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**Abstract**

This paper uses a new data set of the trade mark activity of UK manufacturing and service sector firms (1996-2000) to investigate the market value of trade marks. Data on both trade (and service) marks sought via the UK Patent Office (UKTM) and the European Community Office for Harmonisation of the Internal Market (CTM) are available. Firms use trade marks to signal to consumers that the product is of a certain origin, implying consistent quality and reducing consumer search costs, thus increasing customer loyalty. The value of trade marks may vary across firms and industries, depending on such factors as whether or not patents can be filed and the market structure. Equally the costs of trade marks vary between UKTM and CTM applications, being higher for the latter. We analyse Tobin's *q*, the ratio of stock market value to the book value of tangible assets. We explore the impact of undertaking any trade mark activity and also the effects of increasing trade mark intensity among those who do. The results indicate that stock market values are positively associated with R&D and trade mark activity by firms. We find larger differences between firms with and without trade marks for services than for manufacturing. We also find bigger differences in Tobin's *q* when the services firm is applying for Community marks, rather than just applying for UK marks. Increasing the intensity of trade marks matters for both manufacturing and services, although at a decreasing marginal rate for manufacturing and only for the years excluding 2000 for services. The rapid fall in the UK stock market in 2000 appeared to negate the benefits of trade marks for innovative services firms.

## 1. Introduction

The purpose of this paper is to analyse the potential link between trade marking and firm performance, with particular reference to the services sector. Most of the existing analysis of intangible assets in the form of intellectual property has focused on patents acquired by the manufacturing sector. There are several reasons to expand on this narrow perspective, not least because the major part of any advanced economy today is in service sector activity, but also due to the narrow range of products for which patents can be obtained. Innovation in services, or even in manufacturing, can result in a new good or service that falls outside of the realm of patentable products, especially in Europe, which has not broadly embraced the patenting of software or business methods as allowed in the US. These innovations can be signalled by the firm seeking to trade mark (or service mark) their new brand names and identifying logos, which act as a focus for advertising campaigns at product launch and in market expansion.[1]

Just as patents are seen by policymakers to support the rewards for investment in innovation, so might trade marks serve a similar function, by signalling product differentiation which increases the choice and welfare of consumers. However, in the same way that government is concerned not to allow patents to create excessive monopoly rents, they will also be concerned to ensure that the returns to trade marks are not unduly exploitative, i.e. that trade marks are not strongly anticompetitive.

To conduct empirical analysis of the value of trade marks, we have created an original database of the trade marks sought by around 2000 large firms during the period 1996-2000, covering both the historically important trade mark application route through the UK Patent Office and the new European Community trade mark route, which was only introduced in 1996. A full description of the database and its construction, which also includes patents and R&D, is given in Greenhalgh and

[1] In this paper we shall use the term 'trade mark' to cover both trade and service marks and in our empirical analysis we include applications for both categories of marks in the counts.

Rogers (2005a). The approach to the measurement of firm performance used here is based on the stock market value of the firm, which should move to reflect any increase in expected future profitability of the firm as long as stock markets are well informed. In a companion paper (Greenhalgh and Rogers, 2005b) we examine the effects of increasing the value of output, which forms the basis for increased profits, using value added as the measure of firm performance.

The next section of the paper discusses the nature of the value of trade marks to firms. We then briefly summarise the nature of the database in section 3. The model for estimation is specified in section 4, followed by the estimates in section 5. The final section draws out the main conclusions of the study.

## 2. The value of trade marks

Most of the established literature on the role of trade marks follows Landes and Posner (1987) in arguing that the various benefits are linked to search costs and information provision. At the most basic level, firms use trade marks to signal to consumers that the product is of a certain, consistent quality. This, in turn, reduces the so-called 'search costs' of customers and allows the firm to charge a higher price. Higher prices imply higher profitability, as long as the pressure of competition does not reduce all profits to normal levels.[2] Although the basic thrust of Landes and Posner concerns the role of trade marks in reducing search costs, they do note that the existence of trade marks may encourage firms to increase investment in improving the quality of the good(s).

The issue of quality improvement provides a link to an alternative literature that views trade marks as a proxy for innovative activity. This literature defines innovation broadly as the introduction of new ideas, products or processes into a firm's activities. The use of intellectual property to protect new ideas is viewed as a key component of this process. In some cases the use of trade marks in the innovative process may be

[2] Note that in Landes and Posner (1987) the basic model assumes that all firms will make 'normal' profits in equilibrium due to competition. Firms that have invested in trade marks will charge higher prices, but the costs of such investments will, in equilibrium, be exactly offset the higher margins.

critical, since without a trade mark the incentive to innovate may be removed. Clearly this represents an extreme case when other forms of protection are absent (e.g. patents, first-mover advantages or secrecy). More often the use of trade marks are likely to be one component in an overall strategy to extract value from innovation. In any event, the innovation view of trade marking, which augments the ideas of search costs and information asymmetry as in Landes and Posner, suggests a larger role for trade marking in the economic system.

One implication of the discussion so far is that the value of trade marks may vary greatly across firms and industries. Specifically, in industries where there are a small number of buyers and sellers, for example in those sectors supplying specialised producer goods, the search costs may be very small. This implies that the role of trade marks per se, or their use as a part of the innovation process, is likely to be small. In contrast, in other industries, for example consumer products, trade marks may represent one of the key components of a strategy for innovation. This is particularly the case in service-based industries where it is not generally possible to obtain patent or design protection for new innovations.

So far there has been no distinction between the value of a trade mark to a firm and the value of the trade mark to society. However, economists have raised the possibility that intellectual property can be used as a barrier to entry, hence reducing or stopping competition from new firms. If this is the case, then although trade marking generates a (private) value to the firm, it may act to reduce societal welfare (through higher prices and, possibly lower rates of innovation). The law surrounding trade marking recognises this as a possibility, hence there are restrictions on trade marking generic names and symbols. Furthermore, an application for a trade mark is for a specific 'class' of narrowly defined product and is not applicable to any or all products the firm may wish to evolve in future without registration of further classes, hence attempting to reduce the influence. Lastly, if an existing trade mark becomes a 'common' word in a certain market, then trade mark protection will cease as it is deemed to now act as a barrier to competition.[3]

[3] For example, a Community trade mark may be declared invalid "If in consequence of the acts of the proprietor, the trade mark has become the common name for a product or service in respect of which it

## 3. Data

To create our database at the Oxford Intellectual Property Research Centre (OIPRC) we first extracted a large sample of company records for large firms in UK covering all sectors of the economy. As the vast majority of these firms were parent firms with many subsidiary and associate firms, we next derived their ownership structures. Names of the parent and subsidiaries were then used to search the official records for each type of intellectual property asset. Having constructed the counts of IP assets for each parent and its subsidiaries, we then married the financial data from the company accounts with data that we had constructed on IP assets.

The financial data come from Company Analysis (Extel Financial, 1996, and Thomson, 2001) and they include a standard range of balance sheet and profit and loss items, including sales, profits, assets and also, for some companies, R&D expenditure. The database allocates each firm to a 2-digit standard industrial classification (SICs), on the basis of its dominant activity, and also provides a list of 4-digit SICs in which it has significant activities.[4] For firms that are publicly quoted, the end of accounting period share price is available, which when multiplied by shares outstanding yields the major component of market value. Although the OIPRC database also contains information about patents, the focus in this paper is on trade marks. Greenhalgh and Rogers (2005a) show that use of patents in non-manufacturing sectors is limited.

Data on two different trade mark applications routes are available. The first is trade mark applications to the UK Patent Office, which offer protection in the UK (denoted UKTM). The second is applications for Community trade marks, made via the Office for Harmonization in the Internal Market (Trade Marks and Designs) (OHIM), which

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is registered. Similarly, if the trade mark has become, in usage, a general concept, because, for example, the proprietor has taken insufficient or non-existent measures to indicate to the target public that it is in fact a trade mark that is being used." (http://oami.eu.int/en/mark/marque/faq/faq09.htm). A UK trade mark may also be revoked for similar reasons.

[4] The database uses the US SIC system. 'Significant' is defined according to accounting conventions, see the explanation of diversification variable in data Appendix.

offers protection for all countries in the European Community. Community trade marks represent a uniform right valid across all European Community countries. It is possible to apply for a CTM even though an identical national trade mark is held.[5] Both the wider coverage, and the greater cost of CTMs, suggest that UK firms will attach higher value to CTMs than UKTMs, although this is something that the empirical analysis can test. Since the use of trade mark data is relatively uncommon, combined with the fact that the Community trade mark (CTM) only came into existence in 1996, it is worth summarising some key characteristics of trade marks.

A trade mark is any 'sign' that can be used to distinguish a product or service. A sign can be any word(s), graphics, figures, images or similar that can act as a distinguishing feature. Since 1994 UK marks have included shapes, sounds and smells, and CTMs can also be distinctive colours or sounds; however these types of marks are far less common than words and images. Applications for trade marks are examined and then published, allowing a period of time for others to object, before full registration. Obtaining a trade mark through the UK Patent Office is considerably cheaper than via the Community Office. A UK trade mark costs around 300 euros, while a CTM costs around 2000 euros. In both cases the initial registration lasts for 10 years, at which time a renewal fee is payable (300 euro for UKTMs and 2500 for CTMs). Each trade mark application has to specify a class in which the trade mark is to be used. Multiple classes per single application are allowed, although there is a surcharge for more than three classes. In this paper we count each trade mark class as a unique application, since this appears a better measure of the importance of trade mark activity across the firm's product range.

To create an accurate measure of trade mark applications by a firm it is important to check for applications both in the name of the parent firm and also all the firm's subsidiaries. In other words, since the financial data available are consolidated for an entire group of firms, the trade mark data must also be consolidated. This is done by

[5] Before the introduction of the CTM it was possible to register a national trade mark in other countries by using the 'Madrid Protocol' (administered by the World Intellectual Property Organisation). However, this required additional payments for each countries and, potentially, enforcement via each national legal system.

using company structures from "Who Owns Whom" (Dun and Bradstreet International, 2001) to determine the family trees of the parent firms. The full trade mark application records were then searched for name matches (UK data from Marquesa Search System, 2002; CTM data from ESPACE, 2002).[6]

A detailed discussion of the trade mark data is contained in Greenhalgh and Rogers (2005a), but Table 1 contains some basic summary statistics. The table shows the average percentage of firms that trade mark in each year (1996-2000). Note that the propensity to trade mark varies substantially across sectors. The retail sector has the highest propensity to apply for UK trade marks (55% of firm-year observations), whereas only 12.5% of firms in real estate do so. Even so, service sector firms in several sectors are as active as manufacturing firms in UK marks. The propensity to apply for a CTM is lower than that for UKTM in all sectors and somewhat lower in services than in manufacturing. The last two columns of the table show the mean trade marks per year per 1000 employees. Again there are some very large differences in mean values across sectors.[7] In the analysis below an initial distinction is made between the full sample of firms (all sectors shown in Table 1), the manufacturing sector, and the service sector (all eight sectors including and below 'finance' in the table).

[6] Further information on the construction of the original dataset to 1995 is given in Greenhalgh and Longland, (2001, Appendix Notes); and for the dataset extension from 1996 in Greenhalgh et al. (2003, Technical Appendix).

[7] The 'hotels/catering' sector has a high mean value due to the presence of a firm called Chorion PLC. Information on this company in 2005 shows it to be a company that manages and owns brands, which accounts for its high trade marking. However, the financial data from Company Analysis classifies it as a 'drinking establishment' in 1996-2000. The influence of this firm on the regression results has been checked throughout the paper and, despite its high values, it does not have a notable effect on results.

**Table 1 Trade mark propensity and intensity**

| Sector | Percentage of firms trade marking | | | Trade marks per 1000 employees | |
|---|---|---|---|---|---|
| | UK TM | CTM | Both | UKTM | CTM |
| Agric., Mining | 9.46 | 7.43 | 4.05 | 1.17 | 2.09 |
| Manufacturing | 41.64 | 33.18 | 23.83 | 33.57 | 10.46 |
| Electricity, Gas, Water | 51.4 | 27.1 | 25.23 | 6.92 | 1.99 |
| Construction | 25.52 | 6.77 | 5.73 | 1.88 | 1.03 |
| *Service sectors* | | | | | |
| Finance | 27.6 | 12.5 | 10.42 | 42.79 | 14.4 |
| Real Estate | 12.5 | 5.47 | 2.34 | 2.32 | 28.1 |
| Wholesale | 35.94 | 22.92 | 15.1 | 12.84 | 15.47 |
| Retail | 54.71 | 24.14 | 20.46 | 10.29 | 6.76 |
| Hotels/Catering | 44.74 | 13.68 | 11.58 | 23.25 | 268.51 |
| Transport/Comm. | 49.24 | 34.47 | 25.76 | 21.14 | 13.41 |
| Business Services | 29.17 | 19.68 | 12.07 | 52.14 | 43.42 |
| Other Services | 31.56 | 16.1 | 10.95 | 82.67 | 81.49 |

Notes: The table shows summary statistics for the 5283 observations in regression sample [1] in Table 2. The percentages and intensities are calculated direct from observations (i.e. all firm-year observations).

## 4. Modelling the market value of firms

This paper uses the stock market's valuation of a firm as a measure of the expected value of future profits of the firm. Although there is a literature that questions the accuracy of stock market valuations, the overwhelming majority of studies on innovation and performance use such market valuation as a forward-looking performance measure.[8] The starting point for many empirical studies on innovation and market value is Griliches (1981). This assumes that the market value ($V$) of the firm is given by

$$V = q(A + \gamma K)^{\sigma} \qquad [1]$$

where $A$ is the book value of total tangible assets of the firm, $K$ is the stock of intangible assets not included in the balance sheet, $q$ is the 'current market valuation

[8] The possibility that share prices may deviate from the expected, discounted value of future dividends (profit distributions) has been investigated extensively in the finance literature (e.g. Froot and Obstfeld, 1991, Campbell and Kyle, 1993). Although these papers tend to focus on the possibility of aggregate stock market bubbles or mis-alignments, it is possible that such bubbles are sector-specific. In any event, the empirics below control for such a possibility by including time period dummies in regression analysis and by analysing whether relative valuations for trade mark activity varied over time.

coefficient' of the firm's assets, $\sigma$ allows for the possibility of non-constant returns to scale, and $\gamma$ is the ratio of shadow values of intangible assets and tangible assets (i.e. $\frac{\partial V}{\partial K} \Big/ \frac{\partial V}{\partial A}$). Taking natural logarithms of [1], and using the approximation $\ln(1+K/A) \approx K/A$, [1] can be rearranged to

$$\ln V = \ln q + \sigma \ln A + \sigma\gamma \frac{K}{A} \qquad [2]$$

Note that the approximation becomes poorer the larger the value of $K/A$. The difficult problem for empirical studies is how to proxy $K$ – the stock of intangible assets accumulated by the firm. Interpreted broadly, 'intangibles' can be related to brand names, process or product innovations, advertising, managerial skill, human capital in the workforce and other aspects of the firm. Although balance sheet data do, at times, contain a book value (accounting) value for intangible assets, there is widespread agreement that this vastly underestimates the true stock of intangible assets of the firm (see Data Appendix). As such, many studies of manufacturing firms use R&D expenditure ($R$) as a proxy for $K$, as this may be a good proxy for process and product innovations (e.g. Hall, 1993). Other studies use patents as a further proxy for such capital (e.g. Cockburn and Griliches, 1988).[9]

While R&D and patents may be appropriate for manufacturing firms, service sector firms have much lower levels of R&D and patents. It is also clear that intangible assets are extremely important to many service sector firms. This paper analyses whether trade mark activity can be used as a proxy for $K$ or, put differently, does trade marking affect the valuation of a company? As has been noted, the approximation used to obtain [3] may be problematic, hence the empirical analysis also tests for the significance of a quadratic term for trade mark activity.

There are relatively few previous studies that use trade mark data in this way. Bosworth and Rogers (2001) analyse Australian firm data in the mid-1990s but do not

[9] A review of these studies is contained in Hall (2000); a more recent empirical paper with further references is Hall and Oriani (2004).

find a significant role for trade marking.[10] A more recent study of 300 Australian firms observed from 1989-2002 by Griffiths and Webster (2004) found that the stock of trade marks was a significant determinant of market value, but with a smaller impact than either patents or registered designs; even so the value of a trade mark was rising over this period. Seethamraju (2003) analyses the value of trade marks in 237 US firms from selected industries in 1993-97, finding a positive role for trade marking on sales and also market values. The limited amount of analysis of the most common form of (registered) intellectual property right appears an anomaly, an issue also raised by Medonca et al (2004).

For empirical analysis, equation [2] is modified to the following form,

$$\ln \frac{V_{it}}{A_{it}} = \alpha_j + \alpha_t + (\sigma - 1)\ln A_{it} + \sigma\gamma \frac{R_{it}}{A_{it}} + \alpha_{TM} \frac{TM_{it}}{A_{it}} + \mathrm{X}_{it}\beta + u_{it} \qquad [3]$$

where *i* indexes a firm, *j* an industry and *t* a year; thus $\alpha_j$ and $\alpha_t$ are sets of industry and year dummies, *R* represents R&D expenditure, and *TM* represents trade marks. Note that the dependent variable is now the ratio of market value to tangible assets, which is commonly referred to as Tobin's *q*. The matrix $X_{\mathrm{it}}$ is a set of other control variables (defined below) and $u_{\mathrm{it}}$ is a standard error term. Note that [3] allows ln*q* from [2] to vary across industries (the $\alpha_j$) and over time (the $\alpha_t$). Although [3] shows the influence of trade marking being dependent on a ratio (i.e. trade marks per tangible assets), the empirics below start with an analysis of a dummy variable for 'trade markers' versus 'non-trade markers'. Equally, the data contains both UK and Community trade mark data, which are considered separately. Finally, since the data set contains observations between 1996 and 2000, it is also possible to estimate a fixed effect model (which means replacing $\alpha_{\mathrm{j}}$ with firm specific fixed effects in [3]).

The control variables, represented by the matrix *X* in [3], include dummy variables for being highly diversified, and for whether the firm has sales in Europe or North

[10] Greenhalgh and Longland (2001) analyse the impact of trade marking on wages and job creation in manufacturing firms. They found that trade marks had an impact in increasing wages in a model including firm fixed effects, suggesting some sharing of the revenue gains from trade marks.

America, the sales growth of the firm, the debt to equity ratio, and the book value of intangible assets. These variables are described in more detail in the Data Appendix. In the current context, a key rationale for including these variables is to minimise the possibility that the trade mark variables are picking up the effects of increasing firm size, diversification or internationalisation, all of which may be attractive to shareholders.

## 5. An empirical analysis of the market value of trade marking

As the previous section indicates, there are various ways of using the trade mark data to assess its potential association with market value. The first sub-section below looks at the difference in market valuations between those firms that do apply to register trade marks and those that do not. This simple, dichotomous distinction is deliberately crude. It is clear that firms that trade mark may also have a range of other characteristics that are different from non-trade markers, and it may not be possible to control for all of these in the regression analysis. For example, some firms may have better managers that raise the expected (relative) profit and hence the market's valuation of the company. Since better managers are more likely to use intellectual property, including trade marks, it is clear that the dummy for 'trade markers' could capture managerial ability. This example serves to remind us that it is often highly difficult to isolate the impact of one variable in complex situations; indeed, it is probably better to accept that generating value within a firm is the result of many factors acting in unison. Given this, the analysis of trade markers versus non-trade markers provides an extreme, upper bound on the value of trade marking.

The second sub-section analyses the role of trade mark *intensity*, which is defined as trade marks per million pounds of tangible assets (i.e. the ratio shown in equation [3]). The use of trade mark intensity controls for the fact that large firms often have more trade marks than smaller firms. The firms in this part of the analysis are restricted to those with non-zero trade marks. The results indicate whether variations in trade mark intensity affect market valuations. This can be viewed as a stronger test of the value of trade marks. However, as indicated above, differences across firms in trade mark intensity may proxy other firm characteristics, including a firm's general innovative activities, such as marketing expenditure or advertising. This means the coefficient estimates cannot be interpreted as a purely trade mark intensity effect.

The final sub-section analyses an even stronger test of the importance of trade marking. Since data are available on the trade marking activity of the same firms across the 1996-2000 period it is possible to analyse the following question. Do firms that increase their trade mark activity relative to their average for the period also show an increase in market valuation? There is a potential problem with analysing the CTM data in this way, since CTMs have only been available from 1996. Given this, many firms made a burst of applications in 1996, presumably including a large number of existing national trade marks, hence the first or second year of CTM applications may be atypical (see Greenhalgh and Rogers, 2005a).

### *5.1. Trade markers versus non-trade markers*

Table 2 shows the regression results from the full sample of firms, the manufacturing sample and the service sector sub-sample.[11] In each case three dummy variables are entered to capture the potential impacts of trade mark activity. The first dummy variable shown equals one if the firm *only* filed for one or more Community trade marks in the year. The second dummy equals one if the firms is *only* a UK trade marker. The final dummy variable equals one if the firms filed for *both* a Community and UK trade mark in a given year. Thus, the dummy variables capture all the various permutations of trade mark activity in our data. The dependent variable for all regressions is Tobin's $q$ (the natural log of tangible assets is included as an explanatory variable as a direct test of $\sigma$=1).

Our main interest is in the coefficients on the dummy variables for trade markers. As can be seen, all the coefficients on all trade marker dummies are highly significant in the full and service sectors, with magnitudes varying from 0.24 to 0.57. In economic terms, the coefficient of 0.297 for UK marks implies that the Tobin's $q$ of a services trade marker is around 35% higher than that of an equivalent inactive firm, while the

[11] The split into manufacturing and services is justified by statistical tests. Using tests of the difference between coefficients across samples using dummy variable interactions shows that the coefficients on, for example, the Community, UK and 'both' trade mark dummies, the log of assets, and the R&D ratio are all different across service and manufacturing at the 1% level.

**Table 2 Market value and trade markers**

| | Full | Manufacturing | Services |
|---|---|---|---|
| Log of tangible assets | -0.052 | -0.023 | -0.064 |
| | (5.28)*** | (1.46) | (4.75)*** |
| Dummy for Community trade marker only | 0.370 | 0.111 | 0.562 |
| | (6.02)*** | (1.22) | (7.03)*** |
| Dummy for UK trade marker only | 0.236 | 0.099 | 0.297 |
| | (6.50)*** | (1.50) | (6.89)*** |
| Dummy for both Community and UK trade marker | 0.464 | 0.246 | 0.541 |
| | (10.75)*** | (3.90)*** | (9.13)*** |
| R&D expend / tangible assets | 1.909 | 4.029 | 1.338 |
| | (4.09)*** | (5.17)*** | (3.63)*** |
| Dummy for diversified firm | -0.057 | -0.032 | -0.044 |
| | (1.85)* | (0.49) | (1.17) |
| Dummy for sales in Europe | 0.039 | 0.079 | 0.014 |
| | (1.22) | (1.28) | (0.34) |
| Dummy for sales in N. America | 0.107 | 0.203 | -0.006 |
| | (2.69)*** | (3.58)*** | (0.11) |
| Growth in sales (t, t-1) | 0.242 | 0.328 | 0.167 |
| | (4.24)*** | (2.71)*** | (2.41)** |
| Debt / shareholders' equity | -0.016 | -0.005 | -0.033 |
| | (1.15) | (0.23) | (1.80)* |
| Intangible assets / tangible Assets | 0.183 | 0.614 | 0.139 |
| | (2.32)** | (9.13)*** | (2.83)*** |
| Constant | -0.053 | -0.716 | 0.316 |
| | (0.24) | (2.52)** | (1.05) |
| Observations | 5283 | 1926 | 2910 |
| R-squared | 0.34 | 0.34 | 0.32 |
| Joint sig. of indust. dummies | 0.00 | 0.00 | 0.00 |
| Joint sig. of year dummies | 0.00 | 0.00 | 0.00 |

Notes: The dependent variable is ln of Tobin's q. Estimator is ordinary least squares (OLS) with robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The industry and year dummies rows show the probability of a type 2 error in rejecting the hypotheses that all 2-digit industry (year) dummies are equal.

coefficient of 0.541 for activity in both Community and UK marks raises $q$ by 72%.[12] (Further illustrations are provided in the Data Appendix.)

[12] The coefficient represents the difference in natural logs between trade markers and non-trade markers (i.e. $\ln q_{tm} - \ln q_n = \ln(q_{tm} / q_n) = 0.297$, hence $q_{tm} / q_n = e^{0.297} = 1.346$ ).

The manufacturing sub-sample shows positive, but insignificant, coefficients on the Community and UK only trade mark dummies, but a positive coefficient of 0.246 for firms that use both trade marking routes (in a given year). Thus trade mark activity creates greater differences between firms in services than in manufacturing in this period. Nevertheless, what is recorded here is new applications and clearly most manufacturing firms will have a stock of historically registered trade marks, so for this reason the differences between firms due to recent activities are attenuated.

The results on the other control variables in Table 2 are generally in keeping with existing studies. The coefficient on ln(assets) is close to zero (and insignificant in the manufacturing sub-sample), suggesting that firm size does not greatly affect the Tobin's *q* ratio. The coefficient on the R&D term is positive and significant across all three samples, although much larger for manufacturing. The positive coefficient on the growth of sales variable suggests that the stock market places a premium on fast growing firms (note that all the regressions also contain 2-digit industry dummies that will control for industry-wide differences). The positive coefficient on the intangible assets ratio is as expected, but the fact that the coefficient is often well below one implies that the 'book value' of intangibles is a poor guide to the actual market value of this accounting entry.

Table 3 shows the coefficients on the dummy variables relating to trade marking for all sectors (using an equivalent regression specification to Table 2).[13] Concentrating on the service sectors, the results suggest that firms who trade mark through both routes, or are solely Community trade markers, tend to have the highest market premium, with lower returns for those who are solely UK trade markers. This mirrors the results above (Table 2) for the service sector as a whole. Even so, in several sectors there are mixed results, for example the construction sector shows no premium from solely Community trade marking, but with a large increase in market value stemming from trade marking via both routes and some value from UK trade marks alone. In finance, only firms that are solely active via the Community route gain, yet their premium is very large. In the retail sector it also appears that, despite the

[13] A formal test of the null hypothesis of the equivalence of all the trade marking dummy variables across sectors is rejected at the 10% level.

prevalence of this activity noted in Table 1 above, UK trade mark activity commands no premium, while only the smaller fraction of firms that solely seek Community trade marks have a premium; these rankings of results for retailing are changed when we consider trade mark intensity below.

**Table 3 Trade markers vs. non-trade markers, all sectors**

| Sector | | Community trade marker only | | UK trade marker only | | Both CTM and UKTM | |
|---|---|---|---|---|---|---|---|
| | Obs. | Coeff. | t-stat | Coeff. | t-stat | Coeff. | t-stat |
| Agric. Mining | 148 | 0.66 | 0.89 | 0.08 | 0.22 | 0.30 | 1.11 |
| Manufacturing | 1926 | 0.11 | 1.22 | 0.10 | 1.50 | 0.25 | 3.90*** |
| Electricity, Gas, Water | 107 | 0.39 | 1.72* | 0.15 | 1.03 | 0.44 | 3.36*** |
| Construction | 192 | -1.52 | -1.21 | 0.52 | 2.21** | 1.05 | 4.18*** |
| Finance | 192 | 1.11 | 2.00** | 0.16 | 0.71 | 0.43 | 1.19 |
| Real estate | 128 | 0.31 | 2.45** | 0.19 | 1.21 | 0.31 | 1.22 |
| Wholesale | 384 | 0.67 | 3.43*** | 0.46 | 3.59*** | 0.84 | 5.47*** |
| Retail | 435 | 0.58 | 1.92* | -0.01 | -0.07 | 0.14 | 1.27 |
| Hotel/catering | 190 | 0.57 | 1.68* | 0.34 | 3.20*** | 0.74 | 4.30*** |
| Transport/communications | 264 | 0.40 | 2.21** | 0.51 | 3.88*** | 0.20 | 1.37 |
| Business services | 696 | 0.42 | 2.72*** | 0.06 | 0.65 | 0.51 | 4.08*** |
| Other services | 621 | 0.53 | 4.51*** | 0.37 | 4.11*** | 0.60 | 5.22*** |

Notes: Coefficients with a starred t-stat are significantly different from zero, * significant at 10%; ** significant at 5%; *** significant at 1%.

### *5.2. Intensity of trade marking and value*

A second test of the influence of trade mark activity is to use the specification shown in equation [3], which hypothesises that the ratio of trade marks to tangible assets is the relevant explanatory variable. In fact the derivation of [2] and [3] from [1] uses an approximation that is less accurate as the ratio of intangible to tangible assets increases. Given this, this section estimates a model with a quadratic term for trade marks to assets and only removes this term if the coefficient is insignificantly different from zero. Since the regression model estimated in this section requires non-zero trade marks (for either CTM or UKTM) the sample size is reduced.

The first column of results in Table 4 shows the results from estimated the intensity model on the full set of sectors. Both Community trade mark and UK trade mark

intensity ratios are included in the model.[14] The initial results for the full sample show insignificant coefficients on the squared terms for trade mark intensity; hence these are removed from the set of explanatory variables. Even so, the full sample results still show no significant partial association between trade mark intensity and market value, although it is still the case that firms focusing on Community trade marks have higher market values.

The second column shows the regression results for the manufacturing sub-sample only. The coefficient on trade mark intensity – for both Community and UK trade marks – is positive, while the coefficient on the squared terms is negative. These coefficients implies a concave function – with the marginal impact (d$q$/d$CTM$) of higher trade mark intensity falling as intensity rises. The apex for Community trade marks (d$q$/d$CTM$=0) of this relationship occurs at around 1.47 trade marks per million assets. For the manufacturing firms sample this value is just above the 99$^{th}$ percentile of the distribution. For UK trade marks the apex value is 1.83 (again this is just above the 99$^{th}$ percentile of the distribution). Hence, for the bulk of firms in the data, increasing trade mark intensity increases market value, although at a decreasing (marginal) rate. Specifically, for a firm with mean value of UK trade marks to assets ratio (see Appendix), a 0.1 increase in this ratio is associated with an increase in Tobin's $q$ of around 5%.[15] For the Community trade mark the equivalent figure is around 10%. In both cases, this positive association diminishes as trade mark intensity rises.

[14] The correlation coefficient between Community trade mark intensity and UK trade mark intensity is 0.05 for the full sample, hence we do not feel that multi-collinearity is likely to be an issue. This said, regressions entering only Community trade marks and only UK trade marks have been run and the results are similar to Table 4.

[15] For manufacturing firms, the mean value for UK trade marks to assets is 0.118, and 0.073 for Community trade marks to assets. Normally these calculations are calculated for a one standard deviation change, but in this case the skewness of the data causes the s.d. to be very high (0.368 for UK, 0.224 for Community), hence it seems more reasonable to evaluate the associations for a 0.1 change.

**Table 4 Trade mark intensity and market value**

| | Full | Manufacturing | Service sectors | Service sectors (dummy 2000) |
|---|---|---|---|---|
| Log of tangible assets | -0.006 | 0.060 | -0.029 | -0.032 |
| | (0.51) | (2.62)*** | (1.72)* | (1.93)* |
| Community trade marks / | 0.052 | 0.938 | 0.033 | 0.066 |
| Assets (million) | (1.19) | (2.56)** | (0.73) | (2.05)** |
| Square of Community | | -0.319 | | |
| trade marks /assets | | (2.14)** | | |
| UK trade marks / | 0.013 | 0.486 | 0.026 | 0.057 |
| Assets (million) | (0.47) | (1.80)* | (0.99) | (2.60)*** |
| Square of UK | | -0.133 | | |
| trade marks /assets | | (2.54)** | | |
| Dummy for 2000 x Community | | | | -0.436 |
| Marks / assets | | | | (3.94)*** |
| Dummy for 2000 x UK trade | | | | -0.136 |
| Marks / assets | | | | (2.58)** |
| Dummy for Community | 0.138 | -0.023 | 0.263 | 0.275 |
| trade marker only | (2.10)** | (0.21) | (3.05)*** | (3.22)*** |
| Dummy for both Community | 0.054 | 0.064 | -0.061 | -0.055 |
| and UK trade marker | (0.82) | (0.63) | (0.68) | (0.61) |
| R&D expend / | 1.949 | 2.877 | 1.26 | 1.051 |
| tangible assets | (5.26)*** | (3.72)*** | (3.63)*** | (2.99)*** |
| Dummy for diversified firm | -0.011 | -0.101 | 0.076 | 0.081 |
| | (0.22) | (0.99) | (1.37) | (1.48) |
| Dummy for sales in | -0.016 | 0.111 | -0.079 | -0.075 |
| Europe | (0.33) | (1.22) | (1.35) | (1.29) |
| Dummy for sales in N. | 0.029 | 0.168 | -0.131 | -0.137 |
| America | (0.57) | (2.26)** | (1.84)* | (1.92)* |
| Growth in sales (t, t-1) | 0.203 | 0.144 | 0.211 | 0.238 |
| | (2.60)*** | (0.87) | (2.45)** | (2.75)*** |
| Debt / shareholders' | -0.040 | -0.034 | -0.062 | -0.066 |
| Equity | (1.98)** | (1.12) | (2.11)** | (2.24)** |
| Intangible assets / | 0.438 | 0.471 | 0.353 | 0.382 |
| tangible assets | (7.93)*** | (6.31)*** | (5.61)*** | (6.77)*** |
| Constant | 1.018 | -1.781 | 0.876 | 1.474 |
| | (4.47)*** | (3.42)*** | (3.00)*** | (4.95)*** |
| Observations | 2334 | 982 | 1225 | 1225 |
| R-squared | 0.37 | 0.37 | 0.35 | 0.36 |
| Industry dummies | 0.00 | 0.00 | 0.00 | 0.00 |
| Year dummies | 0.00 | 0.01 | 0.04 | 0.07 |

Notes: As per Table 2.

In column 3 the apparently insignificant role for trade mark intensity in the services sector is, perhaps, surprising, but note that the coefficient on the dummy variable for 'Community trade marker only' is significant in this regression, indicating some value associated with such trade marking.[16] A further issue is that, as the trade mark data are skewed, there is a concern that the results in Table 4 may be affected by influential observations. Testing for the role of a quadratic term will control for this to some extent, but we also explored this problem using dummy variable techniques. Specifically, a dummy variable is created for observations above the 95$^{th}$ percentile in each sector and then interacted with trade mark intensity. Entering this new variable as an explanatory variable acts as a further method of assessing the role of high trade mark intensity firms (a dummy variable for high intensity firms is also added to the regression). The results from this indicate that the firms with UK trade mark intensity below the 95$^{th}$ percentile appear to have a significant partial correlation with market value (the coefficient is 0.36, significant at 5% level), although there is no such result for Community trade mark intensity. Overall, therefore, although there is some indication that the high trade mark intensity firms act to weaken associations, the broad results so far show little support for trade mark intensity in influencing market value in services.

Another hypothesis is that the value of trade marking may have changed over time. For example, since Community trade marks were only introduced in 1996 there could have been an atypical relationship in that year. Equally, the rapid fall in the UK stock market in 2000 could have affected the results. Note that we already included a dummy variable for 2000, to capture the aggregate stock market fall, but it is possible that there was a differential effect on innovative firms. By including interaction terms between specific years and the trade mark intensity variables these hypotheses can be tested. In short, the results suggest that there is a distinct, and significant, year 2000 effect for service sector firms. This regression is shown in the last column in Table

[16] The omitted category in these regressions is 'UK trade mark only', the effect of which is subsumed by the constant term. Replacing the 'Community trade mark only' dummy variable with the UK equivalent yields an insignificant coefficient for the manufacturing sample, but a negative coefficient for the service sector, although the 'both' dummy is now significant.

4.[17] The coefficients imply that, prior to 2000, both higher Community and UK trade mark intensity are associated with higher market value, with the coefficient around 0.06 (the two coefficients are not statistically different from one another). As can be seen from the Table 4, the market's valuations were dramatically reversed in 2000. In particular, higher Community trade mark intensity had a large negative partial association with market value. The analysis has also checked for such a 2000 effect in the manufacturing firms. For UK trade mark intensity there is no evidence of any effect. For Community trade mark intensity there is possibly a negative effect (not statistically significant in the quadratic specification, but significant if the squared terms are dropped[18]).

Table 4 also shows that the inclusion of Community trade mark intensity does affect the coefficients on other variables. In particular, the coefficient on the growth of sales tends to become less significant, while the coefficients on the intangible assets ratio are also affected. For the full sample there is a positive correlation between CTM intensity and sales growth, which indicates why the coefficients have changed, and also coincides with a general view that trade marks can raise performance.

It is interesting to provide an economic interpretation of the significant coefficients on trade mark intensity found above. There are difficulties in providing 'typical' economic impacts, but consider the coefficient of 0.066 from the service sector regression (Table 4 col.4). This implies that an increase in trade mark intensity of one is associated with an increase in Tobin's *q* of 6.6%. An increase of trade mark intensity of one is large (it is more than one standard deviation, but the data are

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[17] Regressions were run with a set of time dummy interaction terms before arriving at this specification. Specifically, tests of the significance of the interaction terms for the 1996-99 dummy times with trade mark intensity were conducted. For Community trade marks the tests show that the 1996-99 interaction terms have coefficients statistically equal to each other, with the year 2000 showing the only significant effect. For UK trade marks the tests imply that 1998 and 1999 were years when higher UK trade mark intensity generated a market premium, with a dramatic reversal in 2000.

[18] Although this paper is not focussed on the manufacturing sector, our analysis has also checked for a year 2000 effect for R&D, for EPO patenting and UK patenting. There appears to be no 2000 effect for these variables.

skewed). Consider instead the move to making one extra Community trade mark application per year by a service firm with mean ln.(assets), implying assets of £116 million). This would raise its trade mark intensity by 0.0086 and thus raise Tobin's *q* by 0.057%. Clearly, any increase in Tobin's *q* has very different implications for the absolute increase in market value depending on the size of the firm. For the same mean firm with mean ln(*q)* of 0.37 or *q* of 1.45, this increase in *q* corresponds to a rise in stock market value of £96,000. (Further illustrations are provided in the Data Appendix.) [19]

Table 5 shows the results of investigating trade mark intensity for each sector. Clearly now the sample sizes of active firms are becoming small, so we report results only for more than 50 observations. For Community trade marks, these show that, as well as the effects noted above in the manufacturing sector, there is a significant positive association between intensity and Tobin's *q* only in construction, wholesale and other services. For UK trade marks, besides manufacturing trade mark intensity is also revealed to matter in retailing, where earlier we found no significant effect when simply differentiating between the active and inactive. The other service sectors, however, show no significant partial association with UK trade mark intensity. These results have been further checked allowing the relationship between trade mark intensity and Tobin's q to vary for those firms with trade mark intensities below and above the 90$^{th}$ percentile; this reveals further positive effects in finance, transport/communications and other services for firms once the top 10% of values are separated from the majority of observations.

Overall the analysis of the role of trade mark intensity produces mixed results: considerable importance of increased intensity for both types of marks in manufacturing and for UK marks in retailing; one or other type of trade mark intensity showing positive impact in five out of eight other non-manufacturing sectors (excluding retailing and with sufficiently large samples for estimation). In all, this

[19] Granstrand (1999) provides a discussion of the value of the world's leading trade marks (or brands), with Marlboro and Coca-Cola both estimated to be worth over $40bn in 1995. These, of course, relate to the most successful, long-established trade marks. The estimates in the Appendix below relate to the typical value of a recent trade mark application across all firms of a given type.

shows a far less consistent pattern of benefits than seen in the results for trade mark activity (Table 3 above).

**Table 5 Trade mark intensity and market value**

| Sector | Obs. | Community trade marks | | UK trade marks / assets | | Firms below 90th percentile | |
|---|---|---|---|---|---|---|---|
| | | CTM/A Coeff. | $(CTM/A)^2$ Coeff. | UKTM/A Coeff. | $(UKTM/A)^2$ Coeff. | CTM/A Coeff.. | UKTM/A Coeff. |
| Agric., Mining | 17 | n.a. | | n.a. | | n.a. | |
| Manufacturing | 982 | 0.94*** | -0.32*** | 0.48* | -0.13*** | 0.95 | 1.31** |
| Electricity, Gas, Water | 57 | -2.29 | | -3.77* | | -2.16 | -4.59 |
| Construction | 51 | 16.8* | | 3.49 | | 72.5 | 20.1 |
| Finance | 57 | 1.90 | | -0.26* | | 6.31 | 4.3* |
| Real estate | 20 | n.a. | | n.a. | | n.a. | |
| Wholesale | 168 | 0.15** | | -0.19 | | 1.97 | 1.76 |
| Retail | 254 | 0.26 | | 0.89** | -0.16** | -0.04 | -0.78 |
| Hotel/Catering | 89 | -2.73 | | 0.05 | | -5.78** | 1.21 |
| Transport/Comm. | 153 | 0.05 | | -0.05** | | -1.35 | 1.99* |
| Business services | 256 | -0.28*** | | 0.04 | | -0.14 | 0.25 |
| Other services | 228 | 0.09*** | | 0.02 | | 0.19 | 0.59*** |

Notes: The table shows the coefficients on trade mark intensity variables from sector specific regressions. In each case, an initial regression included both quadratic terms and these are only dropped if insignificant. The coefficients for the agriculture plus mining and real estate sectors are not reported due to insufficient observations. The final two columns show the coefficients on trade mark intensity when the coefficient for firms over the 90th percentile is allowed to differ from those below. * significant at 10%; ** significant at 5%; *** significant at 1%.

### *5.3. Fixed effect models*

This section sets out to analyse the role of changes in trade mark intensity on changes in share market value using a fixed effect model. In terms of the regression specification in [3] this means that the $\alpha_j$ (the industry dummies) and now replaced by $\alpha_i$ (firm effects). As such, the regression model controls for a firm specific effect that is time invariant (over the period 1996-2000), reflecting persistent but unobserved firm characteristics such as management quality or strategy.[20] As has been discussed above, the fact that Community trade marks only started in 1996 means that the activity of some firms in that year may have been high. In terms of our analysis this

[20] Although the ability to control for such an unobserved, but potentially important, effect appears to be beneficial, in practice the use of the fixed effect estimator can aggravate the affect of measurement error in the data causing coefficients to be biased towards zero (see Johnston and Dinardo, 1997).

suggests that we may want to check the robustness of the results with and without 1996 in the sample. Similarly, the last section has raised awareness that the stock market falls in 2000 could influence coefficients.

Table 5 presents the results from a set of fixed effect regression models. Each of the models constrains the sample to include only firms with three or more observations over the five year period.[21] The analysis again tests for the relevance of a quadratic term for trade mark activity and only omits this is if is not significant. The full sample regression results show no significant role for either trade mark intensity variable. This result is confirmed whether or not 1996 is included in the sample, and is also robust to a '2000 effect'. Such non-significant effects can arise due to the inappropriate pooling of observations when the coefficients differ strongly by sector.

Two alternative manufacturing regressions are shown in the table. The results suggest a concave relationship between CTM activity and market value, but a negative relationship with UK trade mark activity. While the former result is in keeping with the results in the previous section, although the coefficient magnitudes are lower, the latter result is directly opposed to the previous results. Further analysis of the role of potential influential observations, the years 1996 and 2000 and using alternative panel samples tend to confirm these results. Table 5 shows two regressions for the service sector (the second one uses a dummy for 2000 interacted with trade mark intensity as in Table 4). The basic results here are that Community trade marks have a partial correlation with market value but UK trade marks do not. The coefficient magnitude on Community trade mark intensity is around 0.06, similar to that found in the cross sectional analysis in the previous section. Overall the fixed effects model attributes some power to an increase in Community trade mark intensity for each of the manufacturing and services samples, even after controlling for all the time-invariant differences between firms, but with a non-linear effect in manufacturing contrasting with a linear effect in services.

[21] Additional regressions have been run checking that the results are not drive by this choice. Restricting the sample to a balanced panel reduces the number of firms to 176 firms.

**Table 6 Fixed effect estimations**

| | Full | Manu-facturing | Manu-facturing | Service sectors | Service sectors (dummy 2000) |
|---|---|---|---|---|---|
| Log of tangible assets | -0.140 | -0.068 | -0.046 | -0.21 | -0.21 |
| | (3.26)*** | (0.85) | (0.57) | (4.19)*** | (4.18)*** |
| Community trade marks / | 0.040 | -0.117 | 0.431 | 0.057 | 0.058 |
| Assets (million) | (1.37) | (0.93) | (1.60) | (2.01)** | (2.03)** |
| Square of Community | | | -0.259 | | |
| trade marks /assets | | | (2.39)** | | |
| UK trade marks / | -0.034 | -0.470 | -0.647 | 0.018 | 0.019 |
| Assets (million) | (1.45) | (5.85)*** | (3.65)*** | (0.72) | (0.74) |
| Square of UK | | | 0.040 | | |
| trade marks /assets | | | (1.17) | | |
| Dummy for 2000 x Community | | | | | 0.171 |
| Marks / assets | | | | | (0.62) |
| Dummy for 2000 x UK trade | | | | | 0.147 |
| Marks / assets | | | | | (0.86) |
| R&D expend / | 1.588 | 2.011 | 2.169 | 0.442 | 0.65 |
| Tangibleassets | (3.68)*** | (3.23)*** | (3.48)*** | (0.69) | (0.97) |
| Growth in sales (t, t-1) | 0.010 | -0.066 | -0.081 | 0.092 | 0.1 |
| | (0.22) | (0.81) | (1.00) | (1.56) | (1.69)* |
| Debt / shareholders' | -0.010 | -0.033 | -0.033 | 0.027 | 0.028 |
| Equity | (0.50) | (1.16) | (1.15) | (0.94) | (0.96) |
| Intangible assets / | 0.371 | 0.400 | 0.397 | 0.325 | 0.298 |
| tangible assets | (7.19)*** | (4.86)*** | (4.84)*** | (5.03)*** | (4.45)*** |
| Constant | 2.730 | 1.185 | 0.753 | 4.253 | 4.218 |
| | (3.28)*** | (0.77) | (0.48) | (4.38)*** | (4.34)*** |
| Observations | 1728 | 775 | 775 | 869 | 869 |
| Number of firms | 418 | 184 | 184 | 213 | 213 |
| R-squared | 0.09 | 0.16 | 0.17 | 0.11 | 0.11 |
| Year dummies | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: The dependent variable is natural log of Tobin's q. The sample is constrained to firms that have three of more years of data in the sample. Estimator is fixed effects (OLS). The industry dummies, the trade mark activity dummies, the diversification dummy, and the international sales dummies are omitted since they are (largely) time invariant. The year dummies row shows the probability of a type 2 error in rejecting the hypotheses that all 2-digit year dummies are equal. Tests for the stability of the coefficients in 2000 show no significant effects. * significant at 10%; ** significant at 5%; *** significant at 1%.

## 6. Conclusions

This paper uses a new data set of the trade mark activity of UK manufacturing and service sector firms (1996-2000) to investigate the value of trade marks, which are a form of intellectual property and potentially act as intangible assets for firms. Trade (and service) marks in the UK can be sought via the UK Patent Office and the European Community Office for Harmonisation of the Internal Market and we document activity via both routes, which are important avenues for UK firms to register their marks. The database covers all sectors of the economy, allowing us to offer new insights into innovation in services, which has not previously been analysed to the same degree as manufacturing.

We argue that firms use trade marks to signal to consumers that the product is of a certain origin, implying consistent quality and reducing consumer search costs, thus increasing customer loyalty. Product innovations that increase product choice are likely to be welfare improving, as more customers can purchase a variety which fits their needs. The value of trade marks may vary across firms and industries, depending on such factors as whether or not patents can be filed and the market structure. Equally the costs of trade marks vary between UKTM and CTM applications, being higher for the latter, so these need to generate higher returns to be worth the expense. The empirical analysis allows for these differences using several varieties of data disaggregation and of econometric specification.

Following the traditions established in the analysis of the value of patents in manufacturing, we analyse Tobin's *q*, the ratio of stock market value to the book value of tangible assets. Well-informed and forward-looking stock markets are expected to reflect any increase in future profitability from new intangible assets in the share price of the firm. We explore the impact on *q* of firms undertaking any trade mark activity and also the effects of increasing trade mark intensity among those who do.

Stock market values are positively associated with R&D and trade mark activity by firms. We find larger and more significant differences between firms with and without trade marks for services than for manufacturing. We also find bigger differences in Tobin's *q* when the services firm is applying for Community marks, rather than just

applying for UK marks. Increasing the intensity of trade marks matters for both manufacturing and services, although at a decreasing marginal rate for manufacturing and only for the years excluding 2000 for services. The rapid fall in the UK stock market in 2000 appeared to negate the perceived benefits of trade marks for innovative services firms. Disaggregated results show considerable variation between different services, with the largest effects of undertaking some Community trade mark activity being observed in finance, wholesale, retail and hotel/catering services, although in not all of these was an increase in the intensity of trade marking perceived as being significantly profitable for the firm.

# Data Appendix

## Table A1 Definitions of the variables

| Variable | Description |
|---|---|
| Tobin's q | The ratio of market value to tangible assets. Market value is defined as: [share price (at end of accounting period) x ordinary shares outstanding] + creditors – current assets + debt. This is based on the approximation for Tobin's q in Chung and Pruitt (1993). This definition is based on the fact that in order to gain total control of the firm – and the rights to future profits – an investor would have to buy all shares, retire debt and payoff creditors (although they could use current assets). The correlation coefficient between this measure and the simple ln(share value) is 0.86. Tangible assets are defined as total assets less intangible assets. |
| Debt to equity ratio | Defined as total debt to shareholders' funds as reported in balance sheet. Any negative values for ratio are set to zero. Also, any values greater than 9 (the 99$^{th}$ percentile of distribution) are replaced by average of previous and following period, if data available, or by previous or following period if not. |
| Dummy for sales in Europe | This equals one if the accounts report a separate European sales figure. The UK's accounting standards (SSAP 25) sets down guidelines for reporting geographical sales data. In short, where sales, profits (losses) or net assets in an overseas region exceeds 10% of the total, a firm is obliged to report segment data. Given this, the dummy variable isolates firms with a 10% or above interest in Europe. |
| Dummy for sales in North America | This equals one if the accounts report a separate North American sales figure. |
| Sales growth (t, t-1) | Calculated as the $\ln(sales_t) - \ln(sales_{t-1})$ |
| Diversification dummy | This equals one if the firm has activities in 3 or more distinct 4-digit SICs. |
| Intangible to tangible assets ratio | The ratio of intangibles, as reported in the balance sheet, to tangibles in balance sheet. According to the accounting conventions, the value of intangibles can include goodwill, development costs, "brands, patents etc", "licences etc", deferred costs and player registrations. However, this is only done when there is a well-defined market value, which normally means that the firm must have purchased the asset from another firm. The current accounting advice states, "internally generated goodwill should not be capitalised and internally developed intangible assets should be capitalised only where they have a readily ascertainable market value." (http://www.frc.org.uk/asb/technical/standards/pub0109.html) |

**Sectors:** "Other services sector". This sector contains 13 different 2-digit SICs although the most common sectors are "79", which is "Amusement & recreation services" (32% of observations), and "87" ("Engineering & management services", 38% of observations). The latter industry group contains a range of consultancies, including some companies that conduct contract research.

## Table A2 Summary statistics for the regression samples

| Sector | Tobin's q | | | Sales | |
|---|---|---|---|---|---|
| | Mean | median | st. dev | mean | median |
| | | | | Millions | |
| Agric. Mining | 1.61 | 0.92 | 2.92 | 479 | 20 |
| Manufacturing | 2.25 | 0.86 | 13.99 | 951 | 66 |
| Electricity, Gas, Water | 1.15 | 1.09 | 0.55 | 1345 | 515 |
| Construction | 0.45 | 0.28 | 0.94 | 564 | 309 |
| Finance | 2.03 | 0.85 | 3.86 | 131 | 28 |
| Real estate | 0.71 | 0.62 | 0.56 | 112 | 13 |
| Wholesale | 1.30 | 0.76 | 2.37 | 415 | 99 |
| Retail | 1.31 | 0.95 | 3.33 | 1207 | 260 |
| Hotel/catering | 1.51 | 1.1 | 1.17 | 199 | 42 |
| Transport/communications | 2.29 | 1.25 | 2.73 | 1302 | 143 |
| Business services | 3.83 | 1.97 | 6.21 | 252 | 21 |
| Other services | 2.35 | 1.19 | 5.71 | 88 | 25 |

Note: Above statistics are for the 5,283 observations in first regression in Table 2.

| | UK trade marks / assets | | | Community trade marks / assets | | |
|---|---|---|---|---|---|---|
| Sector | mean | median | s.d. | mean | median | s.d. |
| Agric. Mining | 0.016 | 0.004 | 0.028 | 0.024 | 0 | 0.051 |
| **Manufacturing** | 0.118 | 0.02 | 0.368 | 0.073 | 0.007 | 0.224 |
| EGW | 0.019 | 0.006 | 0.036 | 0.003 | 0 | 0.008 |
| Construction | 0.023 | 0.008 | 0.046 | 0.004 | 0 | 0.013 |
| **Service sector** | 0.273 | 0.033 | 1.119 | 0.129 | 0 | 0.746 |
| Finance | 0.223 | 0.016 | 0.918 | 0.022 | 0 | 0.053 |
| Real estate | 0.018 | 0.005 | 0.028 | 0.033 | 0 | 0.068 |
| Wholesale | 0.106 | 0.035 | 0.21 | 0.159 | 0.002 | 0.907 |
| Retail | 0.111 | 0.027 | 0.401 | 0.04 | 0 | 0.148 |
| Hotel/cater. | 0.125 | 0.03 | 0.283 | 0.019 | 0 | 0.054 |
| Trans/comm | 0.193 | 0.01 | 0.941 | 0.044 | 0.003 | 0.138 |
| Business serv. | 0.508 | 0.065 | 1.746 | 0.215 | 0.009 | 0.628 |
| Other serv. | 0.46 | 0.077 | 1.453 | 0.244 | 0 | 1.368 |

Note: Above statistics are for the regression samples shown in Table 4 and 5.

**Table A3 Predicted effects of trade mark activity on stock market value**

| Estimates from Table 2 | ECTM only | UKTM only | Both types of trade marks |
|---|---|---|---|
| All firms | 45% | 27% | 59% |
| Manufacturing | (12%) | (10%) | 28% |
| Services | 75% | 35% | 72% |

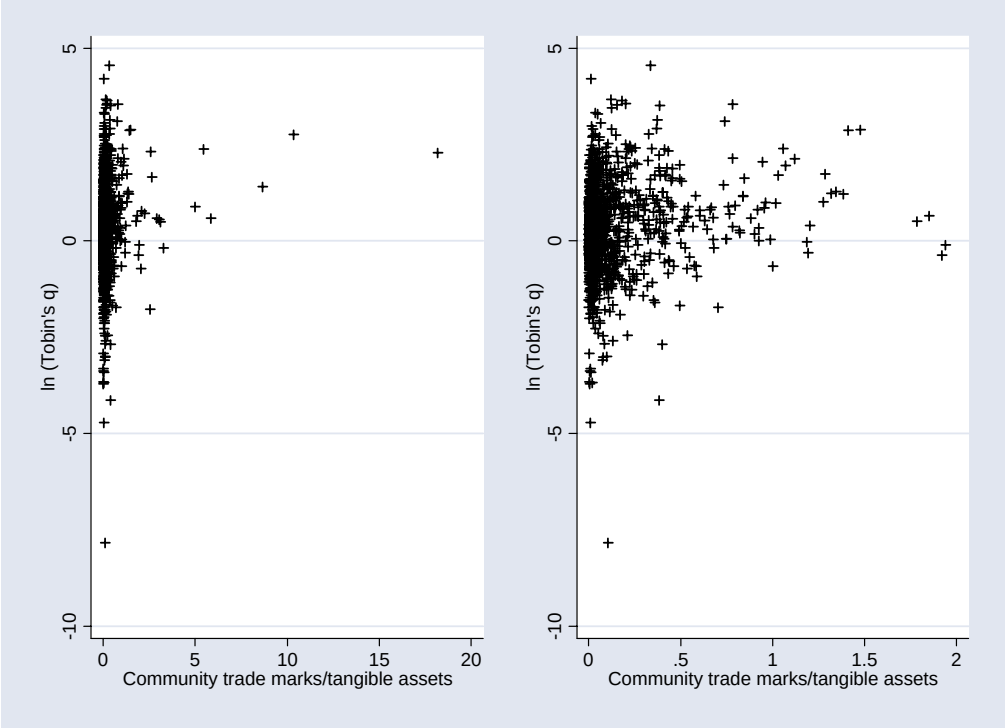
Note: Figures in parentheses are not statistically significantly different from zero.

**Table A4 Predicted increase in stock market value from one extra trade mark**

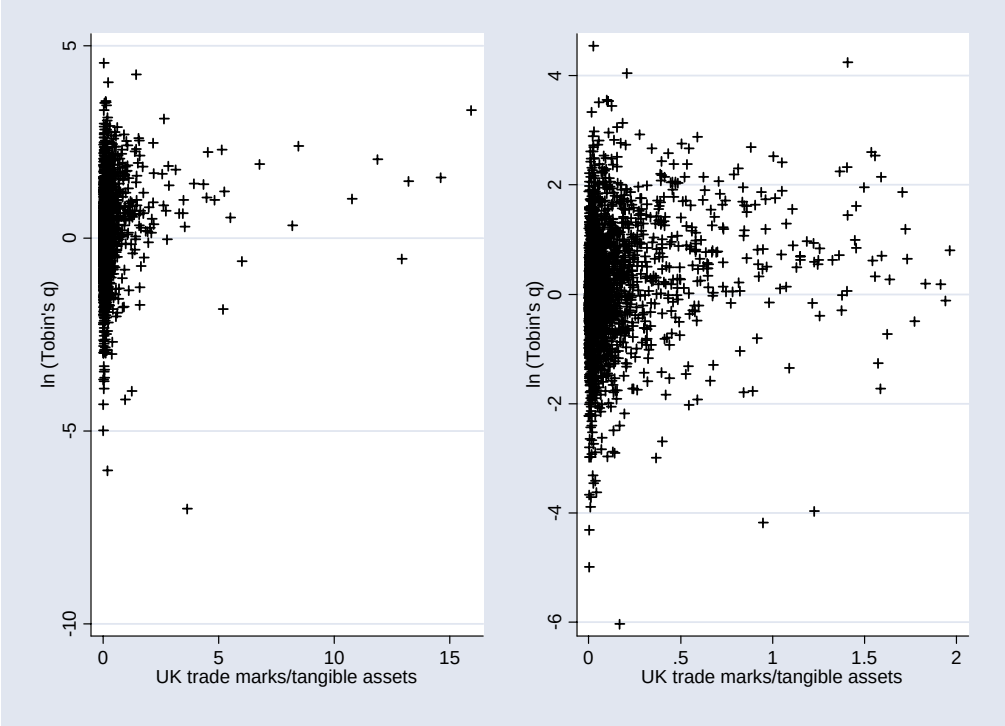
| Estimates from Table 4 | ECTM | UKTM |
|---|---|---|
| Manufacturing | £920,000 | £463,000 |
| Services | £96,000 | £83,000 |
| **Estimates from Table 6** | **ECTM** | **UKTM** |
| Manufacturing | £413,000 | Perverse |
| Services | £87,000 | (£28,000) |

Note: Computed at mean ln.*q* and mean ln.assets and rounded to nearest £1,000. Figures in parentheses are not statistically significantly different from zero.

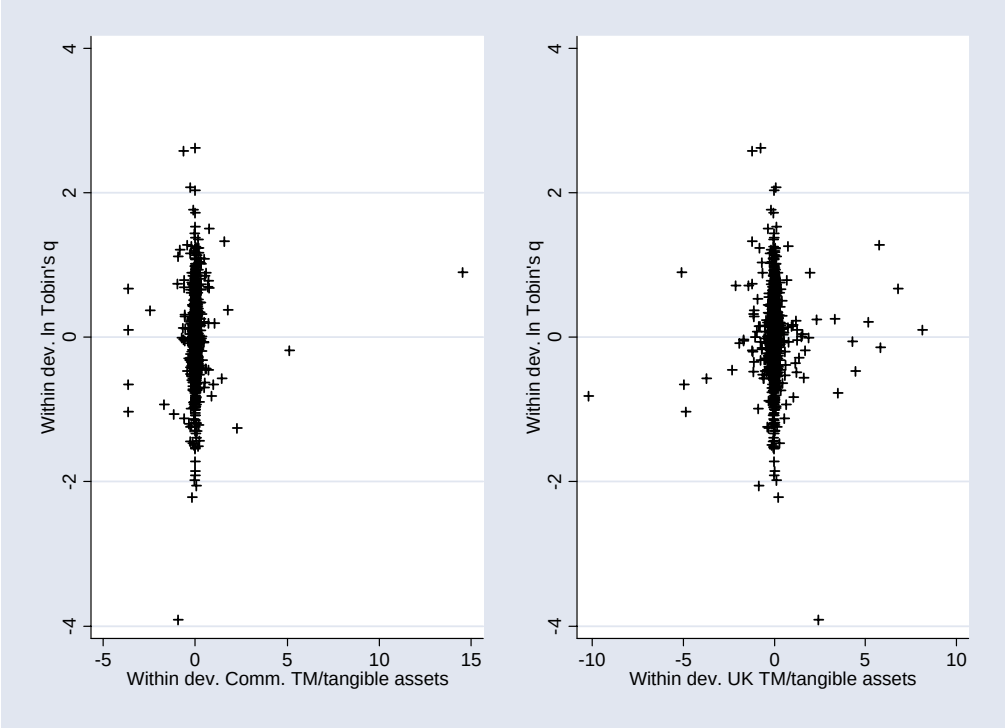
**Graph A1 Community trade mark intensity vs. Tobin's q (Table 4 regression sample). Left hand graph shows full sample, right hand only observations with CTM/assets<2**




**Graph A2 UK trade mark intensity vs. Tobin's q (Table 4 regression sample). Left hand graph shows full sample, right hand only observations with UKTM/assets<2**



**Graph A3 Within deviation plots, UK and Community trade mark intensity vs. Tobin's q (Table 6 regression sample).**

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