

Intellectual Property Activity by Service Sector and Manufacturing Firms in the UK, 1996-2000*

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Abstract

This paper provides evidence from a newly constructed database of UK firms about the extent of their intellectual property acquisition activities over five years. We focus on service sector firms, which have not previously been studied, with comparisons for firms in manufacturing and other sectors, such as agriculture. The measures of IP include both trade marks, which are most important in services, and patents, which are predominantly sought by manufacturing firms. The analysis includes patents and trade marks applied for via both the UK and European routes. While IP assets sought through the UK Patent Office remained strong, more services firms were seeking European Community trade marks and more manufacturing firms were seeking patents via European Patent Office through time. Firm characteristics that are positively correlated with IP activity include larger firm size, stock market listed status and high product market diversification.

Introduction

Our research objectives in this paper were to document the amount of intellectual property (IP) in the services sector and to examine what kinds of firms and industries are most active in acquiring these intangible assets. Services have generally been neglected in studies of intellectual property acquisition, despite the major importance of this expanding sector of the economy and the growing acceptance of the view that intangible assets contribute to firm success within the global knowledge economy. Equally, studies of intellectual property have mainly focused in patents, despite the fact that trade marks are of greater importance for many sectors, especially services. One important exception is Jensen and Webster (2004), who briefly examine the aggregate trends in trade mark activity for Australia, the UK and the US from 1975 to 2002 before focusing on Australia. They demonstrate that in all three countries trade mark applications increased rapidly, by a factor of around 5 in the UK, 7 in Australia, and 10 in the US over 25 years, peaking in the year 2000 and falling somewhat after the ‘dotcom’ bust. For Australia they also demonstrate that a dramatic rise in service marks was the major component of the rapid rise in marks, which accelerated during the 1990s but, as noted in an earlier study for Australia by Loundes and Rogers (2003), the rise occurred across many different industries and firm types, not just in telecommunications or internet-related firms.

As documented below, we have created a substantial new database of UK service firms, drawing on a range of sources and matching information from these various sources for over 1200 such tertiary sector firms, deriving information to parallel our existing database for around 800 primary and secondary sector UK firms. We also investigate the relationship between a number of industry and firm characteristics and the propensity to acquire IP assets. All the analysis provides comparisons between services and manufacturing firms and many of the descriptive statistics show results for twelve major industry sectors covering the whole economy.

We begin by providing a description of service sector IP, together with a comparison with manufacturing and other production firms. We focus at first on trade marks (including both goods and service marks), as these are the most widespread form of IP asset, covering both the historically important trade mark application route through the UK Patent Office and the new European Community trade mark route, which was introduced in 1996. We also document patents applied for via both the UK and European Patent Office routes, but necessarily these are less common forms of IP for service sector firms.

As trade marks have been a less frequent subject of study than patents, we first outline what role these intangible assets might play in the system of rewards to innovation. Economic analysis often distinguishes process from product innovation, but some analysts also distinguish new products that increase product variety (horizontal innovation) from those which offer significant increases in product quality (vertical innovation). Clearly, as novelty is a key condition for the award of a patent, we would expect firms to apply for patents whenever they have created significantly original processes or products, or sub-elements of such items, which fall in the range of items for which patents can be awarded. The patenting conditions require the advance to be novel, non-obvious and capable of industrial application. This frequently limits patents to tangible products in the UK and Europe, where software and business methods have not been broadly accepted for patenting, unless there is an integral technical component. Thus patents will be sought for novel process innovations and for superior products that depart radically from earlier ones.

In contrast with patents, trade mark applications are likely to be more strongly associated with the offer to the market of new product varieties that are not as strikingly novel as those awarded patents. The legal basis for a trade mark is construed without much reference to the economic concept of innovation, being the definition of a distinctive mark, sign or logo, which identifies the source of origin of production and thus provides a signal of quality and reliability of supply to the customer. However, as firms engage constantly in product differentiation and advertising of distinctive brands with the aim of increasing customer loyalty to their products, this activity of non-price competition inevitably involves some degree of innovation, even if only incremental in degree. Firth (1995) argues that for both goods and services, “trade marks and brand names provide important information as to the nature and origin of these products. Such information is essential to the functioning of a competitive market.” Both Firth (1995) and Cornish (1999) identify three ways in which trade marks function: to guarantee commercial origin, to indicate quality, and to serve as a vehicle for advertising. However Firth admits that only the origin function is universally recognised as the proper object of legal protection by registration of a trade or service mark, as the product quality and characteristics are not legally guaranteed.

Nevertheless, new product varieties that increase horizontal diversification will usually provide significantly more choice to customers, thus reflecting a welfare-improving innovation. In addition, in the services sector, innovations prompting trade mark applications may include even the more novel vertical product innovations, in areas where patenting is not

possible due to the nature of the service product, such as business methods. As a measure of the effective rate of innovation in services therefore, trade marks are likely to give a more accurate picture than patents. In manufacturing, even where patents are possible, trade marks will also be sought alongside these patents to protect brand names and support product identification and hence sustain customer loyalty. Evidence of correlation between patent and trade mark activity is given in Greenhalgh et al. (2003) for UK manufacturing and in Loundes and Rogers (2003) for Australian firms.

The database

The basic sample we constructed covers 2054 firms for which we have some financial data drawn from their company accounts; these are classified into twelve major sectors using the SIC of their major product. Eight are service sectors comprising financial, real estate, wholesale, retail, hotel/catering, transport/communication, business and other services, and covering 1232 service firms; the four non-service sectors are agriculture, manufacturing, utilities and construction, covering 822 firms, of which the majority are engaged in manufacturing, 640 firms.

Counts of the four IP assets (UK and EC trade marks and UK and EPO patents) were made starting from the common period of existence of these assets, i.e. 1996 when EC trade marks began, to the year 2000, giving a maximum five-year span for each company that existed throughout this period, or less for companies that were created, or disappeared due to merger or bankruptcy. For each firm, many of which were large and complex in structure, we investigated the firm structure for the group reporting accounts at year 2000 and counted the IP assets sought by the parent firm and each of the subsidiary and associate companies. This was achieved by searching the four sets of annual IP records under all of the possible firm names owned by each parent group. (See the Appendix for more details of the data sources.)

Details of the number of companies per sector and their total activity in terms of value added, employment and R&D in the year 2000 are given in the Appendix, Table A1. The firms in this sample are mainly medium to large-sized and so these sample firms produce a large proportion of national output, sustaining a large number of jobs and contributing a large share of UK R&D activity into the bargain. For example, since total GDP in 2000 was about £950bn, the £304bn of value added generated from the firms in these data account for around 30% of national output.

In terms of UK R&D, the Office of National Statistics (ONS) estimates that £11.5bn was spent, whereas the firms in our data collectively reported £12.3bn (this figure, which is derived from company account data, can be higher, since the ONS data exclude any R&D conducted overseas, or by higher education or public agencies). In terms of intellectual property, our medium to large-sized firms are active in the acquisition of IP assets to bolster their market share and gain the rewards from innovation. The subsequent sections explore the extent and nature of this activity but it is worthwhile comparing the overall scale of IP activity in the data here to the aggregate statistics.

Statistics from the Office for the Harmonization of the Internal Market website (OHIM), which issues Community trade marks, show that 43,010 applications were made in 1996 (the first year of their existence), with 5,705 from the United Kingdom. On average each application related to 2.46 trade mark classes, so the UK figure to compare with our data (where we count each class as an ‘application’ for a trade mark) is 14,034. In our data there are 5,309 Community trade mark class applications, which is 38% of the UK class applications, i.e. a substantially higher share than these firms’ share of GDP noted above, suggesting an initial dominance by larger firms compared to small enterprises.

The total number of Community trade marks applied for, both as reported by OHIM and in our data, fell in 1997 and 1998. In 2000, the total UK applications to OHIM were 7,930 out of a total of 57,324, with a higher number of classes per application at an average rate of 2.81. The firms in our data accounted for 6,722 out of the estimated 22,283 trade mark classes for UK applications, which is around a 30% share, very similar to their GDP share, and suggesting a rise in the Community trade mark activity of smaller firms not covered by our database during the period 1996-2000.

In terms of UK trade mark class applications, the share attributed to firms in our data is substantially reduced. For example, in 1996 there were 34,109 applications for UK trade marks from domestic residents compared to a total of 7,164 in these data (21%). The growth of total UK trade marking has been rapid, with 60,979 applications made in 2000, and applications from the medium to large firms have largely kept up with this by rising to 12,450 (20% of total).

The numbers of patent publications are smaller than trade mark applications. The firms in our data had 747 UK patent publications in 2000 and 1,974 EPO publications. Comparative data on total publications are not commonly available, but the UK Patent Office granted 4,170

patents to domestic residents in 2000. For the EPO, there were 4,359 EPO applications in 2000, suggesting that large firms account for a substantial share of EPO publications. These statistics also show that the medium to large sized firms in these data favour EPO patents over UK patents.

Summary of overall incidence and counts of IP activity

For the whole sample, the proportion of firms which made at least one UK trade mark application within any year (average for the five year period) was 30% and the average number of UK trade marks per firm per year was 4.7. Activity via the new Community trade mark system was lower, with 18% of firms making at least one application in any year and the average number of marks per firm per year being 2.2. As expected, patenting activity was lower, with 9% of firms publishing a UK patent per year and 8% publishing an EPO patent, whilst the numbers of patents per firm per year were modest: 0.35 UK and 0.77 EPO patents. Behind all these averages there was a very considerable range, with the highest numbers of trademarks and patents per year in a single firm being 487 UK trade marks, 624 EC trade marks, 58 UK patents and 355 EPO patents respectively.

These yearly figures conceal a considerable degree of rotation among firms, which do not necessarily seek IP assets in each and every year. As a result the percentages of firms seeking to acquire some IP within the whole five-year period are considerably higher than yearly rates. Details of these percentages by sector are given in Table A2, which shows that in nine out of twelve sectors (the exceptions being Agriculture, Construction and Real Estate) more than half of all the firms applied for a UK trade mark, and more than one quarter for an EC trade mark, between 1996-2000. These applications for patents and trade marks can be seen against the reported R&D activities of the sample firms, which again showed very considerable variation in reporting rates and reported values, with around 18% of firms reporting R&D and the average annual value of this expenditure being £23 million in year 2000 prices, but with a range from about £1,000 to £2.5 billion.

In the four Charts (Charts A, B, C, D) we display the percentage of firms in each of the twelve sectors which sought to obtain one or more of each type of IP asset in a given year of observation. (When comparing Chart A with Charts B, C, D note that the vertical scale on A is smaller than these latter so an equal height bar is larger in A.) Clearly two non-service sectors, manufacturing and utilities, are the most active in respect of patents (Charts C and D) and are also very active in trade marks. Even so, the eight service sectors all show

Chart A: Percentage of firms applying for UK trade marks by sector and year

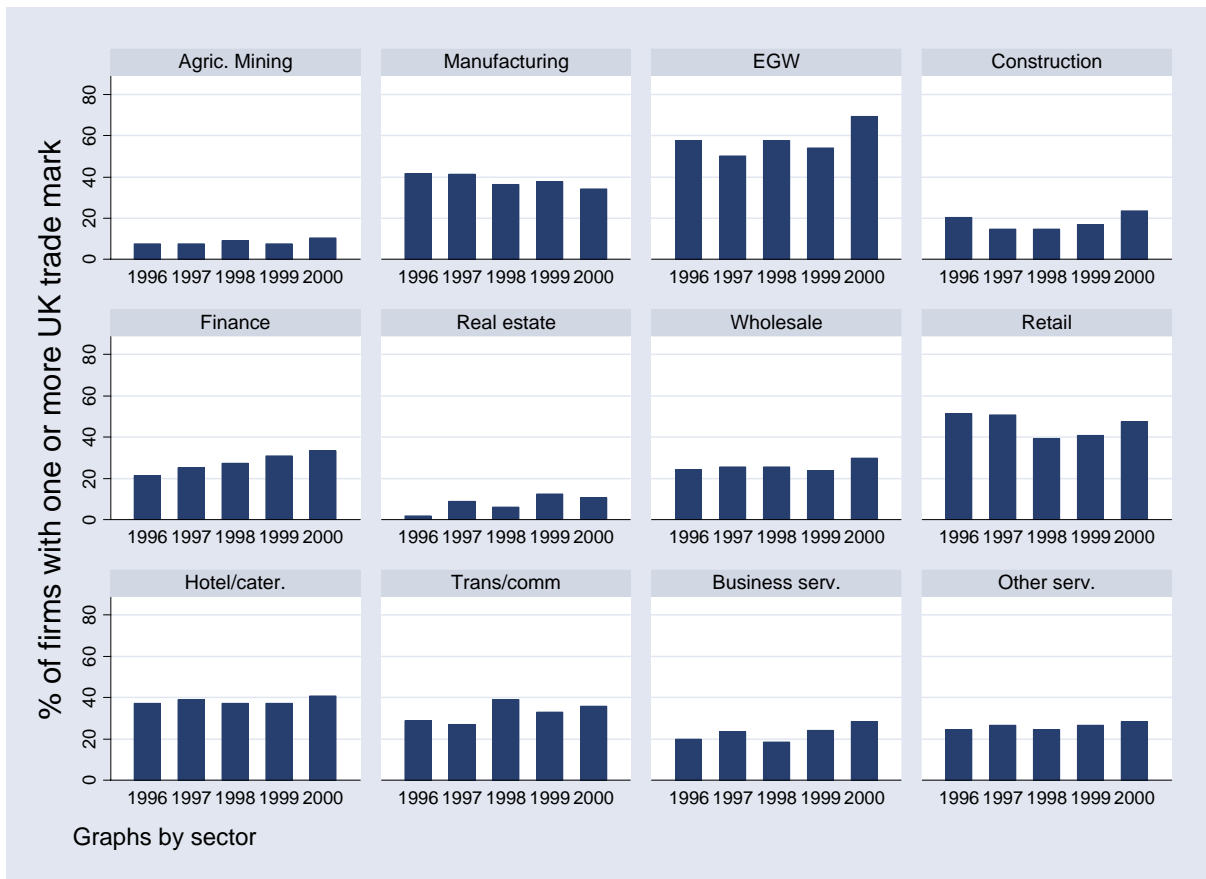


Chart B: Percentage of firms applying for EC trade marks by sector and year

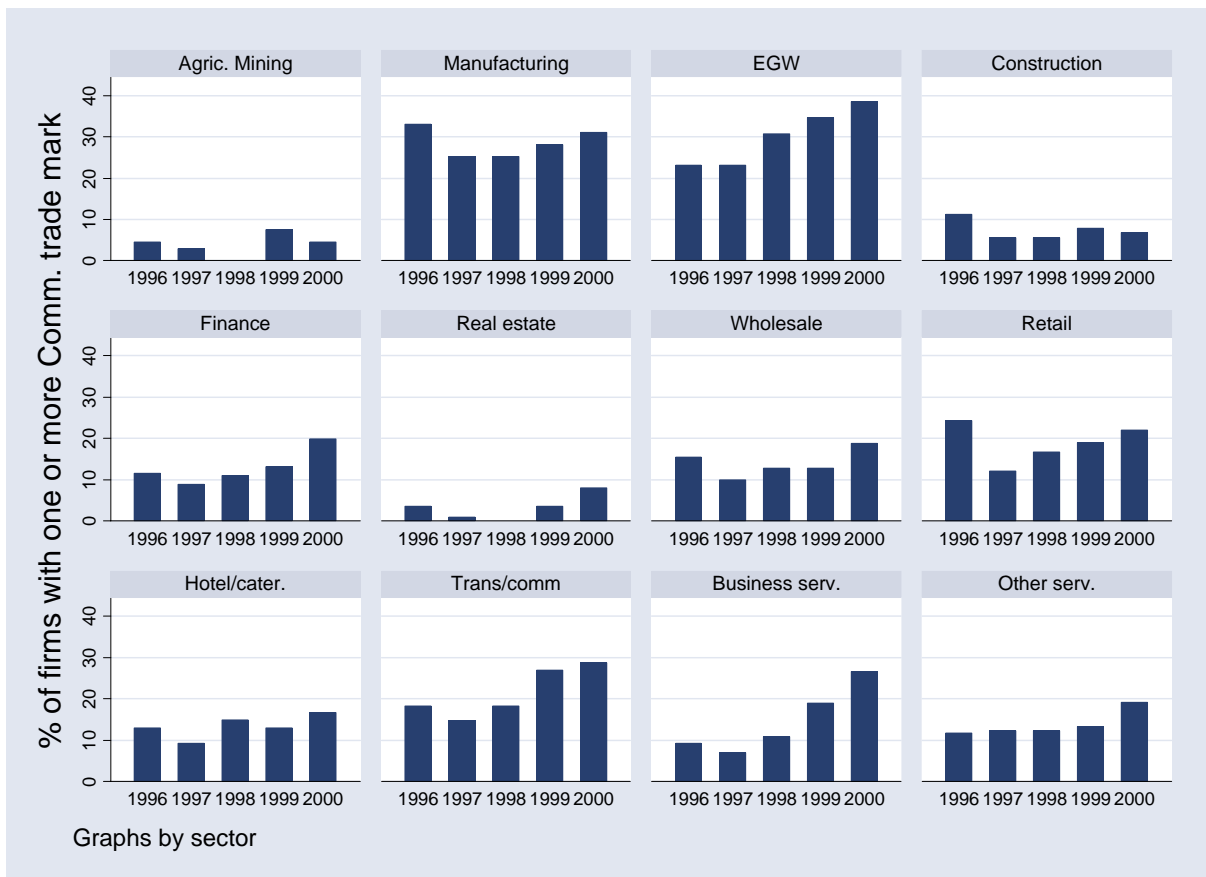


Chart C: Percentage of firms publishing UK patents by sector and year

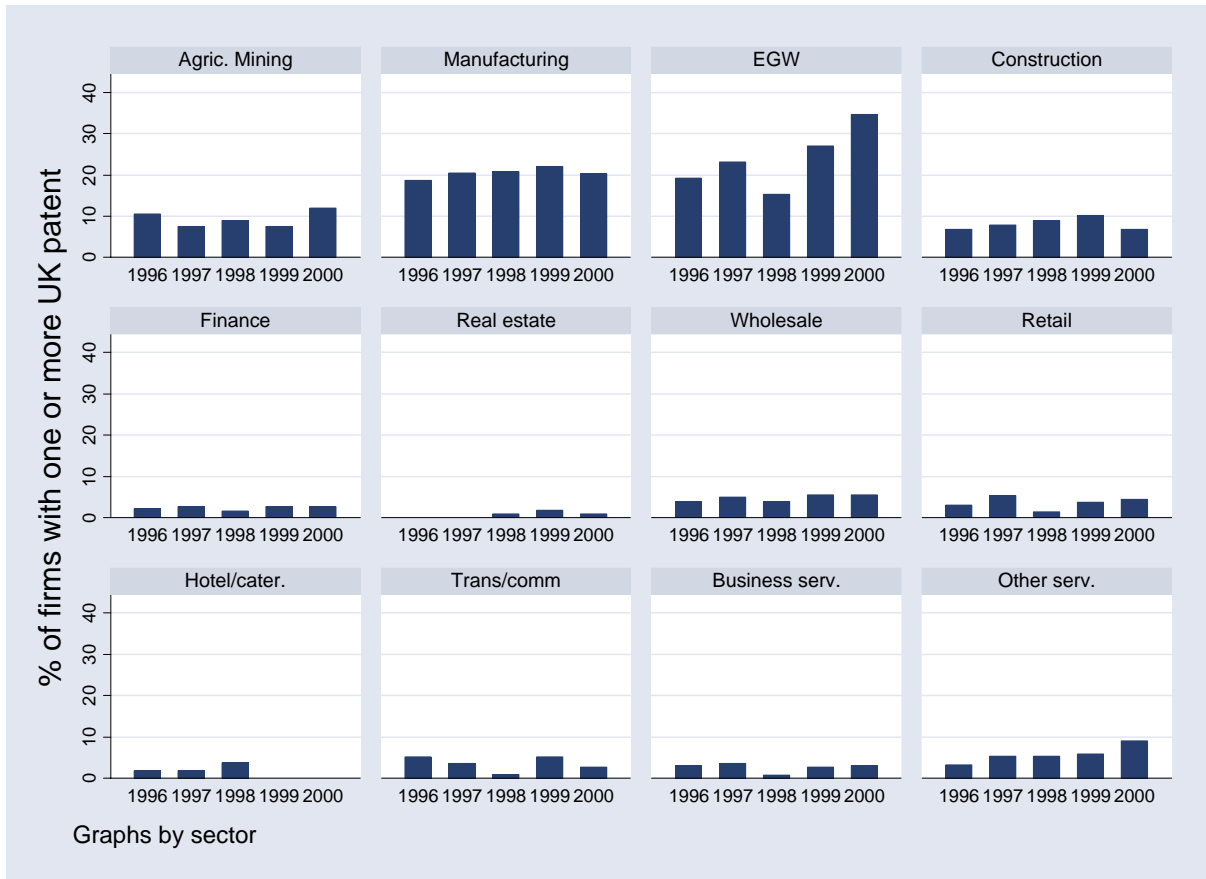
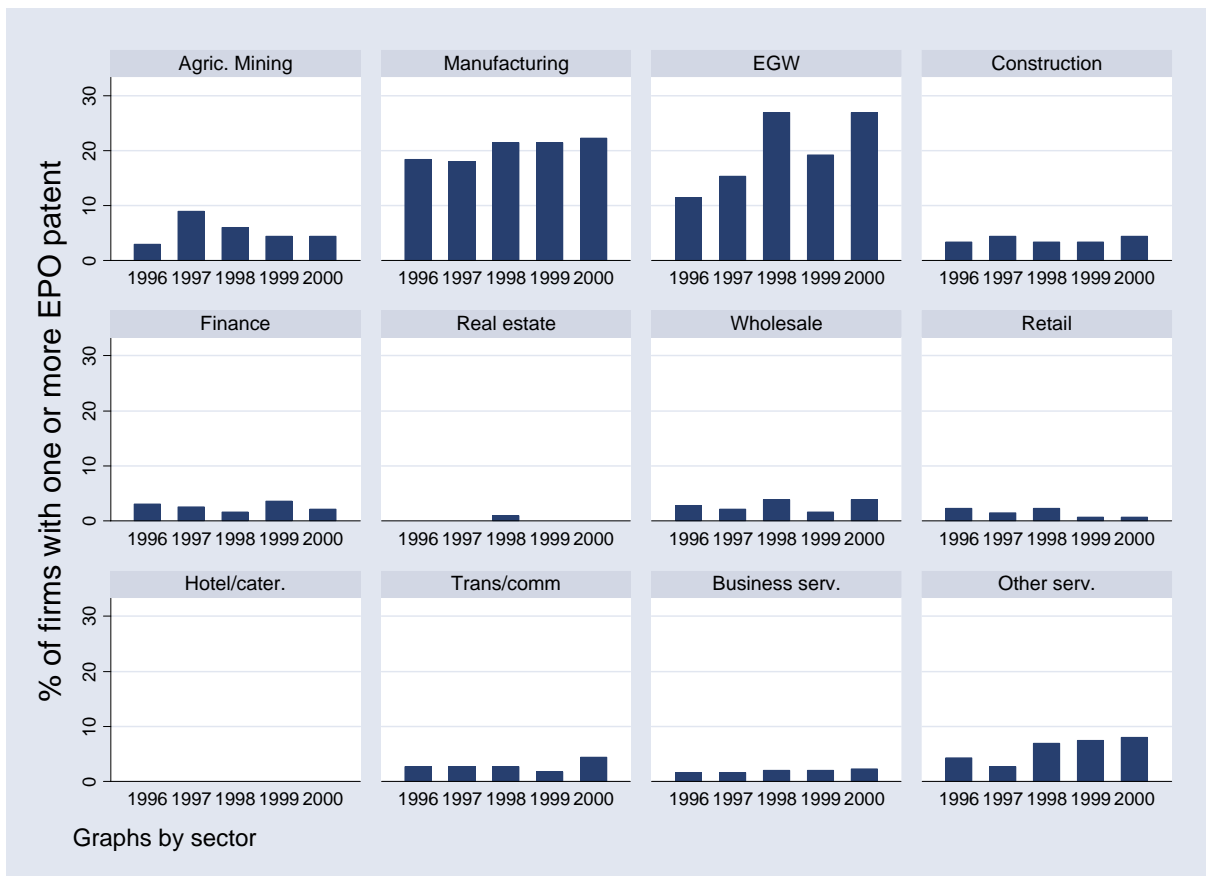


Chart D: Percentage of firms publishing EPO patents by sector and year



considerable percentages of firms applying for trade marks (Charts A and B) and in the case of UK trade marks (Chart A), retail firms are more frequently active than manufacturing firms, with more than 40% per annum of retail firms applying for trade marks, and the hotel and catering trade also showing a higher incidence of UK trade mark activity by the year 2000 than manufacturing.

In the case of European Community trade marks (Chart B), the transport and communications sector makes a strong showing and rapidly increasing rates of activity, reaching levels well above the all-firm average by 2000, are also observed in business services. Over most sectors there is a well-defined pattern with regard to EC trade marks, with an initial burst of applications in the first year this IP right became available, 1996, followed by a small drop, but then showing a rising trend in activity to reach even higher percentages by 2000. Before 1996 firms wishing to protect their marks abroad would have obtained separate rights in selected countries, but with the arrival of the EC trade mark came the opportunity to make one application and obtain protection in a number of countries simultaneously, so firms wishing to protect in 1995 may have delayed until the new system became available, causing the initially high rates of application.

Consideration of Table A3 demonstrates that there is also considerable variation in the average number of IP assets acquired per firm across the twelve major sectors, with high rates of trade marking being characteristic of manufacturing and utilities, retailing and transport/comm., but also increasingly of transport and financial services. This pattern of differences in the number of IP assets is highly correlated with the variation in the incidence of IP activity in the above charts.

There is also a lot of variation within a given sector looking across a finer classification by 4-digit SIC. Table A4 shows the data for the Business Services sector, where the number of UK trade marks per firm per annum in the five year period varies from almost nothing (7359, Equipment Rental and Leasing) to rates of 21 (7342, Disinfecting and Pest Control) and even 32 (7336, Commercial Art and Graphic Design) compared with the sector 73 average of 2 UK trade marks per firm per year. This indicates that it should be worthwhile trying to identify some of the factors associated with the variation in both the propensity to engage in IP activity and in the amount of such activity.

Characteristics of IP active firms

While there are many features of firms and markets that may be associated with IP activity, two issues of particular interest are stock market listing and product market diversification. If firms are listed on the stock market, are they more likely to seek to obtain IP assets to protect shareholder value and impress the financial markets? Firms may be focusing their activity on a narrow field or diversifying and branching out into many product areas, so is the latter type most likely to generate a range of products requiring IP protection?

Tables 1 and 2 contain two-way classifications of the firm by year observations of trade mark activity, according to whether or not the firms were listed on the UK stock market and according to the degree of product market diversification within the companies, together with the appropriate statistical tests of significance of the differences in these probabilities between the types of firms. For both UK and EC trade marks and for both manufacturing and services firms, both stock market status and high diversification are significantly positively associated with being trade mark active. The above results suggest the need for further investigation into these characteristics in a multivariate framework, which can include other characteristics, notably firm size, and in which we analyse the incidence of patents as well as trade marks.

Table 1 Trade marking and stock market status of firms

Company type	Services firms x year observations	% obs. with UK trade mark	% obs. with EC trade mark	Manufacturing firms x year observations	% obs. with UK trade mark	% obs. with EC trade mark
Unlisted Company	2,431	18.8	7.7	1,184	32.8	21.6
Listed company	3,729	37.7	18.2	2,016	41.4	32.6
Pearson χ^2		143.9	135.3		23.4	44.4

Notes: For both services and manufacturing sectors and for both UK and EC trade marks, the percentages of active firms by year are significantly higher for listed than for unlisted firms using the Pearson chi-squared test of association.

Table 2 Trade marking and product market diversification of firms

Company type	Services firms x year observations	% obs. with UK trade mark	% obs. with EC trade mark	Manufacturing firms x year observations	% obs. with UK trade mark	% obs. with EC trade mark
Not highly diversified	3,670	22.2	10.6	1,070	30.1	21.9
Highly diversified	2,490	34.7	19.2	2,130	42.3	31.9
Pearson χ^2		117.9	92.1		44.6	35.3

Notes:

1. Highly diversified means that the firm is active in four or more four-digit SICs.

2. For both services and manufacturing sectors and for both UK and EC trade marks, the percentages of active firms by year are significantly higher for the highly diversified than for other firms using the Pearson chi-squared test of association.

The role of firm size in IP activity

In the literature on IP activity there is a lot of interest in whether large or small firms are more likely to seek to acquire these intangible assets and with what degree of intensity they do so (for example, see the review by Cohen, 1995). Clearly the economy will benefit from beneficial spillovers in the diffusion of domestic innovations, so the competition authorities may decide to allow firms to grow large in relation to market size if this produces the highest rate of innovation, even when it generates distortions arising from market concentration. In an earlier analysis for manufacturing (Greenhalgh and Longland, 2001) we found that the rise in the number of UK and EPO patents and UK trade marks with increasing firm size was either less than proportionate or roughly so. This suggested that two smaller firms would jointly obtain as many or more IP assets as one larger firm of twice their size. In a related study of the same data, Greenhalgh and Longland (2005) found that IP intensity was significant for raising total factor productivity in these firms.

In Tables 3 to 6 we analyse both IP participation: whether a firm is active in acquiring some of a given type of IP asset in the observed year, and IP intensity: the extent of this IP activity in relation to firm size, where size is measured by employment. Tables 3 (services) and 4 (manufacturing) show the analysis of IP participation, whereas Tables 5 (services) and 6

(manufacturing) are for IP intensity. Given that larger firms may also be more likely to be listed and highly diversified, these multivariate regressions thus investigate the role of firm size, stock market listed status and product market diversification when all factors are varying simultaneously. In this analysis we also include a time trend and a set of dummy variables to control for persistent differences by industry group.

Table 3 **Probit estimates of the propensity to be IP active in services**

	UKTM	ECTM	UKPAT	EPOPAT
Firm size	0.256***	0.218***	0.261***	0.157***
(by employment)	0.012	0.013	0.023	0.023
Marginal effect	0.087	0.046	0.011	0.008
Listed	0.065	0.157**	0.303**	0.198
company	0.059	0.171	0.144	0.139
Marginal effect		0.032	0.011	
Highly	0.121***	0.146**	0.236**	0.225**
Diversified	0.046	0.052	0.091	0.097
Marginal effect	0.041	0.031	0.010	0.011
Trend	0.024	0.107***	0.018	0.012
	0.016	0.018	0.030	0.032
Marginal effect		0.023		
Number of observations	4477	4432	3842	3297
Industry dummies $\chi^2(39)$	189.03	172.27	108.84	106.11

Notes to Tables 3 to 6:

1. Firm size is measured by the natural log. of employment in all four tables.
2. Standard errors are given below coefficients and the number of asterisks on the coefficient rises with the level of its statistical significance on a two tail test, * = 10%, ** = 5%, *** = 1%.
3. All the estimated equations contain a full set of dummy variables based on US SIC 2-digit industry. Tests of the joint significance of these industry differences are reported in the last row of each table.

Note to Tables 3 and 4:

1. The dependent variable is a 0,1 dummy variable, where 1 indicates the firm is active in that year in seeking to acquire the type of IP asset.
2. As coefficients for Probit estimates are not easy to interpret quantitatively, the computed marginal effects for those variables that are statistically significant are given below the relevant coefficient and standard error. For firm size and trend this gives the marginal rate of increase, whereas for the two zero-one characteristics (listed, diversified) the marginal effect is the discrete change in probability of obtaining IP associated with having the characteristic.

Table 4 Probit estimates of the propensity to be IP active in manufacturing

	UKTM	ECTM	UKPAT	EPOPAT
Firm size	0.258***	0.266***	0.377***	0.325***
(by employment)	0.017	0.017	0.021	0.021
Marginal effect	0.100	0.092	0.094	0.078
Listed company	-0.058	-0.022	-0.119	0.028
	0.082	0.087	0.102	0.104
Highly diversified	-0.037	0.027	-0.136	-0.028
	0.067	0.071	0.082	0.084
Trend	-0.043**	0.007	0.033	0.073***
	0.021	0.021	0.024	0.024
Marginal effect	-0.017			0.017
Number of Observations	2374	2374	2358	2374
Industry dummies $\chi^2(19)$	124.49	155.16	227.95	343.82

In general (Tables 3 and 4), the strongest predictor of participation in IP activity in any given year for all four types of IP and both services and manufacturing is firm size. Even so, for services firms, the other firm characteristics are also independently significant. In contrast, for manufacturing firms, neither stock market listing nor product market diversification has a separate impact once we have controlled for firm size. This reflects stronger correlation between these three variables in manufacturing than in services, as the stock market listing and product diversification factors were significantly associated with trade mark activity in manufacturing in the two-way analysis of variance reported above in Tables 1 and 2.

To summarise the results for services from Table 3, IP participation is increasing with firm size for all four IP types, with the largest marginal effects being for UK and EC trade marks. Listed firms of any given size are more likely to be active in seeking EC trade marks and UK patents, but not in UK trade marks or EPO patents. Highly diversified firms are more likely to be active in seeking all four types of IP with the biggest marginal effects being observed for both types of trade marks. We also find a significant positive trend in participation for newly available European Community trade marks, but there are no trends for the other three IP types. Finally there are significant persistent differences across the 2-digit industries in the propensity to be IP active for all four IP types, as indicated by the final row test statistics.

Turning to manufacturing firms, Table 4 again shows a higher probability of IP activity in larger firms for all four IP types, with rather similar marginal effects being observed for all types of IP. However for this group of firms, whether the firm is listed or diversified makes no difference once we have controlled for firm size. The trends for manufacturing are negative for UK trade marks, zero for EC trade marks and UK patents, but positive for EPO patents. As for services, there are persistent differences across 2-digit industries. In other respects the profile differs quite a lot from services but, in comparing these two major sectors, we should not be surprised to find that they are both increasing their activity in seeking IP assets through European registries, with this increase being in respect of trade marks for services and patents for manufacturing.

Tables 5 and 6 show that, once the firm is an active IP participant, then the intensity of IP falls with firm size across both services and manufacturing and for all four IP measures. The intensity of IP is generally flat with other three variables (except for UK trade mark intensity being lower if a listed firm in services) and in addition for most IP types there are no significant persistent differences by industry (again with the exception of UK trade mark intensity for services). These results show that there is generally a similarity of IP intensity at any given firm size, regardless of stock market listing, product diversification, industry and year. The constancy of IP intensity across these other variables is similar to that in Table 4 for the propensity to acquire IP in manufacturing, but stands in contrast with the variable propensity to acquire IP in services shown in Table 3. For both services and manufacturing the fall in IP intensity with firm size is consistent with the notion that, for IP active firms, a critical number of IP assets needs to be acquired to achieve a useful portfolio of intangible assets.

Table 5 Robust regressions of the intensity of IP activity in services

	UKTM	ECTM	UKPAT	EPOPAT
Firm size (by employment)	-0.044*** 0.009	-0.172*** 0.008	-0.0003** 0.0001	-0.001***
Listed company	-0.084** 0.043	0.017 0.013	-0.0003 0.0004	-0.001 0.002
Highly diversified	0.020 0.018	0.020 0.016	0.0001 0.0002	-0.0001 0.0005
Trend	0.006 0.004	-0.001 0.004	0.0002 0.0001	-0.0001 0.0002
Number of observations	1435	1435	1435	1435
Ind. Dummies F(39,1391)	170.68	1.36	0.92	0.73

Notes to tables 5 and 6:

1. The dependent variable is the number of IP assets of a given type per employee.

2. Robust regressions were conducted using procedures within STATA 8.0 that reduce or eliminate the influence of outlying observations.

Table 6 Robust regressions of the intensity of IP activity in manufacturing

	UKTM	ECTM	UKPAT	EPOPAT
Firm size (by employment)	-0.044* 0.025	-0.004*** 0.001	-0.002* 0.001	-0.001*** 0.0004
Listed company	-0.022 0.036	-0.006 0.004	-0.002 0.002	0.001 0.001
Highly diversified	0.118 0.092	0.002 0.003	0.003 0.004	-0.001 0.001
Trend	-0.0002 0.004	0.001 0.001	0.0006 0.0003	0.0005** 0.0002
Number of observations	978	978	978	978
Ind. dummies F (19, 954)	0.74	2.81	0.85	2.38

Conclusion

This paper provides some illumination of the neglected topic of innovation in the services sector, which now employs the major share of workers in the UK and other advanced economies. By tracing applications for trade marks and the publication of patents by large companies, and by all the subsidiaries partly or wholly owned by these parent firms, we have documented the acquisition by firms of a variety of intellectual property rights designed to protect their innovations. In so doing, we have provided a new picture of the extent to which these companies were bringing to market large numbers of new goods and services and new processes in the period 1996-2000. While the number of IP assets sought through the UK Patent Office remained strong, trends in registering trade marks in Europe were positive for service sector firms, while manufacturing firms showed an increase in their propensity to seek European patents.

Analysis of the variation across firms in their propensity to acquire IP has identified several firm characteristics that are positively correlated with IP acquisition, including larger firm size, stock market listed status, and high product market diversification. Even so, the intensity of IP activity per employee was found to be negatively associated with firm size, suggesting the need for a minimum portfolio of each type of IP asset per firm.

Appendix

Data Construction

The method of data construction was first to derive the financial accounts for over 2000 firms from Thomson (2001). The next step involved extracting details of the structure of each company from Dun and Bradstreet International (2001) including the parent, its subsidiaries and associates, in order to get a full list of the names under which IP assets may have been sought for each firm. Using these ownership structures, records of each of the four types of intellectual property assets were then scanned for relevant name matches, beginning with computer scanning using both the full length names, including such items as PLC or Ltd., and the truncated names without these designations. Before matches were accepted, additional judgements were made concerning particular matches where the recorded names were similar, but not exactly identical. Because each IP application takes place over a considerable period of time, passing through various stages in the progression to the final acquisition of the IP asset, a decision was necessary concerning what to count and at what stage in the process. The

approach we took for patents was to consider that the firm was IP active when they reached the publication stage in a patent application. For applications via both the UK and European Patent Offices this is typically about 18 months after the earliest global filing has occurred and it is the date at which the content of the patent specification becomes known to competitors. In counting EPO patents, which can be applied for covering many or few countries, we counted patent publications for which the UK was one of the designated states.

With trade marks there is some protection for firms through common law protection from so-called 'passing off', so registration of each name under which the firm is trading is not absolutely necessary to achieve some degree of ownership of the name. Even so, many firms take the step of formally applying for a trade mark to assert more clearly their ownership of brand names. It is easier in law to demonstrate infringement of a registered trade mark than to establish that a customer was misled by a product in an act of passing off. Unlike patents where the protection usually relates to a single class of patent such as chemistry or physics, trade mark applications can involve filing for protection in multiple classes, choosing among a large number of 34 goods and 8 service products. To reflect the spread of products for which protection of the trade mark was being sought, we counted each class as a separate trade mark where the application was made to cover multiple classes.

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Table A1 The database of firms by sector

Sector	Description	Number of firms	US SIC	Value Added 2000 (£million total for firms)	Employment 2000 ('000s)	R&D 2000 (£million total for firms)
1	Agriculture & Mining	67	1-14, 17-19	14,621	372	107
2	Manufacturing	640	20-39	141,302	2,727	10,808
3	Utilities	26	49	11,158	132	90
4	Construction	89	15,16	6,034	164	8
5	Finance	191	60-64, 66,67	53,275	848	8
6	Real Estate	112	65	3,137	43	0
7	Wholesale Trade	181	50,51	6,519	330	47
8	Retailing	132	52-57, 59	24,380	1,297	29
9	Hotels & Catering	54	58, 70	5,163	445	0
10	Transport & Comm.	115	40-48	22,266	761	439
11	Business Services	259	73	11,150	342	657
12	Other Services	188	72, 74-99	5,134	208	122
All	All industries	2054	1-99	304,139	7,669	12,315

Table A2 Proportion of firms making an application for IP within five years by sector

Sector	No. firms	UKTM	ECTM	UKPAT	EPOPAT
1 Agriculture/Mining	67	0.19	0.12	0.21	0.12
2 Manufacturing	640	0.67	0.55	0.40	0.35
3 Utilities	26	0.85	0.62	0.50	0.42
4 Construction	89	0.39	0.22	0.22	0.09
5 Finance	191	0.52	0.26	0.05	0.06
6 Real Estate	112	0.22	0.12	0.03	0.01
7 Wholesale	181	0.52	0.33	0.12	0.07
8 Retail	132	0.75	0.40	0.08	0.05
9 Hotel/Catering	54	0.65	0.35	0.06	0.00
10 Transport/Commun.	115	0.57	0.43	0.10	0.05
11 Business Services	259	0.57	0.43	0.08	0.06
12 Other Services	188	0.56	0.37	0.10	0.12

Table A3 Numbers of new IP assets sought by sector 1996-2000

Sector	No. firms	UKTM	ECTM	UKPAT	EPOPAT
1 Agriculture/Mining	67	235	97	169	44
2 Manufacturing	640	19,931	11,395	2,700	6,467
3 Utilities	26	2,272	461	79	59
4 Construction	89	616	231	92	42
5 Finance	191	4,216	1,675	85	243
6 Real Estate	112	530	171	6	1
7 Wholesale	181	1,717	958	74	83
8 Retail	132	7,619	2,263	38	29
9 Hotel/Catering	54	1262	427	5	0
10 Transport/Commun.	115	4,617	2,028	62	740
11 Business Services	259	2,583	1,681	61	33
12 Other Services	188	2,779	1,246	222	128

Table A4 Business Services – IP assets over the period 1996-2000 by 4-digit industry

Industry	Description	No. firms	UKTM	ECTM	UKPAT	EPOPAT
7300	4-digit code unknown	7	5	4	1	3
7311	Advertising Agencies	9	306	209	3	1
7312	Outdoor Advertising	1	3	0	0	0
7313	Media Advertising Reps.	2	7	6	0	0
7319	Advertising n.e.c.	4	39	6	0	0
7331	Direct Mail Advertising	1	0	0	0	0
7335	Commercial Photography	3	4	6	0	1
7336	Comm. Art Graphic Design	1	162	31	1	0
7342	Disinfecting & Pest Control	1	105	45	4	4
7349	Building Cleaning & Maint.	4	22	0	0	0
7353	Heavy Constrn. Equip. Rental	3	36	3	0	1
7359	Equipment Rental & Leasing	5	3	0	0	0
7361	Employment Agencies	19	102	26	1	0
7370	Computer/Data Processing	17	65	49	0	0
7371	Computer Programming	42	480	312	5	3
7372	Prepackaged Software	40	464	350	6	3
7373	CI Systems Design	23	146	93	1	1
7374	Processing and Data Prep.	6	32	10	0	0
7375	Information Retrieval	26	199	203	1	0
7376	Comp. Facilities Management	3	3	1	0	0
7378	Computer Maintenance	2	8	9	0	0
7379	Computer Related n.e.c.	15	49	93	1	0
7381	Detective, Guard, etc.	1	25	6	0	0
7382	Security Systems	5	140	38	25	6
7383	News Syndicates	2	133	157	2	8
7389	Business Services n.e.c.	17	45	24	10	2

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