.e. no patents or trade marks, patents only, trade marks only, and both patents and trade marks. We also include the size, age, and industry of the firm in the regressions as well as the logarithm of the level value of the dependent variable in order to capture firm, age, size, and industry-specific effects. Table 5.1 shows the results. Due to reasons discussed in the Data appendix, the sample sizes for the different dependent variables vary substantially. For the largest sample (n=997,637), i.e. the asset growth regression, we find that all types of IPR users are positively and significantly correlated at the 1% level with the average annual growth rate (the omitted category is no IPR), where the coefficient on "Only trade marks" is the largest in magnitude, followed by the coefficient on "Both IPRs". The results for the employment (n=67,017) and turnover (159,832) growth regressions are weaker but tell the same story, and the coefficient for firms that only use patents is not significant, Perhaps surprisingly, all the coefficients on the IPR dummies in the turnover regression changed signs, albeit that here the coefficient for the patent-only dummy is insignificant, too. A first intuitive explanation for this may be the relatively high correlation between current period turnover and growth thereof for firms with no IP rights or patents only.

10 A detailed description of the ranking algorithm can be found in the Appendix A3 Ranking

For firms with trade marks or both, this correlation may be weaker, reflecting other factors such as fluctuating spending on advertising or changing degrees of competition. Furthermore, the regressions show that larger firms, as well as older firms, grow slower, which is in accordance with the theory and previous empirical findings (see for instance Greenhalgh et al. 2011).

Together, the relevance ranking and the descriptive regressions not only suggest that holding both IPR types does affect firm performance significantly, but also that users of both IPR types account for relevant shares of total assets, employment, and turnover in their respective industries as well as in the UK overall. Moreover, the ranking of industries revealed that multiple IPR-type users are particularly frequent and account for significant weight in manufacturing industries. These findings provide sufficient evidence to justify our choice to focus in on manufacturing industries and to study these firms at a more disaggregated level.

Table 5.1: Descriptive OLS regressions

	Avg employment growth	Avg turnover growth	Avg total assets growth
Log Employment	.009 *** (0.001)		
Log Turnover		.085 *** (0.001)	
Log Total Assets			.06 *** (0.000)
Only patents	-0.005 (0.01)	-0.021 (0.02)	0.028 *** (0.01)
Only Trade Marks	0.025 *** (0)	-0.028 *** (0.01)	0.068 *** (0)
Both IPR types	0.020 *** (0.01)	-0.041 ** (0.01)	0.045 *** (0.01)
Small	0.018 *** (0)	-0.129 *** (0.01)	-0.100 *** (0)
Medium	0.014 *** (0)	-0.235 *** (0.01)	-0.166 *** (0)
Large	0.015 *** (0)	-0.399 *** (0.01)	-0.358 *** (0)
5-10 years	-0.029 *** (0)	-0.062 *** (0)	-0.041 *** (0)

10-15 years	-0.042 *** (0)	-0.119 *** (0)	-0.101 *** (0)
15-25 years	-0.061 *** (0)	-0.152 *** (0)	-0.136 *** (0)
>25 years	-0.076 *** (0)	-0.177 *** (0)	-0.158 *** (0)
Constant	0.035 *** (0.01)	-0.131 *** (0.01)	-0.119 *** (0)
N	67,017	159,832	997,637
R^2	0.034	0.079	0.063
Industry Dummies	Yes	Yes	Yes
Robust standard errors reported below coefficients. Significance: * 10% level, ** 5% level, *** 1% level.			

5.2 Micro-perspective

IPR-use categories

As a starting point, table A1.1 (in appendix) shows the distribution of firms across IPR-use categories across industries. The sample of firms for this table consists of all firms that report assets, employment, and turnover and have less than five patents and/or trade marks. Table A1.1 shows that most IPR-active firms only rely on trade marks, confirming the patterns identified in a previous report for the UK IPO (Greenhalgh et al. 2011). The main advantage of the micro-level analysis relative to the macro-perspective is the availability of information on bundles, i.e., we relax the assumption that firms, which apply for both, patents and trade marks, automatically use them as bundles. The table in fact reveals that most firms using both, patents and trade marks, do not combine them as bundles to protect the same product. Indeed, bundles are an extremely rare occurrence: the average share of firms using bundles across all industries is only 0.6%, and even within manufacturing the share is only 1.3%. In contrast, the share of firms using both, patents and trade marks – although not as a bundle – is 7% across all industries and 10% for the manufacturing industry. The difference is sufficiently large that even a substantial number of false negatives (IPRs that are in fact used as a bundle although we failed to identify the bundle) in our construction of bundles is unlikely to reverse this pattern. The "*Manufacture of leather and related products*" and "*Manufacture of wood and wood products*" industries – which would both be considered low-tech - stand out, each with a share of around 4% of firms with bundles. Tables A1.2 and A1.3 provide the same breakdown across firm age and size

categories, respectively (although in these tables columns sum to 100% instead of rows). Table A1.2 shows that older firms (>25 years) rely disproportionately on bundles. Firms aged less than 15 years rely considerably less on bundles, although they frequently apply for both, patents and trade marks. Looking at firm size, Table A1.3 reveals that medium sized firms hold the most bundles. SMEs account for only around 28% of bundles although their sample share is around 40%.

Number of IPR filings

Table A1.4 looks at the average number of patents and trade marks firms have applied for across the different types of IPR users. The table distinguishes between firms with and without bundles. Among firms without bundles, firms that have both, patents and trade marks, apply on average for more patents compared to firms that only obtain patents. There is no such noticeable difference for trade marks. Firms relying on bundles have on average substantially fewer patent and trade mark filings than firms without bundles. From table A1.3 we know that this is not simply explained by the size of the firms that hold bundles. When we look at the distribution of patents and trade marks within firms that hold bundles, we note that the larger share of IPRs held by these firms does not belong to a bundle. In other words, even when we restrict the focus on firms that rely on bundles, only a fraction of a firm's IPRs is bundled and the larger share of IPRs is used on its own. Tables A1.5 and A1.6 show the average number of IPRs across firm age and size categories, respectively. From table A1.5 we see that among firms with bundles, the number of patents and trade marks used in and outside of bundles is fairly balanced for younger firms (up to 10 years). Possibly the most interesting finding of Table A1.6 is that micro firms that apply for both, patents and trade marks, have most of their IP rights as part of bundles. This points to the possibility that if micro firms use IP, they either rely primarily on bundles or not, but they do not pursue a strategy of bundles plus standalone IP.

Timing of filings

Figure 5.2 shows the timing of the filing of IP rights that form part of a bundle. To plot Figure 5.2, we determined the type of IPR filed first as part of a bundle, and then we calculated the time that lapsed between the application date of that IPR and any other type of IPR that forms part of the same bundle. The most common pattern is where a patent is filed first and then followed by a trade mark. The figure shows that most trade marks following a patent are filed within the 18 months publication lag of a patent. A similar pattern applies to designs that are filed following a patent application. Overall, the figure suggests that most bundles are assembled within a year after the filing of the first IP right that is part of a bundle. This could suggest that firms do indeed follow a bundle strategy instead of arbitrarily filing different IP rights over time on the same product. However, this might also be coincidental and due to the simple nature of the products in this sample.

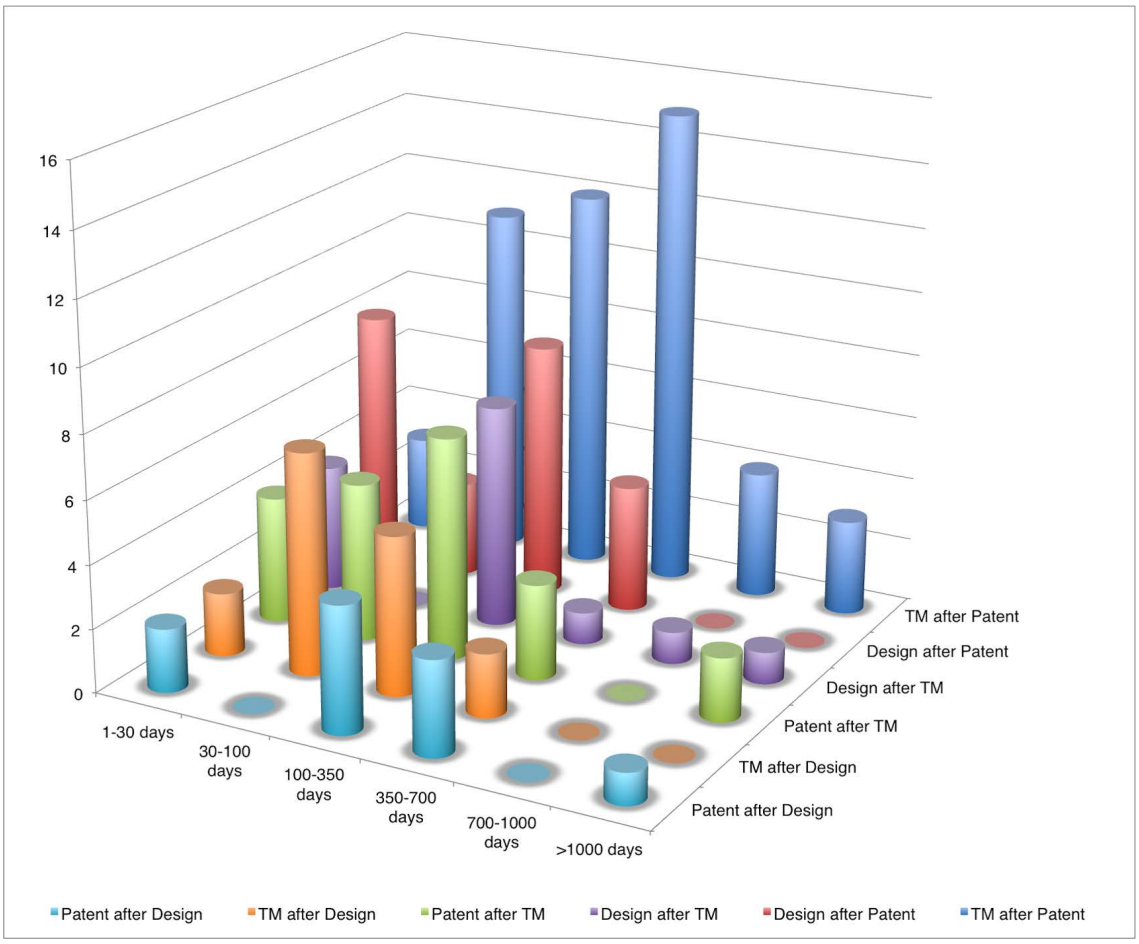

Figure 5.2 IPR bundles – filing lags

Characteristics of IPR bundles

An interesting question concerns the characteristics of the products underlying the IPR bundles. Bundles protect a diverse range of products, including concrete mixers, photovoltaic systems, playground equipment, road signs, air conditioners, etc. (see also the examples provided in Section 4.2 above). This makes it difficult to allocate products unambiguously into product categories. Instead, we use a mapping of the Nice classes of the trade marks associated with the products into broad economic activities (we mapped the 45 Nice classes into 10 broad economic activities).[11] Figure 5.3 shows the distribution of trade marks across broad economic activities. Looking only at the set of firms with bundles, the graph plots the number of trade marks in a given economic sector that form part of a bundle as well as those that do not. The information for chemicals has to be interpreted with caution because we excluded the chemicals and pharmaceutical industry from our data, but the firms included in the sample still have trade marks in the relevant Nice classes. There is interesting variation across economic activities.

11 Class groups were defined by Edital: Agricultural products and services: 29, 30, 31, 32, 33, 43; Chemicals: 1, 2, 4; Construction, Infrastructure: 6, 17, 19, 37, 40; Household equipment: 8, 11, 20, 21; Leisure, Education, Training: 13, 15, 16, 28, 41; Management, Communications, Real estate and Financial services: 35, 36; Pharmaceuticals, Health, Cosmetics: 3, 5, 10, 44; Scientific research, Information and Communication technology: 9, 38, 42, 45; Textiles - Clothing and Accessories: 14, 18, 22, 23, 24, 25, 26, 27, 34; Transportation and Logistics: 7, 12, 39.

Bundles are most heavily concentrated in household equipment as well as construction. In contrast, there are few textile and clothing products that rely on the use of bundles.

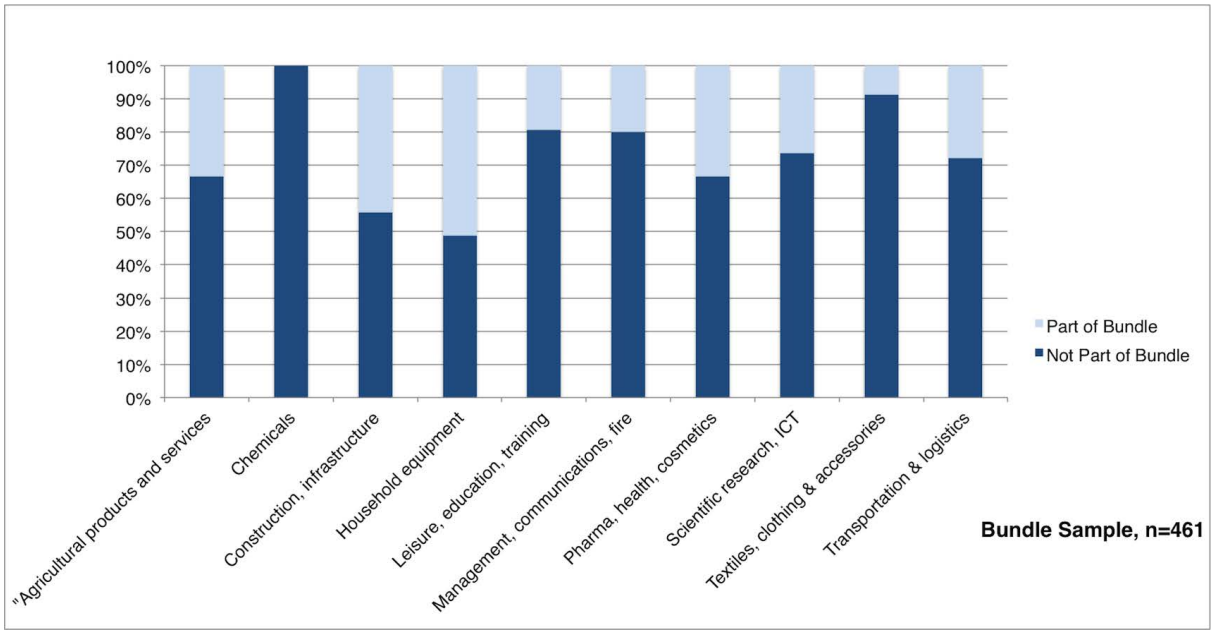

Figure 5.3 Distribution of trade marks held by firms with bundles across broad economic activities

Figure 5.4 looks at the full sample, which also includes firms without bundles. The figure shows the distribution of trade marks across economic activities not only for firms that have bundles, but also for firms that own patents and trade marks without using them in a bundle as well as firms owning only trade marks.

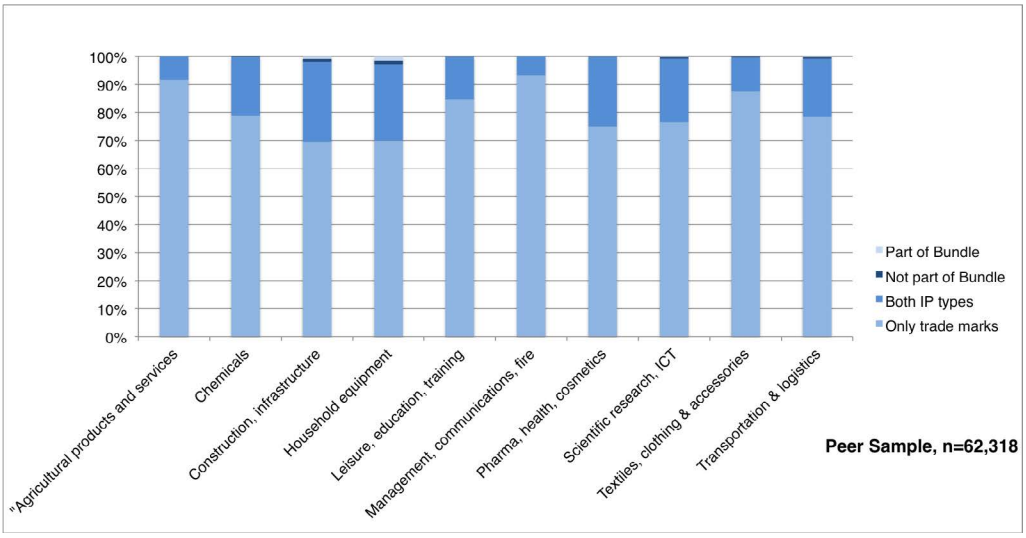

Figure 5.4 Distribution of trade marks across broad economic activities

IPR-use categories and performance

Finally, figure 5.5 shows growth rates for the performance variables used in our analysis, i.e. employment, turnover, and total assets across IPR use categories. Confirming the regression results as well as earlier studies of the correlation between IP right usage and performance, we find that firms, which only use trade marks, seem to perform best on average, followed by firms utilizing both types but no bundles.

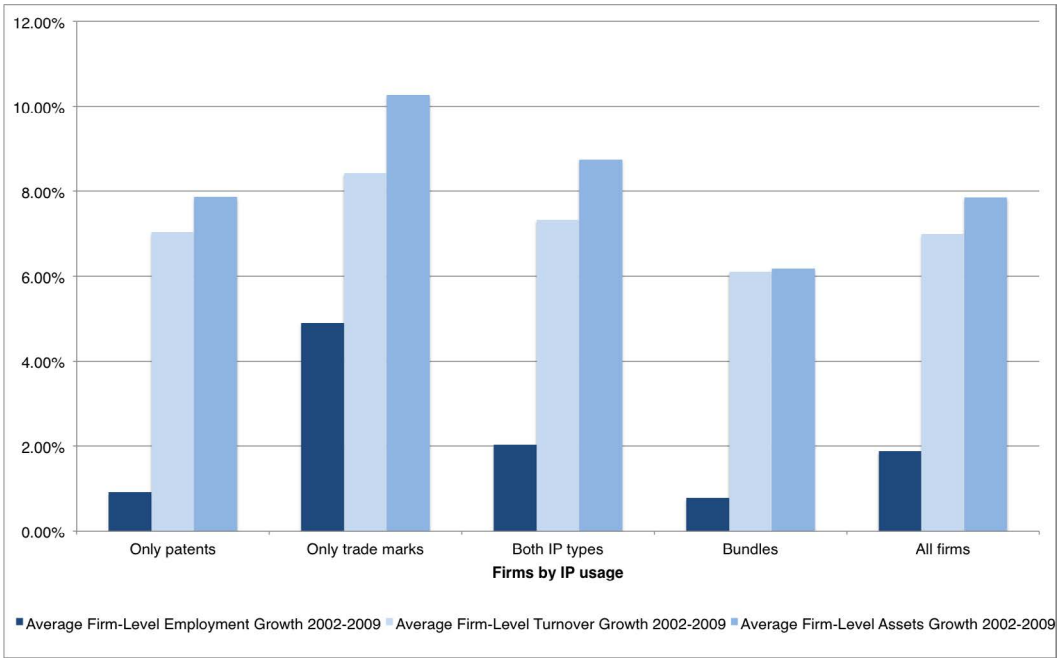

Figure 5.5 Growth rates by IPR user type

To our surprise we find that the firms using bundles perform worst in this comparison. In fact they have growth rates below the average of the whole sample. However, from table A1.1 we know that the majority of firms using IPR bundles are 25 years or older, but not necessarily bigger. These firms can be considered mature, i.e. they have reached a stage of slow but steady, stable growth. Instead of investing in tangible assets, these firms invest in IPRs, creating bundles to secure their current position.

5.3 Court cases

The last piece of evidence on the use of bundles by UK firms presented in this report concerns court cases involving IPR bundles. Table A1.7 shows the distribution of the number of court cases over the period 2000-2008. The table shows that the total number of cases varies between 34 (in 2001) and 50 (in 2006), and totals 381 over the nine-year period. The table shows that the share of cases involving IPR bundles (defined as cases involving at least two of the following IP rights: patents, trade marks, and registered designs) is small. It averages less than 3% of the period. Table A1.8 breaks up the case numbers across different IP rights. Clearly, the overwhelming majority of cases only involves patents. Seven cases involve bundles that contain a patent, nine cases involve a trade mark and six cases a design. Hence, while patents are overwhelmingly litigated on their own, design rights, for example are litigated only as a bundle in combination with patents and/or trade marks. The case of trade marks is less pronounced: there are seven cases that only involve a trade mark and there are nine cases that involve a trade mark as part of a bundle. Finally, Table A1.9 provides more detailed information at the case level. As discussed in the data section, the information is often incomplete due to a lack of court records. Nevertheless, the data provide some interesting insights. First, the range of products protected by bundles is large - products range from the playstation console to bulk containers. There is no evident pattern in terms of product characteristics. This echoes our findings from the micro-level approach – bundles appear across a range of industries, and within industries they cover a wide range of products. Second, for all cases for which we have detailed information, the claim is for infringement. That is, firms use a bundle of IP rights to enforce their IP. Third, for the few cases that were not settled before a judgment was handed down, we observe that patents were not held infringed in any of the cases. In contrast, trade marks and design rights were held infringed in all cases. This suggests that the enforcement of an IPR bundle offers firms a much broader target and hence increased chances to succeed with infringement claims. However, the desire to keep proceedings brief and simple (due to cost considerations) may also deter firms from trying to enforce multiple IPR types for the same product. In light of this evidence it would be interesting to explore why most firms only enforce a patent and whether the firms could have enforced a bundle instead.

6. Discussion

The analysis presented in this report is exploratory. We set out to look at the use of bundles of intellectual property rights by firms registered in the UK from a number of different angles. In a first step, we assumed that firms that have applied for both, patents and trade marks, use them as bundles. This simplifying assumption allowed us to compare these firms' characteristics with those of firms that only hold either patents or trade marks, neither of them, or both. In a second step, we pursued two different ways of constructing IPR bundles at the product-level. The first approach departed from a given product, here home-use coffee machines, and attempted to collect all IP rights that firms, which produce such coffee machines, employ to protect them. While this approach produced some interesting case studies, it was not generally applicable to UK firms and was extremely difficult to scale up to the extent necessary to collect data on a meaningful sample of firms. The second approach used firms with less than five patents and trade marks and a certain minimum of financial data availability as our starting point. We collected detailed information on all IPR holdings for these firms (including registered designs) as well as information on the products marketed by these firms. We then allocated the different IP rights to the products in order to identify IPR bundles consisting of patents, trade marks, and registered designs at the product-level. While extremely labour-intensive, this approach worked out remarkably well and allowed us to construct a sizeable sample of firms, for which we could ascertain whether the joint use of patents and trade marks indeed represents the use of IPR bundles. The third approach taken to analyse the use of IPR bundles is an analysis of all court cases before the Patents Court of England and Wales between 2000 and 2008 that involved IPR bundles in the form of patents, trade marks, and registered designs. These cases offer a detailed, albeit selective, view on how firms use different types of IP rights in combination to protect an invention.

The macro-level analysis pointed to a few industries where firms that file for both, patents and trade marks, account for a sizeable share of total assets, employment, and turnover. Among these industries are chemicals, pharmaceuticals, and telecommunication, which are all known for their heavy use of IPRs. The regression analysis revealed that trade marking alone and trade marking in conjunction with patenting are correlated with a higher growth rate, thus suggesting that firms owning patents and trade marks are indeed a relevant group to be analysed separately. In summary, the macro-level analysis points to a number of manufacturing industries of potential interest for the study of IPR bundles. Yet, the micro-level analysis shows that the joint use of patents and trade marks is a poor proxy for the use of IPR bundles. The analysis demonstrates that only a small fraction of firms, which apply for both, patents and trade marks, use them as bundles. This is a strong argument in favour of micro-level, i.e. product-level, analysis, and suggests that caution is warranted in interpreting results obtained from the macro-level analysis with respect to the use of IPR bundles.

Our attempts to construct a micro-level data set that contains IPR bundles at the product-level revealed the advantage of restricting the set of firms included in the analysis to firms with few IPR filings. These firms tend to also have few products, which makes an IPR-product link more feasible. The data work also suggests that using a firm's product as a starting point for the data construction may not be the most promising avenue to pursue.

The results that we obtain from our product-level analysis are striking. The most important insight is that very few firms that file for both, patents and trade marks, use these rights in combination as bundles. For our sample of firms with a small IPR portfolio, this is generally true across industries. In this sample, bundles appear to be more frequent in industries that produce rather basic products. Most products protected by bundles are relatively technologically simple, such as a pre-fabricated brick panel or TV wall mounts. However, this is likely a result of the sampling method where we purposely select firms with few patents, which implies a lower level of complexity of their products. When we look at the time lags between the filings of the different IP rights that belong to a bundle, we see that firms tend to bunch their filings relatively closely. If trade marks or designs are filed after a patent, they are almost all filed within 18 months of the patent application. This may be coincidental, but could also suggest that, once the firm's invention is about to be made public, there may be a need to protect an invention by using mechanisms that provide more immediate protection, at least until some of the uncertainty about the success of a patent application has disappeared.

The analysis of the court data shows that very few cases involve IPR bundles. In light of the micro-level analysis this should not surprise, as bundles are very rare. In this sense, a share of 3% of cases that involve bundles in the total number of cases is larger than what would be expected given the share of bundles in total IPR holdings. The large majority of cases involving bundles contain trade marks. In fact, while all different IP rights are enforced in court, all cases for which a final judgment was handed down were decided in favour of the claimant based on trade mark and design infringement, never based on patent infringement. Although this suggests that more firms might benefit from enforcing both, patents and trade marks, instead of only enforcing a patent, the fact that we do not observe this strategy more frequently indicates that either the costs or the complexities involved in a multi-IPR litigation outweigh the expected benefits from doing so.

Thus, in a next step it would be of interest to find out how many firms purposely do not enforce multiple rights simultaneously and whether this is to keep costs and complexity low, whether there is too little experience with multi-IPR litigation, or whether there simply is no need to do so in order to protect their product and goodwill. Furthermore, a cross-country comparison of litigation involving IPR bundles could reveal differences in the IPR litigation systems, e.g. in terms of costs, time, and simultaneous treatment of the different intellectual property right types.

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Appendix

A1 Tables

Table A1.1: Distribution of IPR user types by industries

UK Standard Industry Classification 2007	Only patents	Only TM	No bundles	Bundles	N
Crop and animal production, hunting and related service activities	5.00%	90.00%	5.00%	0.00%	40
Forestry and logging	20.00%	50.00%	30.00%	0.00%	10
Extraction of crude petroleum and natural gas	13.33%	86.67%	0.00%	0.00%	15
Mining of metal ores	9.09%	81.82%	9.09%	0.00%	11
Other mining and quarrying	4.55%	90.91%	4.55%	0.00%	22
Mining support service activities	37.50%	45.83%	16.67%	0.00%	24
Manufacture of food products	2.32%	95.07%	2.61%	0.00%	690
Manufacture of beverages	0.59%	97.63%	1.78%	0.00%	169
Manufacture of textiles	9.95%	79.06%	9.95%	1.05%	191
Manufacture of wearing apparel	3.12%	94.14%	2.73%	0.00%	256
Manufacture of leather and related products	1.79%	87.50%	7.14%	3.57%	56
Manufacture of wood and of products of wood and cork except furniture; manufacture of articles of straw and plaiting materials	15.22%	70.65%	9.78%	4.35%	92
Manufacture of paper and paper products	18.98%	66.42%	12.41%	2.19%	137
Manufacture of coke and refined petroleum products	10.00%	90.00%	0.00%	0.00%	20
Manufacture of rubber and plastic products	32.82%	48.90%	17.40%	0.88%	454
Manufacture of other non-metallic mineral products	22.35%	67.04%	7.82%	2.79%	179
Manufacture of basic metals	34.18%	53.16%	10.13%	2.53%	79
Manufacture of fabricated metal products, except machinery and equipment	33.20%	49.26%	15.38%	2.16%	741
Manufacture of computer, electronic and optical products	29.67%	51.17%	18.29%	0.87%	809
Manufacture of electrical equipment	22.86%	50.48%	23.33%	3.33%	210
Manufacture of machinery and equipment n.e.c.	41.83%	42.97%	13.89%	1.31%	612
Manufacture of motor vehicles, trailers and semi-trailers	37.40%	51.22%	10.57%	0.81%	123

Manufacture of other transport equipment	22.40%	65.60%	12.00%	0.00%	125
Electricity, gas, steam and air conditioning supply	11.11%	81.48%	7.41%	0.00%	27
Water collection, treatment and supply	15.38%	69.23%	15.38%	0.00%	13
Waste collection, treatment and disposal activities; materials recovery	11.11%	70.37%	18.52%	0.00%	27
Construction of buildings	8.10%	85.24%	6.19%	0.48%	210
Wholesale and retail trade and repair of motor vehicles and motorcycles	7.75%	87.60%	4.65%	0.00%	129
Wholesale trade, except of motor vehicles and motorcycles	5.96%	85.64%	8.31%	0.08%	1,191
Retail trade, except of motor vehicles and motorcycles	1.12%	91.46%	7.42%	0.00%	445
Land transport and transport via pipelines	9.20%	90.80%	0.00%	0.00%	87
Water transport	4.76%	90.48%	4.76%	0.00%	21
Air transport	10.34%	86.21%	3.45%	0.00%	29
Warehousing and support activities for transportation	3.95%	92.11%	3.95%	0.00%	76
Accommodation	0.00%	100.00%	0.00%	0.00%	92
Food and beverage service activities	0.00%	99.31%	0.69%	0.00%	145
Publishing activities	0.83%	93.78%	5.39%	0.00%	241
Motion picture, video and television programme production, sound recording and music publishing activities	0.00%	97.85%	2.15%	0.00%	93
Telecommunications	8.73%	78.57%	12.70%	0.00%	126
Computer programming, consultancy and related activities	8.12%	73.58%	18.31%	0.00%	579
Financial service activities, except insurance and pension funding	1.00%	96.00%	3.00%	0.00%	300
Insurance, reinsurance and pension funding, except compulsory social security	0.65%	98.70%	0.65%	0.00%	154
Activities auxiliary to financial services and insurance activities	2.70%	94.59%	1.80%	0.90%	111
Real estate activities	2.15%	94.62%	3.23%	0.00%	93
Legal and accounting activities	0.00%	93.33%	6.67%	0.00%	15
Activities of head offices; management consultancy activities	8.24%	84.21%	7.55%	0.00%	437
Scientific research and development	34.46%	21.62%	43.92%	0.00%	148
Advertising and market research	2.08%	94.44%	3.47%	0.00%	144
Rental and leasing activities	4.92%	88.52%	6.56%	0.00%	61
Office administrative, office support and other business support activities	9.76%	77.30%	12.94%	0.00%	912
Public administration and defence; compulsory social security	13.04%	78.26%	8.70%	0.00%	23

Education	0.00%	98.40%	1.60%	0.00%	125
Human health activities	5.48%	84.25%	10.27%	0.00%	146
Residential care activities	0.00%	100.00%	0.00%	0.00%	27
Activities of membership organisations	0.76%	99.24%	0.00%	0.00%	132
Other personal service activities	7.85%	80.89%	11.26%	0.00%	293
Total	13.60%	75.53%	10.33%	0.55%	11,737
N	1,596	8,865	1,212	64	11,737

Table A1.2: Distribution of IPR user types by firm age

Firm age	Only patents	Only TMs	No bundles	Bundles	Total	N
<5 years	14.41%	16.68%	17.49%	9.38%	16.42%	1,927
5-10 years	22.24%	22.08%	24.34%	10.94%	22.27%	2,614
10-15 years	13.60%	14.64%	11.96%	3.12%	14.16%	1,662
15-25 years	19.49%	20.35%	18.40%	15.62%	20.01%	2,348
>25 years	30.26%	26.25%	27.81%	60.94%	27.14%	3,186
Total	100.00%	100.00%	100.00%	100.00%	100.00%	11,737
N	1,596	8,865	1,212	64	11,737	

Table A1.3: Distribution of IPR user types by firm size

Firm size	Only patents	Only TM	No bundles	Bundles	Total	N
Micro	35.53%	22.39%	36.47%	20.31%	25.62%	3,007
Small	13.97%	14.37%	15.18%	7.81%	14.36%	1,686
Medium	28.51%	30.71%	27.81%	46.88%	30.20%	3,544
Large	21.99%	32.53%	20.54%	25.00%	29.82%	3,500
Total	100.00%	100.00%	100.00%	100.00%	100.00%	11,737
N	1,596	8,865	1,212	64	11,737	

Table A1.1-A1.3 show what proportion of firms in each industry, age or size category, respectively, uses only patents, only trade marks, both but not as a bundle or both as bundle.

The column “No bundles” contains firms that do own both, patents and trade marks, but do not use them jointly for the same product.

Table A1.4: Average IPR holdings of IPR users with and without IPR bundles by industries

UK SIC 2007	Firms without bundles				Firms with bundles				
	Only patents	Only TMs	Both IPRs		Not part of a bundle		Part of a bundle		N
	Pat/Firm	TM/Firm	Pat/Firm	TM/Firm	Pat/Firm	TM/Firm	Pat/Firm	TM/Firm	
Crop & animal production, hunting & rel. activities	2	1.56	2.5	1	0	0	0	0	40
Forestry & logging	1	1.6	2	3	0	0	0	0	10
Fishing & aquaculture	0	3	1	2	0	0	0	0	5
Extraction of crude petroleum & natural gas	2.5	1.85	0	0	0	0	0	0	15
Mining of metal ores	1	2.33	2	1	0	0	0	0	11
Other mining & quarrying	1	2.05	2	3	0	0	0	0	22
Mining support service activities	1.89	1.82	3	2	0	0	0	0	24
Manufacture of food products	1.94	1.99	1.67	2.22	0	0	0	0	690
Manufacture of beverages	1	2.18	2	2.33	0	0	0	0	169
Manufacture of textiles	1.68	1.77	1.42	2.47	1	0.5	1	1	191
Manufacture of wearing apparel	2.25	1.99	1.57	2	0	0	0	0	256
Manufacture of leather & related products	2	2.18	2	2.5	0	0.5	1	1	56
Manufacture of wood, products of wood & cork, w/o furniture	2.14	1.91	2.44	2.89	1	2	0.75	0.5	92
Manufacture of paper & paper products	1.96	2.2	2.82	2.59	2.67	1.33	1	0	137
Manufacture of coke & refined petroleum products	1.5	2.56	0	0	0	0	0	0	20
Manufacture of rubber & plastic products	1.78	1.67	2.48	2.56	0.5	0.25	1	0.75	454
Manufacture of other non-metallic mineral products	1.53	1.95	2.43	3	1.4	1.2	1	1.2	179
Manufacture of basic metals	1.81	2.14	2.62	1.38	3	2	0.5	2	79
Manufacture of fabricated metal products, except machinery & equipment	1.88	1.75	2.51	2.13	1.38	1.19	1	1.25	741
Manufacture of computer, electronic & optical products	2.17	1.72	2.49	2.3	1	1	1	1	809
Manufacture of electrical equipment	1.83	1.97	2.16	2.88	1.71	2	0.71	0.86	210
Manufacture of machinery & equipment n.e.c.	1.86	1.59	2.46	2.35	1.12	1.75	1	0.75	612
Manufacture of motor vehicles, trailers & semi-trailers	1.52	1.92	2.31	2.23	1	1	0	1	123
Manufacture of other transport equipment	1.93	1.93	2.6	2.33	0	0	0	0	125
Electricity, gas, steam & air conditioning supply	1	2.14	2	1.5	0	0	0	0	27
Water collection, treatment & supply	2.5	2.11	3	3	0	0	0	0	13
Waste collection, treatment & disposal activities	1	1.74	1.4	1.4	0	0	0	0	27
Construction of buildings	1.59	1.85	2.85	2.23	0	1	1	2	210
Wholesale & retail trade, repair of motor vehicles	2.1	2.04	1.17	1.33	0	0	0	0	129
Wholesale trade, except of motor vehicles & motorcycles	1.66	2.39	1.74	2.19	2	0	1	1	1,191
Retail trade, except of motor vehicles & motorcycles	1.8	2.52	1.18	1.52	0	0	0	0	445

L& transport & transport via pipelines	2.12	2.25	0	0	0	0	0	0	87
Water transport	2	1.95	2	1	0	0	0	0	21
Air transport	2.33	2.32	5	2	0	0	0	0	29
Warehousing & support activities for transportation	2	2.04	1.33	2.33	0	0	0	0	76
Postal & courier activities	0	1.71	0	0	0	0	0	0	7
Accommodation	0	1.83	0	0	0	0	0	0	92
Food & beverage service activities	0	2.41	2	4	0	0	0	0	145
Publishing activities	2	2.32	1.38	1.77	0	0	0	0	241
Motion picture, video & television programme production	0	2.56	2.5	5.5	0	0	0	0	93
Telecommunications	3.27	2.23	2.62	2.75	0	0	0	0	126
Computer programming, consultancy & related activities	2.13	2.13	2.03	1.92	0	0	0	0	579
Financial service act., w/o insurance & pension funding	1.33	2.09	2.11	2.44	0	0	0	0	300
(Re-)Insurance & pension funding, w/o compulsory social security	1	2.26	1	1	0	0	0	0	154
Activities auxiliary to financial & insurance activities	3.33	2.23	1	1.5	1	0	1	1	111
Real estate activities	3	2.07	3	1	0	0	0	0	93
Legal & accounting activities	0	1.79	1	1	0	0	0	0	15
Activities of head offices; mngmnt consultancy activities	1.86	2.25	1.39	1.55	0	0	0	0	437
Scientific research & development	2.12	2.16	2.65	1.95	0	0	0	0	148
Advertising & market research	1.33	2.4	1.4	2.6	0	0	0	0	144
Rental & leasing activities	4	2.22	1.5	1.5	0	0	0	0	61
Office administrative, office support & other business support activities	1.92	2.11	1.66	1.6	0	0	0	0	912
Public administration & defence; comp. social security	2.33	1.94	1.5	1	0	0	0	0	23
Education	0	1.93	1.5	3	0	0	0	0	125
Human health activities	2.62	1.97	2.33	1.53	0	0	0	0	146
Residential care activities	0	1.67	0	0	0	0	0	0	27
Activities of membership organisations	1	2.21	0	0	0	0	0	0	132
Other personal service activities	1.83	2.06	1.52	2.06	0	0	0	0	293
Total	1.91	2.09	2.14	2.15	1.05	0.85	0.95	1.02	11,737

Table A1.5: Average IPR holdings of IPR users with and without IPR bundles by age

Firm age	Firms without bundles				Firms with bundles				
	Only patents	Only TMs	Both IPRs		Not part of a bundle		Part of a bundle		N
	Pat/Firm	TM/ Firm	Pat/ Firm	TM/ Firm	Pat/ Firm	TM/ Firm	Pat/ Firm	TM/ Firm	N
<5 yrs	1.57	1.8	1.76	1.71	0.83	0.83	1	0.83	1,927
5-10 yrs	1.94	2.01	1.97	1.81	0.57	0.14	1	1	2,614
10-15 yrs	1.94	2.17	2.23	2.07	0	0.5	1	1.5	1,662
15-25 yrs	1.91	2.15	2.02	2.4	2.1	0.7	0.9	0.9	2,348
>25 yrs	2.06	2.26	2.55	2.54	1.36	1.72	0.9	1	3,186
Total	1.91	2.09	2.14	2.15	1.05	0.85	0.95	1.02	11,737

Table A1.6: Average IPR holdings of IPR users with and without IPR bundles by age

Firm size	Firms without bundles				Firms with bundles				
	Only patents	Only TMs	Both IPRs		Not part of a bundle		Part of a bundle		
	Pat/ Firm	TM/ Firm	Pat/ Firm	TM/ Firm	Pat/ Firm	TM/ Firm	Pat/ Firm	TM/ Firm	N
Micro	1.66	1.59	1.55	1.45	0.23	0.15	1	1.08	3,007
Small	1.81	1.89	2.1	2.42	2	0.8	0.8	0.8	1,686
Medium	1.88	2.15	2.44	2.32	1.47	1.47	0.97	1	3,544
Large	2.44	2.46	2.78	2.89	1.62	1.94	0.81	0.94	3,500
Total	1.91	2.09	2.14	2.15	1.05	0.85	0.95	1.02	11,737

In Tables A1.4-A1.6 we distinguish between firms that use IPR bundles and firms that do not, and within these groups we distinguish between the IPR user types. The tables summarise for each industry, age and size category how many patents or trade marks the average firm in its respective category owns. Firms are allocated to the “Firms with bundles” cateogry if they were using a bundle defined as “any combined use for the same product of at least two out of the following three IPR types: design rights, patents, or trade marks”. Quite a few firms use design rights and patents or design rights and trade marks, which implies that it is possible for firms with bundles to use, on average, less than one patent or trade mark. For instance, let there be three firms using bundles, one of which is a patent+trade mark bundle, the other a patent+design bundle, and the third a trade mark+design bundle. In this case, on average, each firm holds 2/3 design rights, patents, and trade marks.

Table A1.7: Court cases at Patents High Court 2000-2008: share of all cases involving IPR bundles by year (year in which case initiated)

Year	Cases not involving bundle	Cases involving bundle	Share
2000	43	0	0%
2001	33	1	2.9%
2002	48	0	0%
2003	38	1	2.6%
2004	44	1	2.2%
2005	41	4	8.9%
2006	49	1	2.0%
2007	37	1	2.6%
2008	37	2	5.1%
Total	370	11	2.9%

Note: Bundle defined as case where at least two out of the following three IP rights are enforced: patent, trade mark, registered design

Table A1.8: Court cases at Patents High Court 2000-2008: distribution of cases involving patents, trade marks and registered designs by year (year in which case was initiated)

Year	Patent	Patent & Trade mark	Patent & Design*	Patent & Trade mark & Design*	Trade mark	Trade mark & Design*	Design*
2000	18	0	0	0	1	0	0
2001	21	0	0	1	1	0	0
2002	24	0	0	0	1	0	0
2003	28	0	0	0	1	1	0
2004	27	0	0	0	0	1	0
2005	26	1	1	0	1	2	0
2006	39	0	1	0	0	0	0
2007	30	0	0	1	2	0	0
2008	34	1	0	1	0	0	0
Total	247	2	2	3	7	4	0

Note: * Design refers to registered design

Table A1.9: Court cases at Patents High Court 2000-2008 involving IPR bundles:

#	Case number	Registered IP			Product	Claim	Outcome
		Patent	Trade mark	Registered-Design			
1	HC05C00847	EP0845971	CM1111418		Nursing bottles	Infringement	Patent not infringed, trade mark infringed and passing off
2	HC05C01603	GB231898		GB1047764	Tile	Infringement	Settled
3	HC05C02121		5 CM, 1 GB	1 CD, 1 GB	Playstation console	Infringement	Trade marks and designs infringed
4	HC05C03835		na	na	Shoes	Infringement	Settled
5	HC06C02798/ HC06C04427/ HC07C01820/ HC07C02923/ HC07C02700	na		na	na	na	Settled
6	HC07C02394	na	na	na	na	na	Settled
7	HC08C02240/ HC08C02241	EP0370307, EP0734967	na		Intermediate bulk container	Infringement	Patents not infringed, trade mark infringed and passing off
8	HC08C03239	na	na	na	na	Infringement	Infringed
9	HC03C02061		9 GB, 3CM	5 GB	Air freshener	Infringement	Settled
10	HC04C01985		na	na	na	Infringement	Settled
11	HC01C03862	na	na	na	na	Infringement	Settled

A2 Data

The integrated database consists of two components: a firm-level data set and IPR data. The firm-level data is the FAME database that covers the entire population of registered UK firms.[12] In FAME, 'firms' represent registered firms, i.e., the legal entity that organizes production (administrative unit), in contrast to census-type data that often uses the plant or production unit. This unit of analysis corresponds to the enterprise in the BSD. In contrast to ONS data, FAME is a commercial database provided by Bureau van Dijk. The advantage of using FAME over ONS data is that it is freely accessible under a licensing agreement and that firms can be identified by name, which is essential for this current project.

12 FAME downloads data from Firms House records where all limited firms in the UK are registered.

The original version of the database, which formed the basis for the update carried out by the UKIPO, relied on two versions of the FAME database: FAME October 2005 and March 2009. The main motivation for using two different versions of FAME is that FAME keeps details of 'inactive' firms (see below) for a period of four years. If only the 2009 version of FAME were used, intellectual property could not be allocated to any firm that has exited the market before 2005, which would bias the matching results. FAME is available since 2000, which defines the earliest year for which the integrated data set can consistently be constructed. The update undertaken by the UKIPO used a November 2011 version of FAME. However, since there are significant reporting delays by firms, even using the November FAME 2011 version means that the latest year for which firm-level data can be used reliably is 2010.

FAME contains basic information on all firms, such as name, registered address, firm type and industry code. Availability of financial information varies substantially across firms. In the UK, the smallest firms are legally required to report only very basic balance sheet information (shareholders' funds and total assets). The largest firms provide a much broader range of profit and loss information, as well as detailed balance sheet data including overseas turnover.

In terms of numbers of firms, FAME October 2005 contains information on around 3.1 million firms (of which 0.9 million are inactive). The FAME March 2009 data contain 3.8 million firms (of which 1 million are inactive) and FAME November 2011 contains 2.7 million active firms. Inactive firms are those that have exited the market and belong to one of the following categories: dissolved, liquidated, entered receivership or declared non-trading. FAME contains firms' Firms House registered numbers, which means that it can easily be linked to other data sets that also contain registered numbers, such as Bureau van Dijk's Zephyr database that contains Merger & Acquisition data.

The IPRs data come from three different sources: the UKIPO, Marquesa Ltd and the EPO Worldwide Patent Statistical Database (PATSTAT). Marquesa Ltd supplied data on UK trade mark publications and Community marks registered for the earlier version of OFLIP. The UKIPO updated the database using its own trade mark data as well as data from OHIM.

The Community trade mark data include international marks designating the EU. Data on UK and EPO patent publications by British entities were downloaded from PATSTAT version April 2010 and April 2011. Due to the on average 18 months delay between the filing and publication date of a patent, using the April 2011 version means that the patent data are presumably only complete up to the third quarter in 2009. This effectively means that we can use the patent data only up to 2009 under the caveat that it might be somewhat incomplete for 2009. Patent and trade mark data are allocated to firms in the year in which a firm applied for the registration of the corresponding intellectual property.

PATSTAT combines patent information from several sources: DocDB (the EPO master bibliographic database containing abstracts and citations), PRS (the patent register for legal data), EPASYS (the database for EP patent grant procedure data), and the EPO patent register as well as the USPTO patent database for names and addresses of applicants and inventors. PATSTAT covers patent applications made to 80 patent offices worldwide and provides bibliographic details on over 60 million patent applications. Importantly, it also includes information on PCT patent applications as well as patents' legal status while alternative patent databases such as the EPO ESPACE Bulletin do not.

Since IPR records do not include the registered number of a firm even if the applicant is a registered business, it is not possible to merge data sets using a unique firm identifier; instead, applicant names in the IPR documents and firm names in FAME have to be matched. Both, a firm's current and previous name(s), were used for matching in order to account for changes in firm names. Matching on the basis of firm names requires names in both data sets to be `standardized' prior to the matching process in order to ensure that small (but often systematic) differences in the way names are recorded in the two data sets do not impede the correct matching. For more details on the matching see Helmers et al. (2011).

Note that we do not have any information on patent assignments. In contrast, FAME contains information on firms' ownership structure, which can be used to also allocate IPRs across business groups. The data used for the macro-analysis was aggregated at the level of the ultimate domestic owner, in order to avoid the double counting of employment, turnover and total assets. Double counting can also occur if a subsidiary files an IP right and adds its parent, who is also registered in the UK, as co-owner. However, the data used for the micro-analysis do not account for business groups because we observe the actual users of the IP rights by definition. We obtained annual information on business groups from BvD's Amadeus.

We deflated turnover and assets using the sector-level producer price deflator provided by the EUKLEMS project for the years 2002-2007 and implied output prices from the ONS Blue Book 2011 for the years 2008 and 2009. The base year is 2005.

A3 Ranking

The idea is to rank each industry according to how relevant its firms, that own both patents and trade marks, are relative to their single or no-IPR using peers in terms of within-industry and overall share of total assets, employment, and turnover.

The data used for this exercise entail the population of registered UK firms between 2002-2009 for which information was available either on total assets *A*, employment *L*, turnover *R*, or all of them. Each of these variables was aggregated at the 2-digit UKSIC 2007 level *j*, at the UK level *UK*, across firms as well as by type of IPR user *k={0,1,2}*, i.e. no IPR (0), single IPR (1), or both (2). In a next step we calculated the share of each IPR user type within its own industry S_w and relative to the UK totals *S*, i.e.

$$S^X_{Wjk} = \frac{X_{jk}}{X_j} = \frac{\sum_{i=1}^{n_{jk}} X_{jk}}{\sum_{i=1}^{n_j} X_j} \quad and \quad S^X_k = \frac{X_{jk}}{X_{UK}} = \frac{\sum_{i=1}^{n_{jk}} X_{jk}}{\sum_{i=1}^{N} X_i}, \; X = \{A, L, R\}$$

For instance, $S^A_{W,1,2}$ would be the share of total assets (A) in industry 1, e.g. Agriculture, held by firms using patents as well as trade marks. Similarly, the share of total assets in the UK held by owners of patents and trade marks is denoted by S^A_2. This yields six lists, i.e. for each variable A, L, or R there are two lists, industry level and UK level, containing the shares for each IPR type, i.e. no-IPR, single, or both IPR. In order to identify in which industries multi-IP-type holders account for a significant share of all the variables at both levels, i.e. within industry and relative to UK totals, a simple scoring system was employed: for each of the six lists, shares that were among the top 10% values across the different IPR user types were awarded three points,

among the top 20% two points, and among the top 30% with one point. This way, an industry could accumulate up to nine points at the within-industry level and another nine points at the UK level. These points were added together thus determining the final ranking. In order to illustrate this graphically, we denoted the score achieved at the within-industry level on the x-axis and the score achieved at the UK level on the y-axis. Thus, industries closest to the north-east corner of the diagram are the most relevant industries for firms holding both, patents and trade marks.

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