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EMPIRICAL STUDIES OF TRADE MARKS - THE EXISTING ECONOMIC LITERATURE

Philipp Schautschick and Christine Greenhalgh

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Manor Road Building, Manor Road, Oxford OX1 3UQ

Empirical studies of trade marks – the existing economic literature

Philipp Schautschick[*] and Christine Greenhalgh[**]

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Abstract
This paper surveys empirical studies employing trade mark data that exist in the economic literature to date. Section 1) documents the use of trade marks by firms in several advanced countries including Australia, the United Kingdom and the United States, 2) reviews different attempts to gauge the function of a trade mark as indicator of innovation and product differentiation, and 3) provides an overview of the association of trade marks with dimensions of firm performance and productivity. Sections 4) and 5) give accounts of studies that focus on the social costs and value of trade marks, namely their importance for firm survival, their impact on demand, and firms' incentives to innovate but also to raise rivals' costs. Section 6) covers first endeavours to investigate the interplay between different types of intellectual property rights, while 7) briefly concludes.

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*Ludwig Maximilians University, Munich, and Munich Center for Innovation and Entrepreneurship at the Max Planck Institute for Intellectual Property and Competition Law
philipp.schautschick@gmail.com

** Oxford Intellectual Property Research Centre and St Peter's College, Oxford
christine.greenhalgh@spc.ox.ac.uk

Introduction:

For over three decades many economic studies of innovation and intellectual property have focused on the analysis of R&D and patents, which are activities predominantly observed within the manufacturing sector (Griliches, 1981). Much less attention has been paid to trade marks, even though these intellectual property assets are more widely used by firms of all types across the whole economy. A growing empirical economic literature is now emerging that explores the expanding use of trade marks and tries to evaluate the economic role and impact of this type of intellectual property. Our aim in this paper is to survey this field in order to summarise what has been established to date and to identify what is needed from future research.

Section 1) documents the use of trade marks by firms in several advanced countries including Australia, the United Kingdom and the United States, 2) reviews different attempts to gauge the function of a trade mark as indicator of innovation and product differentiation, and 3) provides an overview of the association of trade marks with dimensions of firm performance and productivity. Sections 4) and 5) give accounts of studies that focus on the social costs and value of trade marks, namely their importance for firm survival, their impact on demand, and firms' incentives to innovate but also to raise rivals' costs. Section 6) covers first endeavours to investigate the interplay between different types of intellectual property rights, while 7) briefly concludes.

1 – The use of trade marks in the US, UK, and Australia

Trends

Trade marks have been in existence for more than a century in the rich world but, whichever country is examined, the growth of trade marks has been astonishingly rapid in the period since 1975. Taking first the long view of earlier history, we can consult Duguid et al. (2010). These authors constructed three series of data on trade mark registrations for France, the UK, and the US for the century leading up to 1970. While they acknowledge that the data sources are not without difficulties for making comparisons over such a long period, they conclude that France and Britain had both an earlier and more enduring interest in trade–marking than

the US.[1] Even so, in all three countries the gradual rise in trade mark activity was very modest over this 100 year period in comparison with what occurred in the latter part of the 20th century.

In their recent report, von Graevenitz et al. (2012) offer us a plot of patent and trade mark applications in the US during the whole of the last century, and it is clear that the growth in both forms of intellectual property rights (IPR) was quite explosive in recent decades (see Figure 1 below). The increased growth in trade marks appears to have begun about ten years earlier than that for patents, which only take off from the mid–1980s. Applications for both types of IP rights appear to be impeded by recessions as the background plot shows (the darker stripes are the years of downturn in US GDP growth). Given the consistency of positive economic growth in the three decades before the dramatic slowdown since 2007, this would lead us to expect rising IPR numbers. But even so, recent rates of increase appear quite unrelated to historical rates of growth.

Jensen and Webster (2004) have documented for Australia the rapid growth in trade mark activity over more than twenty five years. These authors date the upsurge in Australian trade marks from the mid–1970s, calculating that the growth in trade marks exceeded that of real GDP by 2.3% p.a. between 1975 and 2002, having previously only just kept pace. They also plot a comparison of levels of trade–marking activity in the US, UK, and Australia, reproduced here as Figure 2 and showing a remarkable degree of correspondence in their patterns of growth from 1975 to 2002, with each country seeing rapid retrenchment during 2000 to 2002 after strong growth during a quarter of a century.[2,3]

The question then arises as to what is the major cause of such rapid growth in trade marks. Jensen and Webster contrast the demand driven effect of rising consumer incomes, leading to demands for more product differentiation and higher quality, with the natural growth in production leading to the existence of more firms and products. Empirically they find support for both of these causes, but with a stronger impact of demand growth than of supply. In their

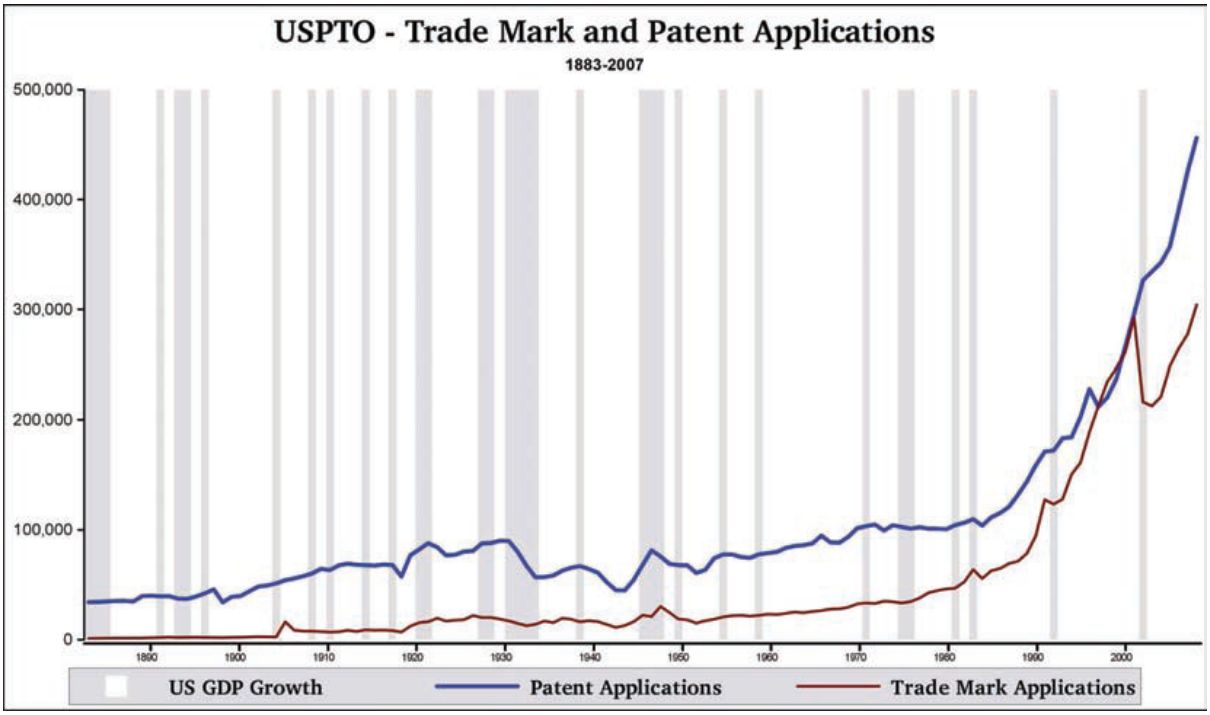
[1] In France the establishment of a national system of registration had occurred in 1803, more than seventy years before the US and UK.

[2] See Figure 1 of Jensen and Webster (2004). Trade mark growth was somewhat more volatile in the UK than in the US and Australia, dipping during 1991–2 in what was for the UK a significant recession. In a study of patents and trade marks in the UK from 1986 to 2000, Greenhalgh et al. (2003) identified considerably faster growth in trade–marking activity following recovery from the recession of 1991–2 compared with activity in the 1980s.

[3] As seen in Figure 1 for the US, trade marks recovered quite rapidly after this downturn which mirrored the 'dot.,com' bust,

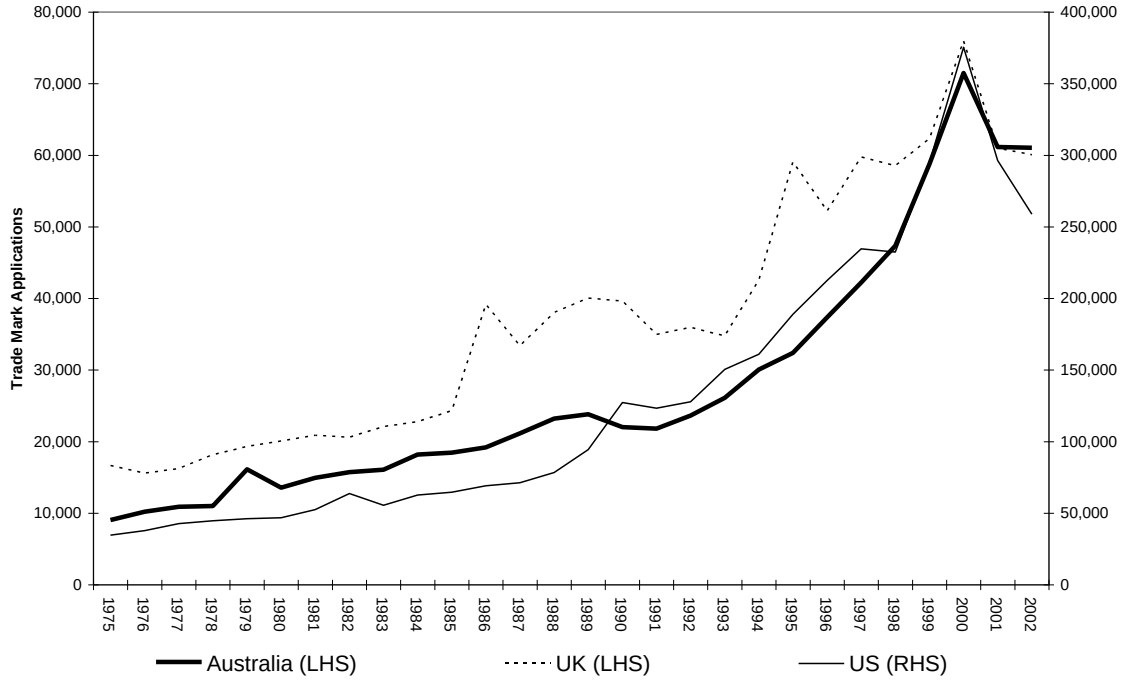
study any given increase in GDP is associated with double this increase in trade marks, whereas for a given increase in production the rise in trade marks is about half as much.

Figure 1: Demand for patents and trade marks at USPTO



Source: Figure 1 in von Graevenitz et al. (2012)

Figure 2: Recent trends in global trade–marking activity, 1975–2002



Source: WIPO data base as represented in Jensen and Webster (2004)

Cross–country comparisons

While the level of trade mark activity has been rising in many countries, clearly the identity of those registering the marks will vary according to the nature of the economy. Baroncelli et al. (2005) provide a chart of the shares of foreign and domestic residents registering trade marks, which demonstrates clear differences by level of development. Their analysis of a broad panel of countries observed during 1994–1998 finds that the foreign residents' share of registrations is inversely related to the level of income per capita. In high–income countries it was 34% on average, rising to 46% in middle–income countries and to 81% in low–income countries. They interpret these differences as indicating that higher development is associated with a greater degree of dominance of domestic brands in the home market and a stronger presence of these same brands in foreign markets.

This comparison is itself likely to change over time and to differ significantly between countries within each of the three groups. For example, Australia is an open economy with a higher share of domestic production and export of raw materials than most other developed economies and with a relatively smaller manufacturing base. Even so, perhaps because of its

distance from other production locations, registrations of trade marks there by foreign nationals were below the average indicated by Baroncelli et al. above (see Figure 4 of Jensen and Webster, 2004). However, they rose from 23% to 31% between 1985 and 2002 with a significant surge in the mid–1990s. Jensen and Webster offer their interpretation of these changes as being associated with falling transport and communication costs and rising globalisation of the world economy.

Rapid changes in the sources of ownership of foreign registrations are also identified by Baroncelli et al. (2005), Table 3. Their data shows that across all income groups high income countries dominate trade mark registrations by foreign residents. Even so, during the five years 1994–1998, middle–income and other countries displaced shares previously held by high–income countries by 3% in high–, 4% in middle–, and 16% in low–income countries. This reflects the rapid growth in exports from middle–income producers accompanied by the need to protect their trade marks in the destination markets.

Sector and industry differentials

A number of studies have attempted to tease out differences by sector and industry in the use of trade marks. Commencing with the large cross–country database of Baroncelli et al. (2005), these authors show that the highest use of trade marks across the world occurs in the scientific equipment and pharmaceuticals sectors, which they categorise as being R&D–intensive.[4] Also present in the top ten sectors were advertising–intensive manufacturing industries, such as clothing, footwear, detergents and food products. This reflects the situation of the mid–1990s, when they also found a great degree of similarity in the sectoral distribution of trade marks in high, middle and low income countries.[5] Despite the dominance of manufacturing in these rankings, in all three country groups there were two service sectors (business services and 'other' services) that were also among the top ten users of trade marks, with 'other' services always appearing within the top four. This category, 'other' services, reflects a miscellany of personal and professional services.

[4] The pharmaceutical sector accounts for the highest percentage of trade marks registered in middle– and low–income countries, whereas among the rich countries scientific equipment has the largest share, but both sectors are in the top four sectors for each type of country. See Baroncelli et al. Table 4.

[5] Nine out of ten sectors were common to all three types of countries. The uncommon element was education which ranked in the top ten for high income countries compared with chemicals making the ranking in middle and low income countries.

Millot's (2011) comparison of the trade mark activity in France and Germany in 2005/06 is roughly in line with these findings, albeit that the more relevant service sectors in France were the insurance and the office machinery sector. Apart from that, the distribution of trade mark active firms across sectors is very similar across these two countries.

Other studies have shown that this pattern is in no way stationary through time. Greenhalgh et al. (2003) studying UK trade marks from 1986 to 2000 found that the classes of trade marks that exhibited the highest rates of expansion over this period were predominantly service marks, for which registrations exhibited explosive growth in the later years, expanding seven–fold from 1993 to 2000. Equally, Jensen and Webster (2004) exploring trade mark growth in Australia from 1975 to 2002 found that service industries, including communication, education, and personal services, experienced particularly strong growth in trade mark applications. Another feature of their data was that industries subject to considerable economic deregulation and restructuring over this period – such as electricity, gas, and water – also experienced stronger trade mark growth than most other industries.

Greenhalgh and Rogers (2008) focus on IPR activity in services, documenting four types of IPR activity – domestic and European trade marks and patents – for large and medium–sized firms in the UK over the period 1996–2000. Their sample size was about 2000 firms, of which around 1,200 had their principal product in services. These authors compare IPR activity in eight service sectors with that in agriculture, manufacturing, utilities, and construction. From a series of charts relating to each type of IPR activity by year for each of the twelve comparison sectors, their study permits both static and dynamic, comparisons.[6] While manufacturing and utilities dominate patents, as they do recorded R&D, the differences by sector in trade mark activity are much less dramatic, particularly for trade mark applications to the UK office. The eight service sectors all show considerable percentages of firms applying each year for trade marks both in the UK and the EU. In the case of UK trade marks, retail firms are more frequently active than manufacturing firms, with more than 40% of retail firms applying for trade marks in any given year. The hotel and catering trade also shows a rising incidence of UK trade mark activity, exceeding that of manufacturing by the year 2000. Despite the historic importance of UK marks, in general the growth in trade mark activity for most categories of service firms at this time is in their applications for Community

[6] See Greenhalgh and Rogers (2008), Charts A to D.

trade marks, indicating their positive appraisal of the wider remit of such marks, which only came into existence in 1996.

Differences between large and small firms

One of the perennial questions in the study of innovation is whether large or small firms are more prolific, as this may affect the returns to public policy in such areas as R&D subsidies and other support for innovation. Several studies using UK data have explored this issue by investigating whether (pro rata for their size) smaller firms are more or less IPR–active than larger ones.

Greenhalgh et al. (2003) constructed two panels of UK production firms for 1986–95 and 1996–2000. These panels of firms were medium to large sized in respect of their sales and employment, mostly listed on the stock market and having many subsidiaries.[7] Evidence on the relationship between UK trade mark applications and firm size was explored measuring size either by sales or by employment. This analysis showed a higher intensity of UK trade marks for the smaller firms in these panels of production firms for all dates examined between 1985 and 2000.[8]

Greenhalgh and Rogers (2008) expanded the database used in the above study to include a parallel panel of service sector firms for the later period of 1996–2000. They then analysed the relationship between firm size and IPR activity for both manufacturing and services in the late 1990s. To do this, they use a multivariate modelling approach to explore the role of other factors in influencing IPR activity, such as stock market listing, product diversity, and size. While the expansion of IPR activity is not necessarily proportionate with size, as shown by Greenhalgh et al. (2003), nevertheless we expect larger enterprises to be more likely to be IPR–active. Indeed, for both services and manufacturing the strongest predictor of participation in IPR activity, whether for trade marks or patents, in any given year, is firm size.[9]

[7] Counts of IP assets for these firms were generated by a complex process of search and matching of company names from various sources of IP records. This procedure allowed for the fact that IP assets could be registered under a variety of names of subsidiary and associate firms within the group.

[8] See Greenhalgh et al (2003) Tables 11a, 11b, and Figures 7a, 7b.

[9] See Greenhalgh and Rogers (2008) Tables 14.3 and 14.4.

The more interesting issue is whether the larger firms are proportionately more or less active. If they are less than proportionately active, then society might prefer to have two smaller firms, each of half the size of the larger firm, to generate more new products. In their analysis of the intensity of IPR activity, measured as the number of IP assets per employee, Greenhalgh and Rogers find that, for both services and manufacturing and for both trade marks and patents, the intensity of IPRs falls as firm size increases.[10] For both services and manufacturing the fall in IPR intensity with firm size is at least consistent with the notion that, for IPR–active firms, a critical number of IP assets needs to be acquired to achieve a useful portfolio of intangible assets. Whether it is an optimal outcome for society that intensity falls with size is a difficult question to assess.

The above studies have focused on medium to large sized firms. Adopting a new approach to database construction was required in order to explore the role of small to medium sized enterprises (SMEs) in IP creation. Rogers et al. (2007) created a database for the whole population of firms in the UK for the period 2001–2005, drawing on the FAME database of registered companies for the basic observations.[11] FAME records that the UK has around 140 thousand SMEs and two million micro firms. For all these firm names computer searches were conducted to match records of trade mark and patent activity in the UK and EU.

Just less than 5% of the SMEs used one or more of the IPR types at some point in the 2001 to 2005 period. UK trade marks were the most commonly used IPR type, followed by Community marks, UK patents, and lastly EPO patents. The ratio of SME IPR activity to large firm activity varies across IPR type and region, but for trade marks it is around 74% and for patents it is around 60%. Nevertheless, because of the very large number of such firms in existence, the absolute number of trade mark applications by SME and micro firms together considerably exceeds that of all large firms in each year of the study. Whether using descriptive statistics of median values or multivariate statistical methods, Rogers et al. (2007) find that, in proportion to their asset base, SME and micro firms are more IPR intensive than large firms, thus confirming the findings of the earlier studies using only medium–sized to

[10] See Greenhalgh and Rogers (2008) Tables 14.5 and 14.6.

[11] Size was predominately defined by assets as this was a more frequently recorded value for small firms than employment or sales. According to the EU, an SME must have total assets greater than Euro 2 million and less than or equal to Euro 43 million. Micro firms are those with smaller assets than the lower bound and large firms are those with more than the upper bound. For more details of data construction see Rogers et al. (2007) pp.7–8 and Table 1.

large firms.[12] These findings emphasise the need for innovation incentives to reach this large population of SME and micro firms.

2 – The function of a trade mark as an indicator of innovation and product differentiation

In this section we discuss literature that has examined whether trade marks are a useful indicator variable for innovation, as argued strongly by Mendonca et al. (2004). Because innovation is itself hard to measure, it is quite difficult to firmly establish the link between trade–marking and innovative activity. To get some idea of this relationship, it is necessary to explore the statistical correlation between trade marks and some other variable(s) used to proxy innovation, or to relate trade marks to direct surveys of innovation that are infrequent and often imperfect in their coverage.

In an early study using a survey of 2500 Benelux SMEs, Allegrezza and Guard–Rauchs (1999) explored empirically the determinants of trade mark registrations by firms. They find a significant positive relationship between trade–marking and R&D intensity, as measured by the frequency of R&D activity in the firm. Given that R&D is often used to proxy innovative activity, this seems to indicate links between innovation and trade marks. However, given the small range of industries in which firms conduct formal R&D, mainly manufacturing, this study is by no means definitive.

Given that firms operating in the service sector are not frequently able to patent their innovative service products and do not often engage in R&D expenditure, one of the biggest gaps in our measurement of innovation arises in this sector. In another early study Schmoch (2003) analysed the responses of German firms to the 2001 Community Innovation Survey, which gives some information about innovative activities. He found a significant correlation between the share of turnover associated with innovative products and trade mark use in knowledge–intensive business services. However, Hipp and Grupp (2005), in an extensive examination of the nature of innovation in services using similar data, cautioned against assuming a simple correspondence between innovation and trade marks. Further work using German firm–level data is presented by Götsch and Hipp (2012). As in Schmoch (2003), the

[12] See descriptive statistics in Table 12 and multivariate analysis in Table 13 of Rogers et al. (2007).

innovation indicator is the share of turnover achieved with new products and services. These authors find that use of trade marks is positively and significantly associated with innovation in high–tech manufacturing and in knowledge–intensive services, but not in low–tech manufacturing nor in other service sectors.

One of the most extensive explorations of the relationship between alternative innovation indicators is that of Jensen and Webster (2009). Between 2001 and 2007, more than 1,000 Australian firms responded to the Melbourne Institute Business Survey, supplying information on their innovative activities and their usage of IP. The firms were drawn from all sectors of the economy and the sample was broadly representative of the underlying economic structure.[13] Jensen and Webster (henceforth J&W) present estimates of firm–level correlations between innovation, R&D, patents, trade marks, and design registrations. They show results at the whole sample level and disaggregated between manufacturing and services. They are also able to distinguish between innovations that relate to products, processes, organisation, and marketing.

For the whole economy sample (J&W Table II), there are statistically significant correlations between innovation activity, patents, and trade marks, but the level of these correlations is not very high. The correlations between reported R&D activity and use of the three types of IPRs are actually very much higher, extending the findings by Allegrezza and Guard Rauchs (1999) noted above. But why should this difference in correlations exist? It is perhaps the case that firms that are attempting to innovate by conducting R&D, even if they are only occasionally successful at doing so as reported by an innovation occurrence, are more likely to be active in using IP rights.

When these overall results are broken down by sector, or by type of innovation, there is more to report. In manufacturing (J&W Table III), innovation is correlated with both R&D and trade marks almost equally strongly. In services (J&W Table IV), there is a weaker but still just significant correlation with trade marks, but not with the other measures. Looking across the four innovation types (J&W Table V), product innovation is correlated with patents and trade marks, as well as R&D, but not with design rights. Process innovation is weakly correlated with trade marks, but not with other indicators. Organisational innovation shows nil or negative correlations with each of the proxy variables. Market innovation was significantly

[13] See Jensen and Webster (2009) Table VI for details of the population and sample distributions.

correlated with trade marks but only to a minor level. Jensen and Webster argue their findings arise because process and organisational innovation can be more easily protected by secrecy and do not impact directly on consumers as is the case with product innovation. Overall these authors conclude that trade marks appear to be a useful innovation indicator, while cautioning about the need to recognise the differences in correlations by sector and innovation type.

A very recent study by Millot (2012) presents an original analysis of why firms use trade marks with the aim of exploring the relationship between trade marks and innovation. She develops a theoretical model of the trade mark decision and estimates this to test hypotheses that can be generated from it. A key feature of the model is that two firms (an innovation leader and an imitative follower) can each engage in advertising, but advertising has public good effects or spillovers for competitors by alerting customers to the general product type. Another key feature is that the value of advertising depreciates between periods. Registering a trade mark reduces spillovers from the leader's advertising. The extent of spillovers and the rate of depreciation feature in determining the predictions from the model about the choice to trade mark.

The database for empirical testing is nearly 20,000 French firms observed during 2005–2008. This database is used as a cross–section in which trade mark activity in 2008 is related to the firm's recent history of innovation of four types: product, process, organisational, and marketing innovations. As well as presenting results for all firms, the empirical study breaks out high– from low–technology manufacturing industries, as well as knowledge intensive from other service industries for examination of links between trade marks and innovation. The key findings are that product and marketing innovations are determinants of trade mark activity in the whole sample and in all sub–sectors. However, in high–technology manufacturing, patents also predict trade–marking, and this weakens the link between product innovation and trade–marking. Process innovation is not related to trade–marking and nor is organisational innovation, with the latter being if anything negatively related. The similarities with the results of Jensen and Webster (2009) are quite striking.[14] Millot argues that innovations that are not close to customers do not lead to trade mark activity; it may also be the case that reorganising the firm detracts from the launching of new product varieties.

[14] Götsch and Hipp (2012) also showed correlation of trade marks with product innovation but not process.

This difference between types of innovation and trade mark practices can also be revealed by in–depth study of particular industries. Malmberg (2005) compared the electromechanical, automotive, and pharmaceutical industries over time and found very large differences in trade–marking in relation to product innovation in these three sectors. In both the electromechanical and automotive sectors new products were often identified by model numbers obviating the need to register new trade marks. By contrast, most new products in pharmaceuticals were trade marked. Several authors have referred to the objective and need for building brand names to try to sustain customer loyalty after the expiry of patents, as generic drugs are chemically equivalent to the patented original and are thus physically perfect substitutes.

Detailed analysis of the nature of trade mark activity is also provided by Flikkema, Man, and Wolters (2010), who surveyed 660 companies that had registered trade marks via the Benelux office. They sought to discover to what extent these registrations were related to any innovative activity and how closely in time they were registered compared with related innovation. These authors found that about 60% of recently registered Benelux trade marks refer directly to a broad range of innovative activities. In addition, most of the trade marks are filed close to the market introduction of both new products and services. Hence they argue trade marks may be useful to measure innovations in the late stages of their development, something that is not always captured by either patents or the bulk of R&D expenditure occurring earlier in time. They also find that trade marks appear to capture innovative activity that is not captured by other IPRs, particularly technological innovation in small firms and service innovations that quite often rely on developing new products from existing technology.

Trade marks as a proxy for product differentiation

Next we discuss the use of trade mark data to proxy horizontal and vertical product differentiation at the industry–level. The starting point of establishing the link between trade marks and product differentiation is the observation that because trade marks are costly, firms will employ trade marks only as extensively and as long as their expected benefit outweighs or equals their costs.

Fink et al. (2005) argue that trade marks are informative about the vertical dimension of product differentiation, i.e. differences in quality, because high–quality products would be

expected to be protected by more trade marks than low–quality products. The reason is that the value of the legal protection of a brand by a trade mark increases with the likelihood of imitation, passing–off, or dilution, and products are more likely to be imitated as they become qualitatively better. Thus, the value of legal protection of a brand increases with the quality of the branded product. This implies that with increasing quality of their products, firms are willing to incur higher costs, i.e. obtain more trade marks, in order to protect their brand from infringement.

With regards to horizontal product differentiation, i.e. differences in the characteristics of the good besides quality, the argument goes that trade marks serve to associate the different varieties of a good with its mutual origin. This way, each variety benefits from the origin's reputation. Moreover, each variety also benefits from the reputation of all the other product varieties in the firm's portfolio. Thus, not only the 'umbrella brand' will be trade mark protected, but also all the names of the varieties that are associated with the main brand. Otherwise, competitors could exploit the association of a certain variety with its origin by using in their favour the unprotected name of that variety. Thus, more horizontal product differentiation likely leads to more trade mark activity.

Fink et al. (2005) as well as Mangani (2007) employ these implications of trade mark activity at the industry–level to test hypotheses from the international trade literature. Mangani tests the hypothesis that larger and richer economies produce a wider variety of products at a higher level of quality by using a cross–section of trade mark applications at OHIM in 2003 in addition to GDP and population data. Fink et al. test for income–related biases in international trade, i.e. whether income–rich countries are more likely to trade amongst each other than with relatively poor countries, using bilateral trade flows and trade mark registrations from the WIPO database between 1994–1998, covering 22 source countries and 100 destination countries in 22 three–digit ISIC manufacturing sectors.

To some extent, both papers are concerned with the same hypothesis put forward by Linder (1961), namely that because i) larger and wealthier countries spend a larger share of their income on higher quality products than smaller and poorer countries; and ii) more developed countries have a comparative advantage in producing a wider variety of products of higher quality, larger and wealthier countries are more likely to trade with each other than with smaller and less wealthy countries.

In his article, Mangani attempts to answer the question whether large economies export more in absolute terms because they export more in terms of quantity, quality, or variety. To this end, this author puts forward a methodology that allows him to link macroeconomic variables of a country to the different types of product variation using trade mark data. The different types of product variations are:

- variety across industries (extensive margin).
- variety within industries (intensive margin), which is decomposed into
    - a quantity component and a
    - quality component.

The extensive margin reflects the breadth of a country's economic activity across industries, while the intensive margin measures the level of differentiation within the industries. To measure within industry differentiation, this author looks at the number of trade mark registrations per Nice class, counting trade marks multiple times if they are filed in several classes. A large number then corresponds to a greater level of differentiation. However, a large number can be a result of many trade marks, which are only filed for one or two classes, or a result of few trade marks, which are filed for many classes, or both. This leads to a further distinction between the quantity component of within–industry variety (the number of trade marks per Nice class, counting each trade mark only once), and the quality component (the number of Nice class registration per trade mark). In other words, this author assumes a good to be of higher quality if it is filed in more Nice classes, while more trade marks per class simply imply more variation within a product or service category. This is in contrast to the work by Fink et al. (2005), where data on Nice classes were not available and higher quality was assumed to correspond to more trade marks rather than more classes per trade mark.

In a series of very basic univariate regressions, Mangani shows that the number of Nice class applications, i.e. the total number of trade marks where each mark is multiplied by the number of classes in which it was filed, is positively and significantly correlated to GDP at current exchange rates (0.98), less so to population (0.3), but more so to GDP per capita (1.3). In other words, an increase of total GDP by 1% leads to a 0.98% increase in Nice class applications. Regressing the different measures of variety on total GDP shows that a higher

GDP explains 41% of the variety across industries and 59% of the variety within industries. Put differently, an increase in GDP is more likely to increase the variation within an industry than to create capacities for new product or service categories in an economy. Within an industry, an increase in GDP by 1% leads to an increase in horizontal product variation by 0.54% and to 0.4% improved quality.

While Mangani's (2007) work shows that the size and the wealth of an economy is positively correlated to both horizontal and vertical product differentiation, Fink et al. (2005) go one step further and employ bilateral trade flow data to explain international trade mark registrations between countries. Moreover, these authors develop a theoretical model illustrating the expanded Linder hypothesis, i.e. that larger and wealthier countries with similar tastes for product differentiation tend to trade more amongst each other than with poorer countries. In order to explain the trade mark registrations by exporting countries in importing countries, measures of imports and exports from and to the world, respectively, are included, as well as an index of the degree of trade mark protection, the GDP per capita of the source and destination countries, a dummy for the membership of the Madrid system, and a measure of the distance between the source and the destination country. This regression is estimated individually for each of 22 ISIC manufacturing industries. The results suggest that new trade mark registrations by exporting countries in a particular industry in importing countries are positively correlated with exports from this industry to the world as well as with imports from the world into that industry. Unfortunately, these researchers do not control for the size of an industry in a country. This makes these results less reliable, because the higher number of trade mark registrations as well as the higher imports and exports may all be correlated to this variable, which in these regressions is contained in the error term, thus causing the coefficients to be biased and inconsistent. Despite this it is noteworthy that the results also show that the same language between the source and the destination countries, membership of the Madrid system, as well as a shorter distance separating them geographically, all add positively to the propensity of the exporting country to trade mark in the importing country.

To test the expanded Linder hypothesis, i.e. that countries are more prone to trade with each other as their economic situation and their tastes for quality and variation converge, these authors regress the value of exports from industry *k* in country *i* to the same industry in country *j* on importer and exporter fixed effects as well as the interaction of a measure of

vertical and horizontal product differentiation of exports from country *i* and GDP per capita of country *j*. Product differentiation is calculated as the share in non–resident trade mark registrations in an industry in country *j* filed by firms in the same industry in country *i*. Thus, rather than measuring levels of product differentiation, this term captures the relative extent of product differentiation of exports from country *i* to country *j* compared to that of other countries exporting to country *j*.

Their results suggest that the Linder hypothesis is supported in 10 of the 22 manufacturing industries, most of which are consumer goods industries such as food products, beverages, tobacco, wearing apparel and footwear, as well as leather products and furniture. This is consistent with the intuition that more trade marks can be found in industries where product differentiation plays an important role, and that wealthier countries are prone to import a wider variety of goods of overall higher quality.

To sum up this wide literature, studies for many countries and for many economic sectors appear in general to support the view that trade marks are a useful addition to the list of measures that can inform us about innovative activity at the firm and at the sector level. Like other such indicators they are not equally valid for all firms, not always superior to other measures for a given sector, and do not provide coverage for all types of innovation and differentiation. Nevertheless, they are a useful addition in a field where measurement is inherently difficult and expensive if survey data have to be collected.

3 – The association of trade marks with dimensions of firm performance

Several of the studies we reviewed above find positive associations between trade marks and innovation. Given that innovation is expected to improve firm performance, either by reducing costs or by increasing demand for its novel products, we would then expect to find positive impacts on firm performance from trade–marking activity. In this section, we begin by reviewing studies that have investigated the links between trade mark activity and the stock market value of the firm. This measure reflects what investors expect about the future performance of the company, so it should rise if successful innovation and new product marketing is signalled by new trade marks. We also summarise below studies that link trade

marks to more immediate measures of performance, including current productivity and profitability.

Trade marks and stock market value

The relationship between a firm's stock market value and its underlying intangible assets is explored in a literature that goes back a long way – for a useful discussion of the underlying theory and empirical methodology, and a survey of pre–existing studies at that date see Hall (2000). The empirical equation specified in these studies reflects the idea that both the book value of tangible assets (known from firm accounts) and the value to firms of a range of intangible assets (not formally assessed by accountants) contribute to the determination of the stock market value of the firm. At the time of Hall's survey, the measures used to proxy these intangible assets were solely R&D and patents.[15] In addition almost all of the studies used US data for their investigation (see Hall, 2000, Table 7.1). As noted by Hall, the stock market value of the firm offers a measure by which we can observe the changes in the overall price of the firm caused by rises in assets that are not generally traded separately in the market. Even so, the analysis has to be limited to private firms that are listed on the stock market, so this is still rather restrictive compared with the whole range of firms operating in the economy.

A paper by Bosworth and Rogers (2001) was an early attempt to investigate the impact of trade marks on market value.[16] The study used data for a small sample of large Australian firms observed in 1994–1996 and included an exploration of the value of trade marks and design rights in addition to the value of R&D and patents. In their first analysis of market value using all firms in the sample, whether in manufacturing or other sectors, and including as explanatory variables both R&D and patents, the effects of trade marks and designs were positive but not statistically significant. When they limited their analysis to non–manufacturing firms, they found the results were partly reversed, as there was a statistically significant positive impact for trade marks, but not for R&D, patents, or designs. Even so, the coefficient magnitudes suggested that the value of a trade mark (to a non–manufacturing firm) was less than half the value of a patent as recorded for all firms (with this result being clearly dominated by returns to manufacturing firms). Nevertheless, it is likely that the R&D cost of developing what was eventually patented was much higher than the design and marketing

[15] These studies sometimes included patent citations, used as a weighting measure to proxy the importance of the innovation.

[16] In another early study, this time using US data, Seethamraju (2003) analysed the value of trade marks in 237 US firms from selected industries in 1993–97, finding a positive role for trade mark activity on sales and also stock market values.

activities leading to the trade mark, so the net return for each type of IPR investment is unknown.

The early positive findings by these authors encouraged the development of more extensive firm–level databases, both in the UK at Oxford University's Intellectual Property Research Centre (OIPRC) and in Australia at Melbourne University's Intellectual Property Research Institute of Australia (IPRIA). In both centres the IPR activity of larger samples of firms could be catalogued through several years, giving rise to panel data (i.e. multiple observations on each firm). Two studies published in the same volume by Greenhalgh and Rogers (2006) and by Griffiths and Webster (2006) present further evidence of the positive value investors assign to the acquisition of trade marks by firms.

The sample analysed by Greenhalgh and Rogers (2006) of over 670 firms was sufficiently large to be able to compare results for manufacturing firms with two sets of non–manufacturing firms, firstly a group of financial services (finance, insurance, and real estate) and secondly a broad utilities sector (transport, communications, gas, electricity, and water) all observed from 1996–2000. Like the earlier study by Bosworth and Rogers (2001) the benefit effect of applying for UK trade marks was weaker for the whole sample than for the financial service sector, whose use of trade marks had been growing very strongly and where the stock market return to trade marks was high. But despite a high level of use of trade marks by the utilities sector, firms in this sector did not show any significant increase in market value for acquiring any type of IPRs, so the results were not uniform across the two service sectors. For manufacturing firms, the key variables were doing R&D, acquiring European patents, and buying intangible assets such as goodwill through takeovers.

The study by Griffiths and Webster (2006) analysed around 300 Australian companies from 1989 to 2002. As well as exploring the existence of significant positive returns to Australian trade marks and patents, they also investigated whether these returns were rising or falling over this period. These authors go to some lengths to remind the reader that, without full costings of different types of innovative activity, the analysis cannot tell us whether or not the investment in inventive activity is profitable. However, they are confident that their estimates of the trends in the average net present value accorded by the stock market to a patent or trade mark are reliably estimated (but again making no claims that the net returns have risen or fallen, as this would depend on costs). Their finding was that the average value accorded to

trade marks was rising over the 1990s, whereas that for patents was falling over the same period, and that there was no discernible trend for design rights. They speculated that the rise in the value of trade marks may reflect the increasing extent to which new brands are seen as critical to the marketing and commercialisation of product lines.

Greenhalgh and Rogers (2012) put together a database for the period 1996–2000 covering 1600 large and medium sized firms operating in all economic sectors of the UK. This large sample of more than 6000 observations permitted them to break down the statistical analysis to compare firms in the manufacturing and service sectors. The extent of trade mark activity via the domestic application route and the European route were both monitored. They were also able to investigate trends in returns over the late 1990s.

They find that the impact of doing any trade mark activity in a given year was positive on market value in the full sample, with a slightly bigger impact of taking out a Community trade mark compared with just a UK mark. Comparing sectors, these 'news' effects of new trade marks on stock market value were much larger and more significant in services than in manufacturing, where news about patents and R&D was already doing the job of informing stock markets.

In addition to the effect of doing any trade–marking, these authors also looked at what impact arose from taking out more trade marks in a given year (relative to the size of the firm) – this variable was termed the intensity of trade mark activity. In the data as a whole there was no rise in stock market value associated with higher intensity, but this finding for the whole sample concealed a more complex story. When trade mark intensity was interacted with a time trend the finding was that there were initially gains from higher trade mark intensity, but these were eroded by a falling trend in this value over time. This finding is in sharp contrast to that by Griffiths and Webster (2006) for Australia where the market value of trade marks was rising. Given that we know (from section 1) that trade mark activity was rising strongly in both countries, the UK result conforms to economic expectations that the marginal value of each extra trade mark would fall as their number increased. It is thus the contrary Australian result that remains to be investigated further.

Sandner and Block (2011) developed a multi–country database of around 1200 large firms observed for the period 1996–2002 yielding nearly 7000 data points. Their sample selection

was based on the requirement that all the firms being analysed were trade mark active in Europe at some point in this seven year period. Their analysis was focused on the impact of European Community trade marks applied for by these firms, but did not include any analysis of their domestic trade marks. As well as recording the instances of European trade–marking over this period (which coincides with the start–up of the European mark in 1996, so reflects the firms' entire stocks of these assets), the authors developed four value indicators to try to differentiate between high and low value trade mark activity by firms. These measures were the breadth of the trade mark, measured by the number of classes applied for, the seniority of the mark claimed at the time of registration, oppositions to other firms' marks made by the firm, and oppositions received by the firm to its own marks.

The results of this study were that the stock of Community trade marks exerts a strongly significant positive impact on stock market value of these firms. Of the four 'value' indicators, two showed positive significance – the holding of senior trade marks and the conducting of oppositions against other firms' trade marks. Insignificant results were seen for the other indicators – the breadth of the trade mark and opposition activity received by the firm from competitors. The authors' comment on this last finding is that trade marks appear to differ from patents, where the level of opposition has been found to be informative about the value of the patent.

Taken as a whole, this developing literature indicates that, in general, stock market analysts take note of trade mark activity and value firms more highly as a result. This news about the firm appears to be more important in the service sector, where investors often lack the information provided by R&D and patent activity available in manufacturing. Where the studies did make comparisons over time, we have seen conflicting evidence about the trends in rewards between countries.

Trade marks, productivity, and profitability

While studies of stock market value are useful in reflecting the estimated future profits from innovative activity, it is also of interest to examine the actual observed returns. Studies of productivity and profitability can show how far trade mark activity is affecting the immediate performance of firms. Furthermore these studies can include observations on firms that are not listed on the stock market so they are more general in terms of the sample of firms that

can be studied, although they are partial in terms of the time over which the benefits of trade marks are observed.

An early study of the impact of trade marks on productivity is that of Greenhalgh and Longland (2005), who examined whether trade marks were associated with increases in the real value of firms' output for given factor inputs, i.e. with higher productivity.[17] The sample of firms analysed contains 740 manufacturing firms observed from 1988–1994. For these firms their records of R&D (if reported), patents, and trade marks were observed, together with information on real net output (measured as the value added by the firm to material inputs) and inputs of labour and capital. Given that this database contains repeated observations on firms, it was possible to differentiate the short term impact of new trade marks on productivity within the firm and the longer term contribution of trade mark activity to persistent differences in productivity between firms.

The findings from this study were that increasing the intensity of trade mark activity (i.e. the number of trade marks relative to the size of the firm as measured by employment) for the whole sample of firms had a significant positive impact on next years' output. This result held when it was controlled for both UK and EU patents as well as firm–level R&D intensity. The results remained significant when persistent productivity differences between firms were eliminated using appropriate statistical methods. When these persistent differences were examined in a separate cross–section analysis, trade mark activity was also shown to be correlated with permanent productivity differences between firms.

Nevertheless, when the full sample of firms was split into high–tech and low–tech industry sectors, the analysis revealed significant differences between sectors – in particular, trade marks were important in influencing both short and long term productivity in the low–tech sector, whereas for high–tech firms their R&D activity was the most telling factor followed by patents. This sample did not include service firms so the study does not permit exact comparison with the later stock market studies described above. Even so, the differences between high– and low–tech manufacturing suggest that stock markets are right to value R&D and patents for those sectors where these are important types of intangible investment,

[17] Note that in studies of productivity an increased value of real net output from given inputs can arise both because a greater volume of output is made possible by innovation and/or because the price in the market place has increased per unit due to better quality and thus higher demand.

but also that they can draw useful inferences about firm productivity from the trade mark activity of firms in other sectors.

In the later work of Greenhalgh and Rogers (2012), productivity is examined for a broader sample of firms, covering both manufacturing and service firms. In this paper, direct comparison between productivity changes and stock market valuation is possible as both types of analysis are given. Trade mark activity shows a large value–added premium for firms that applied for trade marks in the previous year, by between 10 per cent and 30 per cent, depending on the type of trade mark averaged across all firms. For service firms that applied for both UK and European Community trade marks in a given year, their value–added is around 47 per cent higher than that of other firms. The value–added premium for manufacturing firms that were also seeking both UK and Community trade marks in the previous year is lower (at 16 per cent) than that for service firms. These authors conclude that:

> "In the analysis of the firm's net output, the results are broadly consistent with those derived using the market value approach, suggesting that stock markets are efficient in estimating the likely benefits of new intangible assets and that managers do not seek trade marks to follow a management fad, but can expect to receive real returns from innovative activity."

Turning now to the issue of how far firm profitability is enhanced by intangible assets, Griffiths, Jensen, and Webster (2011) analyse the determinants of financial profitability for a sample of nearly 2,700 Australian firms observed from 1990–2006. In this study, the authors are able to measure each firm's stocks of patents, trade marks, and designs, as well as several other control variables, such as tangible capital and the age of the firm. While the ultimate focus of the paper is to examine the determinants of persistent excess profits, distinguishing between innate cost advantages and artificial barriers to market entry, their empirical analysis begins with an estimating equation relating actual gross profits to both tangible and intangible capital stocks. This shows that both patent and trade mark stocks are key contributors to profits, although rather surprisingly design rights are not significant determinants. These authors conclude by urging firms and regulators to collect better data on intangible assets, so that the returns to intangibles can be monitored alongside the returns to tangible assets.

So far most of the empirical analysis of share prices and productivity that we have quoted has been conducted using data on large–sized firms. Studies of small firms are rare, but the survey paper by Helmers and Rogers (2010) summarises the findings of a study conducted by Rogers, Greenhalgh, and Helmers (2007). This work was commissioned by the UK IP Office on all of the UK's small and medium–sized enterprises (SMEs), a population of around 130,000 firms, observed in the period 2001–2004.

This study relates firm profitability and survival over the three years 2002–2004 to the acquisition of a new trade mark during 2001. It is posited that as a result of investment in launching an innovation, profits may be low or even negative for a number of years, even if the new product is ultimately successful. The findings show that, in comparison with firms not acquiring any marks, trade mark active firms are more concentrated in the lowest and highest quartiles of the profits distribution. The negative effect is particularly strong for those acquiring a European Community trade mark where the proportion falling into the lowest quartile of profits is 44% compared with 25% of inactive firms. Also, this hollowing out of the profits distribution is most pronounced for the youngest firms aged less than five years old; it continues for firms aged five to ten, but virtually disappears for trade mark active firms aged more than ten years. These findings emphasise the risks of innovation for smaller firms, especially the youngest ones that are likely to have less experience and resources, by showing that there are losers as well as winners from attempts to innovate.

4 – The impact of trade–marking on firm survival

So far, the studies reviewed were concerned with the impact of trade marks on firm related characteristics such as performance, innovative activity, and its IPR strategy. The effects of trade marks on society as a whole have received little attention, which is mainly due to the lack of a theoretical framework as to how trade marks relate to social welfare. Nevertheless, it is possible to indirectly gain insights regarding the welfare implications of trade marks. For instance, a widely accepted view is that more competition improves welfare. Conversely, less competition decreases welfare. Thus, it can be interpreted as welfare improving if the protection of intangible assets increases the probability of a firm to remain in the market, given that it is not blocking entry of a more efficient firm. While the study of firm survival is a well–established field on its own, Jensen et al. (2008), Buddelmeyer et al. (2010), and Helmers & Rogers (2010) look at it from a new angle by using different intellectual property

rights as measure of innovativeness and competitiveness at the firm–level and in the industry as a whole.

The main findings of the three studies are that innovation as measured by trade marks at the firm–level increases the likelihood of survival for new firms significantly, while it appears that additional patent applications decrease incumbents' expected life span. Moreover, as often assumed, the researchers find that a more inventive and more competitive environment benefits the survival chances of new firms at the cost of incumbents' propensity to survive.

The papers use different approaches to disentangle the effects of idiosyncratic firm–level decisions (such as the time of entry, the level of innovation, and the type of innovation) from the influence of the industry environment and of business cycles. One possibility of avoiding biases from unobserved economy–wide effects is to select a cohort of new firms at a given point in time and to follow their development over a certain period, which is the approach taken by Helmers & Rogers (2010). For a period of five years they track the development of the entire cohort of 161,857 limited companies newly incorporated in the UK in 2001. These authors interpret the function of the individual intellectual property right in the following way: patents measure firms' inventiveness, i.e. their ability to identify a technology or a process that is novel and non–obvious, while trade marks and design rights best proxy innovativeness, which embodies the process of taking an idea or an invention to the market.

Using an IPR firm–level data set, these authors employ two distinct methods to analyse the impact on firm survival that can be attributed to firms' individual innovation decisions and the role played by the innovation intensity prevalent in the industry. First, to avoid biases by assuming any kind of systematic exit distribution, the Kaplan–Meier estimator is calculated, which is a non–parametric frequency estimator of the form $\hat{S}(t) = \prod_{t_i \le t} \left(1 - \frac{d_i}{n_i}\right)$. The number of firms that exit in period t is represented by d_i , and n_i is the total number of firms in t including those that exit during that period. In other words, the estimated probability of surviving t periods solely depends on the share of surviving firms in each period before and during period t. Computing this estimator for each year from 2001–2005 and distinguishing between IPR–active and IPR–inactive firms yields two survival functions, which show the rate of survival as a function of time. In every year, the survival rate of IPR–active firms lies strictly above that of IPR–inactive firms.

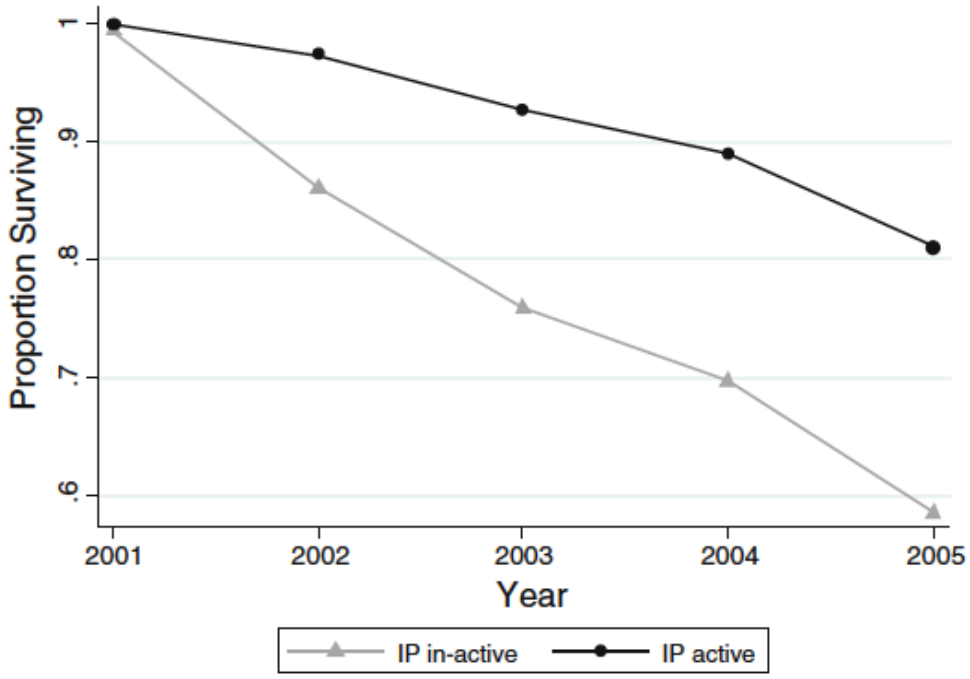


Figure 1: Survival rates for IPR–active and IPR–inactive firms

Source: Helmers & Rogers (2010), Figure 2, p. 235

However, a simple frequency measure of firms exiting the market does not disclose anything about the underlying mechanics. In order to take advantage of the large set of firm and industry–level variables at hand, a relationship between them and the likelihood of a firm exiting a market can be established using a formal model. A common method for estimating the role played by different individual and environmental factors for the realisation of a dependent variable with only two outcomes, which in this case are 'firm exit' or 'survival', is to use a Probit model. This type of model has the property that, regardless of the type or magnitude of the variables that feed into the model, it generates a value between 0 and 1 representing the hazard, i.e. the likelihood of exit.

Of relevance for such an analysis are variables that represent the firms' ability to compete successfully and others that reflect the conditions in which the new firms operate. In order to characterise each firm sufficiently, the authors include counts of firms' IPR applications, total assets, a variable indicating whether it is part of a group and if so, whether it is owned domestically or by a foreign entity. The industrial environment of each firm is accounted for by the inclusion of a measure of the competitive conditions and a measure of growth for each industry. Moreover, to control for spatial effects, regional unemployment rates and house

prices are included, as well as a dummy variable indicating if a firm is located close to a university.

As noted above, at the firm–level, IPR activity is said to proxy inventiveness and innovativeness. At the industry–level, using aggregated patent and trade mark data helps capturing their potential impact on within–industry competitiveness. Studying this effect is of interest since it has been hypothesized in Graevenitz et al. (2012) that IP rights, if used strategically and excessively, may create barriers to entry by hampering technological advancements (patents) or by limiting the ability of new firms to market new products (trade marks).

The results at the firm–level suggest that new firms, that applied for at least one trade mark (patent) as indicated by a dummy variable, have a 16% (14%) lower probability of exiting during the observed 5–year period compared to IPR–inactive firms. A more disaggregated regression using patent and trade mark counts further discloses that applying for national trade marks filed at the UK Intellectual Property Office (UK IPO) is correlated with a lower likelihood of exit than is applying for Community trade marks. Interestingly, the reverse is true for patents, i.e. a patent filed at the EPO increases the expected life span of a new firm by more than a national patent. Intuitively, this might reflect the fact that firms wish to protect more promising inventions at a larger scale, while trade marks can differ across countries, and can thus be applied for sequentially when and where required.

In their papers, Jensen et al. (2008) and Buddelmeyer et al. (2010) define the role of innovation a little more abstractly. Patents are understood to proxy for products or services new–to–the–world, i.e. for *radical innovations*, while an improvement to an existing service, product or process, which is merely new–to–the–firm, is termed *incremental innovation*. This is because the authors interpret the effect of innovation on firm survival in terms of the level of its inherent risk. In most cases, it is reasonable to assume that an improvement to an existing product carries less entrepreneurial risk than a product that is new–to–the–world. In other words, the outcome from launching a radical innovation, i.e. bringing to market a new–to–the–world product, is less predictable than from marketing a modified version of an existing product or implementing an improved process. Engaging in radical innovation can therefore be expected, *a priori*, to have less of a supporting effect on firm survival, on average, than focussing on incremental innovations. Furthermore, the authors attempt to

disentangle the impact of innovative activity *per se* and that of successful innovation in particular by introducing the distinction between the stock of (renewed) intellectual property rights and the most recent IPR applications. This allows allocating each firm's patent, trade mark, and design right holdings to one of the following four categories:

	Investment	Capital
Radical Innovation	Recent patent applications	Renewed patents
Incremental Innovation	Recent trade mark and design right applications	Renewed trade marks and design rights

Table 1: Interpretation of patents and trade marks in Jensen et al. (2008) and Buddelmeyer et al. (2010)

In addition to innovation capital and innovation investment, the authors take account of further firm–level variables such as size, age, ownership structure; industry variables such as firm entry rates, industry risk, earnings, and dummies; and also macroeconomic indicators such as the current interest rate, the GDP, and the Australian Stock Market index.

The base for the analysis is the stock of registered Australian companies in 1997 where all data are available, which leaves 229,869 companies or roughly 65% coverage. In contrast to Helmers & Rogers (2010), in their two papers these authors track all incumbents as well as new–firm registrations and de–registrations during the period 1997–2005 (Jensen et al., 2008) and 1997–2003 (Buddelmeyer et al., 2010), respectively. Doing so allows drawing a more general picture of the impact of innovation on firm survival, since survival and exit is observed for all types of firms. Moreover, in their 2008 paper, the authors also distinguish between new firms and incumbents by defining as incumbents all firms that were already registered in 1988. However, firms of different ages and sizes react differently to macroeconomic fluctuations and business cycles, which is why some economy–wide indicators are included to separate the impact of innovation from that of the general environment.

Another issue researchers have to deal with when matching IPRs to financial data is that of ownership. For stand–alone firms there is no issue. For subsidiaries or parents, however, the question arises how to allocate the IP rights that are held by the group as a whole. In the case that each subsidiary operates independently and files their IP rights individually, nothing has to be done. It is often the case, however, that the parent firm holds all IP rights and subsidiaries are free to use them or have to acquire exclusive licences. Alternatively, there

may exist an individual subsidiary that is solely devoted to deal with the group's IPR holdings. Jensen et al (2008) and Buddelmeyer et al. (2010) are taking account of this by adding up all IP rights for a group and then allocating the aggregate number of rights to each firm within the group. This, however, could overstate the IPR holdings by individual firms significantly and thus lead to severe under– or overestimation of the impact of innovation on the probability of exit, depending on the direction of the effect.

Buddelmeyer et al. (2010) present the model underlying the basic hazard function they estimate in both papers, where the authors assume that hazard, here 'firm exit', occurs if revenues are insufficient to cover costs. To test this empirically, a linear function of the firm, industry, and economy level variables outlined above proxy for revenues and costs, respectively. The function that is chosen to represent firm exit behaviour is a piecewise–constant exponential function with proportional unobserved heterogeneity, formally $h_i(t \mid \mathbf{x}) = h_0(t) a_i \exp(x'_{it} \mathbf{b})$.[18] In other words, the probability of a firm to de–register is modelled as a multiplicative function of three components: the natural propensity to exit only depending on firm age, $h_0(t)$; the firm specific, time–invariant characteristics (α_i), which cannot be observed but affect the natural hazard rate proportionately; and the vector (x'_{it} **b)** of explanatory variables that have an exponential impact on the firm–specific baseline hazard.

In the empirical model the difference in the interpretation of IP capital and IP investment is reflected in the way the variables are computed. IP capital is calculated at the firm–level as the sum of the years that each renewed patent, trade mark, or design right had been in force. In contrast to this, IP investment is simply the count of IPR applications lagged once or twice. Both variables enter the regression as natural logarithms in order to reflect diminishing returns to IP and the skewed distribution between IPR–active and IPR–inactive firms.

The distinction between IP capital and IP investment leads to novel results, some of which are in line with related literature and some of which are not. For instance, while radical innovation capital (i.e., renewed patents) is associated with a lower probability of exit, investing in radical innovations (i.e. applying for a patent) increases the likelihood of de–registration significantly. Distinguishing between new firms and incumbents, on the other hand, shows that patent applications only affect incumbents, while it has no significant effect on new firms. Both findings are in contrast to those in Helmers & Rogers (2010), thus

[18] Jensen et al. (2008) makes do without the unobserved heterogeneity parameter □□

supporting the hypothesis that recent applications proxy more risky innovation than established IP rights. For the median firm of the 1997–2003 sample, the calculations show that registering for a patent decreases the expected life span of a firm by 7.6 years on average, while increasing the stock of renewed patents from zero to five years increases it by 13.5 years.

The findings related to trade marks are even more pronounced. Applying for the first trade mark prolongs the expected life span of the median firm, on average, by 6.6 years, while extending the incremental innovation capital by five years, i.e. the stock of renewed trade marks, yields 19.5 additional operating years for the median firm. However, neither the impact of design right stocks, nor that of recent design right applications is a significant contributor to firm survival. The results in both papers are very similar. Overall, the authors show in a novel way that innovative activity associated with trade marks is less risky than that associated with patents, and that solid innovation capital as proxied by renewed IP rights increase the expected life span of an average Australian firm.

So far, it appears as if firms that engage in successful or incremental innovation fare better, or at least live longer, than their IPR–inactive peers. Perhaps this can be interpreted as a direct effect of innovation, which implies that it might be worthwhile to also look at indirect effects. For instance, how does innovation by one firm affect the survival chances by other firms? Since it may not be possible to ever measure direct spillover effects or externalities, a picture of the general direction can be drawn by looking at the industry–level. In other words, do firms survive longer in highly innovative industries, and does this hold for new as well as for incumbent firms?

To this end, Helmers & Rogers (2010) include the share of trade–marking and patenting firms in a sector as a measure of industry innovativeness, and find that a higher share of trade markers within an industry is correlated with a higher likelihood of exit, while the reverse is true for patents. As interpretation of this result, the authors suggest that a more patenting intensive sector is one that is subject to rapid technological change, which makes survival of new firms more likely as it reduces incumbents' ability to displace the new entrants. More trade mark activity, on the other hand, could be a result of more marketing intensive industries where reputation plays an important role, which is difficult and costly for a new firm to build up and maintain. They also estimate exit propensities at the sector level, which

reveals significant heterogeneity across sectors. For instance, while in all but three sectors trade–marking is associated with a statistically significant drop in the likelihood of exit, the same can be said for only four out of ten sectors with regard to patents. Thus, the results show that the roles played by the different types of innovativeness vary significantly across industries.

Jensen et al. (2008) construct as an innovation index at the industry–level a weighted average of R&D intensity, R&D employment, patents, trade marks, resources allocated to organisational change, and productivity. Surprisingly, on average, the most innovative industries between 1997 and 2005 were, in order, "Mining", "Printing, publishing and recorded media", "Electricity, gas and water", "Finance and insurance services", and "Cultural and recreation services". Underpinning the robustness of the results, including this measure in the regressions has virtually no effect on the coefficients of the restricted regression summarised above. Moreover, it shows what is often assumed, namely that a more innovative environment provides better grounds for new firms to survive, while incumbents are more likely to perish. Again, the argument goes, young and agile firms are more capable to adjust to a rapidly changing environment compared to large and old firms. While this implies more opportunities to survive for new firms, it also leads to more displacement of incumbent firms that cannot keep pace.

5 – The interplay of trade marks, advertising, and competition

In order to consider the relation between trade marks and social welfare more closely, it is sensible to distinguish between brands and trade marks. Put simply, a trade mark provides the legal foundation of a brand. The legal protection is essentially granted to guarantee the trade mark as indication of origin. There exist a number of popular examples for properties of a trade mark that constitute a brand over and above its essential function, i.e. the indication of origin. For instance, trade marks signal unobservable characteristics such as the use of recyclable materials; they represent a firm's goodwill that has been built up over time; and consumers associate some trade marks with a certain social status or image. Firms nurture and operationalize these additional properties as further means to distinguish their goods and services from those of competitors. The motive is to generate rents beyond those accruing from the functionality of their products and services alone. This can lead to the creation of strong brands, i.e. trade marks that are well known and that enjoy a large loyal customer base.

On the one hand, the existence of such brands makes consumers' lives easier, because they serve as a focal point in the consumption decision, and thereby reduce consumer search costs (Landes & Posner, 1987). On the other hand, the fact that consumers require more convincing to switch to a product or service from a new firm may make entry and survival of new competing products and services harder. Thus, the effects of strong brands on society are ambiguous, while trade marks *per se* are generally perceived as a competition–promoting institution.

Having established this distinction, the question is how trade–marking and brand–building interact. While coming up with a trade mark and registering it is a one–off event, building a brand involves long–term commitment such as customer service, reputation–building, and generating trust in the firm's product or service. In a report for the UK IPO, Greenhalgh et al. (2011) investigate this relationship between trade marks and brands using the Annual Respondent Database (ARD2) from the UK Office for National Statistics (ONS) for the period 2000–2006 in combination with the Oxford Firm–Level Intellectual Property Database (OFLIP). The regression sample contains panel data on 35,279 UK firms of all sizes and across all industries. These authors estimate a Cobb–Douglas–type production function using ordinary least squared regression methods, where trade marks and patents proxy for intangible assets, and gross value–added on input serves as the dependent variable. Controlling for industry intensity of patenting and trade–marking behaviour, foreign ownership, export activity, industry fixed–effects, and a time–trend, the results show that both advertising and trade–marking contribute positively to the value a firm generates. The interaction term of trade–marking and advertising activity, however, is negative and significantly different from zero, implying that trade–marking and advertising are (imperfect) substitutes. Intuitively, one would expect this to be positive since a trade mark is the legal basis for a brand and thus a complement. However, both activities are costly, and resources allocated to trade–marking are resources that are directed away from brand–building or innovating, which might explain the relatively small negative effect. Also noteworthy is the observation that the inclusion of advertisement in the regression equation reduces the coefficient on the industry trade mark intensity and turns it insignificant. It thus appears as if the trade mark activity in an industry is strongly correlated to firms' advertising activity.

In another exercise these authors include stock variables for trade marks and advertising during the period 2000–2003, and relate them to the rates of growth of employment and

turnover between 2003 and 2006 for a smaller sample of 8,470 UK firms of all sizes and from all industries. The results confirm the findings from the value–added estimations – both trade–marking and advertising activity grant a growth premium in terms of employment and turnover, but their interaction, however, remains negative and significant, indicating some substitutability between these two activities. Although this does not establish a causal link between trade marks and brands, it is suggestive evidence that there is some connection. Unfortunately, the question whether the premium of advertising and trade–marking is due to increased valuation for the firm's product or to reduced competition, and whether it is beneficial to society or not, remains unresolved.

A novel approach to investigating the strategic use of the tools offered by the trade mark system to raise rivals' costs is provided by Collette (2012), who analyses a new data set on completed trade mark opposition cases in Canada between 1996 and 2009. This author tries to answer whether incumbent firms with deep–pockets use the possibility of opposing trade mark applications by rivals to raise their costs, both directly by requiring the re–allocation of resources to the opposition proceedings, and indirectly by delaying the proceedings in order to interrupt the marketing process. In a series of different logit regressions, the relationship is analysed between firm–level characteristics and i) the likelihood of the opposition being successful; ii) the opponents' propensity to request additional time from the trade mark opposition board (delay) at the different stages of the opposition proceedings. Firm–level characteristics include variables such as the opponent's and the applicant's size and experience, the ratio of their sizes, whether they are incumbents, and to which industry they belong. The sample consists of 2575 opposition cases during 1996–2009, for which both the applicant and the opponent could be matched to a firm–level database. In this sample, opponents use at least one delay in 45% of the time, and the mean opponent is 30% larger in terms of revenue than the mean applicant, i.e. $13.3 billion compared to $US 10.2 billion.

The results show that very large firms with revenues of $25 billion or more are 6% more likely to delay the proceedings and 4% more likely to be successful with their opposition. This effect is aggravated as the firm becomes larger and if it is an incumbent. This is in line with the hypothesis that large firms strategically delay the opposition process to increase the burden on the applicant. However, the results also show that the more often opponents engage in opposition proceedings, the less likely they become to request more time, while the likelihood of winning the opposition increases. In contrast, the more experienced is the

applicant, the more likely is the opponent to request additional time, and the less likely is the opponent to win. While the author argues that the results provide evidence that large firms oppose and delay strategically, it seems more likely that the requirement of additional time depends on the experience of both parties individually, and perhaps the ratio thereof, too. Nevertheless, the study provides detailed insights into the patterns of the use of oppositions, the proceedings, and their outcome depending on firm characteristics such as size and experience. One the one hand, the fact that large firms are more likely to oppose new trade mark applications and that small, new firms are significantly more prone to lose opposition proceedings may partly be a result of strategic behaviour. On the other hand, it also raises the questions how frequent and common are the attempts to free–ride on the success of successful brands, and to what extent are large and successful firms the victims rather than the culprits in the brand exploitation game?

A different approach to the question of the overall welfare effect of trade marks is provided in Greenhalgh (2011), who distinguishes between the private value and costs of a trade mark, i.e. those that accrue to the owner only, and its social value and costs, i.e. those which society enjoys and bears. It follows that in order to evaluate the net effect of trade marks on society, their social value has to be weighed against their social costs, a task which proves to be methodologically challenging. In this recent paper, Greenhalgh presents evidence in the form of legal cases from which it becomes clear that owners of strong brands and 'deep pockets' indeed seek to prohibit the use of any similar marks, even if the allegedly infringing product or service shows significant differences to those marketed under the strong brand. Furthermore, Davies & Maniatis (2010) discuss cases where firms try to extend the monopoly granted by a patent beyond its lifetime. These firms argue that certain distinctive features of their product are unique and thus indicate origin, which is why they should be protectable under trade mark law. However, both papers find that the law appears to be exercised unbiased as regards to firm size and with awareness of the trade–off between the protection of valuable brands and healthy competition.

These last papers provide mixed evidence about firms trying to abuse the rights conferred by a trade mark in order to fence–off competitors. Such efforts are costly and allocate resources away from inventive and innovative activity. Is there reason for concern that trade marks create the wrong incentives for firms, which results in stifled innovative activity and slower economic growth? Possibly, according to the results of Frey (2012), who conducted a series

of semi–structured interviews with 21 IPR experts from 19 originator pharmaceutical firms in Europe and the U.S., as well as using a unique survey of 73 pharmaceutical firms listed either in the EU or the U.S. The interviews reveal that IPR management plays a supportive, thus complementary, role to R&D, business development, and marketing efforts. Both the interviews and the survey show that the primary objectives of firms' IPR management are securing freedom–to–operate, maximising exclusivity and the duration thereof, and obtaining the best value for money. Together with the fact that these firms spend a quarter of their annual turnover on average on marketing activities, the findings stress firms' intent to build a strong brand. What remains unanswered is whether this intent is necessary in order to compete vis–à–vis other players in the market for pharmaceuticals or whether it is aimed at the creation of market power in order to keep competitors at bay. Nevertheless, when asked about their motives to trade mark, firms replied that the most important reasons are the protection and the identity provided by trade marks as well as its function to communicate to customers. In contrast to the above–mentioned strategies of 'deep pocket' firms, combining trade marks and patents in order to increase exclusivity or duration thereof plays a secondary role, and its function as a substitute either as legal instrument or as commercial asset is irrelevant according to the vast majority of surveyed firms.

If identity and communication are the most relevant motives for firms to trade mark, what impact does communication via trade marks have on demand? Jensen & Webster (2008) explore this question by analysing how adding information about unobservable characteristics of retail grocery products on their labels affects consumer demand for such products. As noted earlier, brands carry a lot more than mere information about a product. Thus, in order to identify the effect of communicating unobservable product characteristics via labels, these authors focus on brand–unrelated labels. The characteristics investigated are whether the product is made from recycled materials, claims health–supporting functions, is certified as being Australian–made, is environmentally–friendly, supports a charity, carries an Australian flag, or offers entry into a raffle. The intuition is that when faced with a variety of similar products, consumers may choose the one that corresponds most to their own preferences in terms of these unobservable characteristics.

These authors employ fixed–effect panel regression methods on commercially available pooled monthly data on a bundle of 92 goods in 12 product categories from major supermarkets across Australia over the period from 2002 to 2005. Only mature product

categories, where the goods were sufficiently homogeneous, were selected, so the effects of the characteristics can be compared. The quantity of a given product sold is modelled as being determined by a set of labelling characteristics that are unique to the brand and time–invariant, its own price, the mean price of all other products within that category, a fixed effect that is common to all brands within that category, the age of the brand's trade mark, the brand density in each product category, and an error term containing firm–specific shocks. The results regarding the characteristics are mostly as expected – consumers are more attracted towards products containing recycled materials and that are certified to be made in Australia, compared to those that offer support for a charity and those which are health–conscious. To their surprise, the authors find that eco–friendly products, non–certified Australian–made products, and those that offer entry into a raffle are less attractive to consumers. This is further evidence that marks conveying information of some kind do affect the demand for the products carrying them, and thus shows that trade marks do play a different role in addition to indicating a product's origin.

Perhaps more relevant for the discussion of the relation between trade marks and competition is their finding that up to a certain point, each additional year a brand exists leads to an increase in the demand for that brand. Beyond that point demand decreases, mirroring consumer fatigue if firms fail to re–invent their product regularly. Moreover, the investigation shows that the more brands there are in a given product category, the lower is the demand for each brand in that category. Although at first sight this speaks for healthy competition, it is not clear whether this connection can be made, because several brands in one category may belong to the same firm, and thus only seemingly compete against each other. Nevertheless, it is evident that the number of brands does affect competition, which raises the question whether there exists a socially optimal number of brands in a given market.

The studies reviewed in the first part of this section were concerned with direct effects of the trade mark system on firms' incentives to substitute brand–building for innovative activity, their motives to trade mark, and the legal strategy of firms with deep pockets to take advantage of their brands to limit competition. The wide variety of approaches, i.e. interviews, surveys, case reviews, and statistical methods, stress the difficulty of assessing the direction and the extent of the influence that the design and the application of IP law has on consumer and firm behaviour, and thus on competition. Nevertheless, there is evidence that the trade mark law does create incentives for firms to engage in costly actions that are

targeted at building or preserving market power, which leaves fewer resources for optimisation and innovation. The extent of those actions, however, is limited because the case reviews suggest that judges are well aware of the trade–off between protecting valuable brands and preserving competition. Although only a fraction of trade mark related legal disputes is taken to court, the interpretation and application of the law by the judges in those cases most likely determines the sign of the net social value of trade marks through its signalling function to all agents in the economy. Yet, more thorough investigation of the impact of brands and trade marks on competition and the economy as a whole will help the courts to take even better informed decisions.

In the second part of this section, we return to the assumption that trade marks proxy innovation because they likely represent product launches or improvements over existing products or methods. Both can make existing products less desirable if not obsolete, a phenomenon which is widely known as creative destruction, a concept first described by Joseph Schumpeter early in the last century, which leads to competition via innovation. This type of competition results from the fact that innovation by one firm has direct consequences for its immediate competitors. Whether it replaces its own products or that of its competitors does not make a big difference, as in either case it gains a comparative advantage. In order to regain their position, competitors will themselves engage in innovation, which leads to increased returns later on. Greenhalgh & Rogers (2012) confirm this theory using a sample of 1600 large UK manufacturing and service firms between 1996 and 2000. Employing trade marks and patents as proxies for product innovation, these authors show that an increase in trade–marking by other firms in the same four–digit industry would reduce a firm's value–added, confirming the immediate effect of innovation by competitors on a non–innovating incumbent. At the same time, this raise in industry trade–marking intensity yields an increase in the market–to–book value ratio. The latter result reflects the second part of the competition in innovation, where the losing firms will respond by engaging in more intense innovation in order to generate higher future returns, which is anticipated by the stock markets.

Thus, successful innovation yields large but short–lived gains. These are first used to recover incurred costs, but then the firm has the option to invest some of the remaining funds in its workforce. It can do this either via higher wages to keep the existing staff motivated, or by hiring more skilled personnel for future research, development, and marketing. In other words, a link is likely to exist between a firm's innovative activity and the size and

remuneration of its workforce. In their early study, Greenhalgh & Longland (2001) are the first to model UK employment as a function of a firm's sales, industry–levels of wages, costs of capital and materials, R&D expenses, and a range of IPR variables (including trade marks) to proxy innovation. These authors analyse a panel of about 500 large UK production firms operating between 1986 and 1995. In the initial regression, firm specific time–invariant effects were included, showing no effect of trade marks on the number of jobs in a firm. However, a supplementary analysis of the firm specific effects showed that there are persistent differences between trade–marking firms and those that never register trade marks. In particular, trade–mark–active firms consistently employ significantly more workers than firms without trade marks. Further analysis of the impact of trade marks on firm wages shows that registering trade marks is also significantly associated with rising wages. Viewing these results together shows that innovative activity is associated with more jobs at higher wages, albeit unclear to the researchers whether the extra returns are being shared with the existing workforce, or whether higher wages are paid to attract better skilled personnel. These results are confirmed in the UK IPO report on trade mark incentives mentioned above. In this report, Greenhalgh et al. (2011) essentially repeat these analyses using more recent ONS–ARD data, which now include service firms as well as Community trade marks. The results suggest that trade mark active firms employ, on average, 20% more workers than trade–mark–inactive firms with the level of sales held constant, implying that trade–marking firms are more labour intensive than their non–trade–marking counterparts. Moreover, wage regressions show that trade marks alone imply a 0.7% wage premium and trade marks in conjunction with patents a 2% wage premium over and above industry average wages. Similar to the earlier results, including firm fixed–effects leaves trade marks and patents insignificant indicators of wage differences. This confirms that the higher levels of employment and wages are time–persistent characteristics of IPR–active firms.

6 – The effects of bundling different IP right types

Intellectual property law is a very dynamic field of law since its subject matter, i.e. technological and creative inventions and innovations, is continuously changing. It is inevitable that possibilities arise, that could not be thought of at the time the law was designed. Thus, adjusting IP law or its interpretation in order to establish legal certainty in new areas and applications made possible by technological advancements is a natural process.

In order to make economically sensible adjustments, the effects of the respective IP right under consideration and the interrelations with its legal neighbours need to be taken into account. Interrelationships, or overlaps, between the different types of intellectual property rights can occur because a clear–cut distinction between the legal and economic functions of these different types of IPR is not always possible. This section surveys the thin and very young economics literature on such interrelationships.

The first treatment of the effects of joint consideration of patent and trade mark protection can be found in Parchomovsky & Siegelman (2002). These authors develop a simple model of the complementary effects of trade marks and patents. Here, the underlying mechanics are based on the assumption that building up brand loyalty can act as extension of the patent lifetime, thus incentivizing the patent owner to charge less than monopoly prices during the patent period in order to maximise profits over the entire lifetime of the product. A number of product and demand side characteristics are identified where the joint use of patents and trade marks is most promising.

On the product side, it is argued that consumers are less likely to switch brands if search costs are high, i.e. if goods such as food and beverages, clothes, and any type of services have to be experienced in order to be evaluated. Furthermore, the more complex is a good the more difficult it becomes to make an informed decision among a range of alternatives, in which case the consumer is more likely to stick to what she knows. Above all, however, it is necessary that some demand for the product remains beyond the lifetime of the patent, for otherwise the brand has no additional value for the patent and would not be a complement in this setting. It follows that product heterogeneity, complexity, and a lower degree of predictability of the consumption experience all add to the value of brand loyalty.

On the demand side, these authors identify the age and sophistication of consumers to be influential on the extent of brand loyalty. Elderly consumers have weaker incentives to invest in searching for new brands if they are satisfied with their current one, partly because they face a shorter time span during which these search costs could be recouped. Similarly, consumers who fail to anticipate their future consumption behaviour are more prone to avoid search costs and stick with their brand longer than optimal, too. Taking into account all these characteristics suggests that patent and trade mark complementarities are most likely be found in differentiated experience good industries, that are subject to a slow rate of technological

change and that focus on younger or elderly consumers. Bearing these theoretical considerations in mind, we now turn to the empirical approaches in the literature addressing the interrelationship between different IPR types. In what follows, we refer to the set of different IP rights that relate to one product or service as an 'IPR bundle'.

As mentioned above in Section 5, in his interviews of European and U.S. pharmaceutical firms, Frey (2012) finds that combining trade marks and patents in order to increase exclusivity or duration thereof plays a secondary role, and its function as a substitute either as legal instrument or as commercial asset is rated irrelevant by the vast majority of surveyed firms.

"Lawyers throw all the tools at you." [19] –
Complementarities of copyrights and trade marks

In addition to the market–side effects outlined above, Somaya and Graham (2006) suggest that different forms of IPRs may act as complements due to economies of scope. Complementarities between IP rights in the form of economies of scope occur if the existing know–how and experience with one type of IP right simplifies the introduction of another type. In other words, for a firm that is already IPR–active, it is cheaper to introduce other types of IPR compared to a firm that has no IPR experience. These authors report on unstructured interviews with six employees of five software firms which all indicate that production–cost side complementarities exist between different types of IPRs. Based on these interviews, the authors suggest that the more a firm is aware of the importance of intellectual property protection (*management attention to IPRs*) and the more resources a firm allocates to IPR related matters (*IPR–related organizational resources)*, the more likely it is to employ more than one type of IPRs.

In order to test for a relationship between the two IPRs empirically, these authors model the use of copyrights and trade marks as individual linear equations, which are then stacked up and estimated together. This *seemingly unrelated regression* (SUR) technique takes account of correlations across the equations and delivers a correlation matrix of unexplained error terms, which according to the authors, is indicative of complementarities or substitutive effects between the two dependent variables, i.e. copyrights and trade marks. In other words,

[19] (Somaya & Graham, 2006, p.11)

the authors assume that the part of IPR–activity that cannot be explained by common observables are likely due to interrelations between the two IPR types.

The data for this undertaking stem from an original database created by these authors. It contains information on firms' litigation and IPR activity matched with accounting data. The database covers 85 of the top 100 PC software firms in the U.S. over the time period 1985–1999. By using IPRs that have been subject of litigation, it is ensured that the rights under consideration are actually used and therefore of value to their owner. Moreover, in order to take account of the significance of a particular copyright or trade mark for the company, as dependent variables the authors calculate copyright and trade mark years–in–litigation instead of mere counts of the suits. Patent counts and the number of patent attorneys employed by a company serve as proxies for *management attention to IPRs* and *IPR–related organizational resources*, respectively. Furthermore, trade mark and copyright counts, firm size, age, revenues, profits, and R&D expenditure variables are included as control variables.

The above–mentioned regression equations are estimated jointly using the generalized least squares (GLS) method. Time–invariant firm–specific effects are captured in order to focus on the variation within the firm rather than between firms. The correlation between the error terms, i.e. the unexplained variations, can then be computed, which in the model without the proxies for *management attention to IPRs* and *IPR–related organizational resources* is strongly significant and positive (0.31), and thus indicates a complementary relationship between the dependent variables. In other words, the more a firm is involved in trade mark litigation, the more it is involved in copyright litigation and vice versa. However, including the managerial attention variable decreases this correlation to 0.25, while it shows that patenting activity itself is highly correlated with both trade mark and copyright litigation activity. In particular, the results suggest that on average, one additional patent filed by a firm corresponds to 41.2 (6.9) additional suit–days of copyright (trade mark) litigation. An effect in the same direction can be observed when the IPR–resources variable is included instead of the managerial attention. This shows that an additionally employed patent attorney increases the number of suit–days in copyright (trade mark) litigation by 729 (168) days. The complementarity between trade mark and copyright litigation years is also reduced to 0.25. Including both management variables simultaneously shows that resources allocated to IPRs are strongly correlated with managerial attention to IPRs, and that resources alone have no

independent explanatory power on the number of trade mark and copyright suit–years or on the relationship between them.

Although these results seem intuitive, the authors argue that the analyses should be repeated without the largest firm in the sample, Microsoft, whose earnings (profits) are 16 (20) times that of the next largest company. This step reduces the indication for complementary effects between trade mark and copyright litigation but doesn't change the statistical significance thereof. The loss in magnitude of the correlation can be explained by the stronger correlation of organizational IPR resources and the dependent variables, which without Microsoft in the sample remains significant even with the inclusion of managerial attention to IPRs. This evidence suggests that the IPR know–how in smaller firms is shared across IP right types, advocating the view that concurrent movements of different IPR types within a firm is mainly a result of economies of scope rather than actual interrelationships between the IP right types themselves. Although the results show that firms do employ strategies to protect their assets using IPR bundles instead of only individual IPR types, they remain silent on whether this bundling approach is beneficial to the firms or to society.

Complementarities of patents and trade marks

While Somaya & Graham (2006) study the co–movement of copyrights and trade marks without investigating the impact of it on performance measures, Millot & Llerena (2012) investigate the interrelationship of patents and trade marks by analysing the impact of different IPR strategies on firm performance.

Millot & Llenera (2012) develop a simple model based on the same idea that Parchomovsky & Siegelman describe. This model predicts that if the effects of advertisement are persistent but advertisement itself difficult to appropriate, as for instance in the pharmaceutical industry if patent protection has lapsed or is not available, trade marks tend to complement patents. On the contrary, if advertisement depreciates quickly as is the case in high–tech industries such as computers and software, trade marks and patents will tend to be substitutes.

In order to test their hypotheses empirically, Millot & Llenera employ a supermodularity approach described below. Firms are assumed to stick to one IPR strategy because product level data are not available. The possible IPR strategies are:

- Using both types of IPRs, denoted as {patent, trade mark},
- using only patents or only trade marks, i.e. {patent, 0} or {0, trade mark},
- or using no IPRs at all, thus {0, 0}.

At the core of the supermodularity concept lies Aristotle's observation that "*the whole is greater than the sum of its parts"* (Metaphysica, 10f–1045a), which has been formalized and applied to a large class of games by Topkies (1979), Vives (1985) and Milgrom & Roberts (1990). For the purpose of this undertaking, however, it suffices to say that given V is a real–valued, monotonously increasing function, then the two input factors patents (P) and trade marks (TM) are said to be supermodular, or complementary, if V(P,TM) + V(0,0) > V(P,0)+V(0,TM). To get a better understanding of this equation, imagine two firms A and B with identical products. On the left hand side of the equation, firm A protects its product with a patent and a trade mark, and firm B doesn't protect the product at all. On the right hand side, firm A protects the product with a patent and firm B with a trade mark. If the two firms together are worth more given that one firm uses a bundle and the other nothing compared to the case where one firm uses only patents and the other only trade marks, then it follows that the patent and the trade mark generate more value when used jointly than when they are used in isolation. If the converse is true, the input factors are submodular, or substitutive, to each other. This expression is then used to derive testable hypotheses (Mohnen & Röller, 2005).

The integrated database used by Millot & Llerena (2012) covers 785 French publicly traded firms in the year 2007 and their corresponding patent and trade mark rights. These authors estimate a market value equation containing four dummy variables, each of which represents one possible patent – trade mark strategy. However, only trade mark and patent applications between 1998 and 2007 are taken into consideration. This limits the authors' ability to test for the proposed complementary between trade marks and patents, which only occurs once the patent expired. On the one hand, one can argue that the market already values the future effect of the trade mark complementing the patent before this actually occurs. On the other hand, the value added by the trade mark, according to their theory, depends on the goodwill built up during the patent–period, which is a volatile process that is still on–going at the time of observation. It is therefore likely that the complementary effects are underestimated, which might explain why the results for the full sample indicate that no interrelationship between patents and trade marks exist with respect to market value. However, the results again confirm

that while patents alone do not significantly contribute to market value, trade marks alone as well as in conjunction with patents do increase a firm's market value.

To sum up the findings of the rare attempts to measure complementarities between different IP rights, it seems that the evidence so far suggests weak but significant effects between copyrights and trade marks as well as between patents and trade marks. However, the results from Millot & Llerena (2012) likely suffer from limitations in the data. Moreover, using a product–level approach, Helmers & Schautschick (2013) show that of the firms that own both types of IP rights, only a small share of about 5% are using bundles to protect one product or product type. This implies that results from empirical analyses should be assessed critically if ownership of both patents and trade marks is assumed to be equivalent to an IPR bundling strategy by that firm.

What can be learned from the literature on this under–researched area is that different interpretations of the functioning of trade marks and patents lead to different potential sources of their interrelationships. These can be summarised as *demand–side* and *supply–side complementarities:* demand–side complementarities occur if the use of a patent increases the value of a brand, which in turn increases the value of the legal protection against counterfeit and passing–off. Supply–side complementarities occur if employing one type of IPR also reduces the costs of using further types of IPR, or if marketing is required as an additional input factor to generate demand for the patent–protected innovation. While firm–level data may be sufficient for testing supply–side complementarities, product–level data, i.e. linked IP rights, are required in order to test for demand–side complementarities. From the papers reviewed in this section, it can only be concluded that there is evidence for the existence of supply–side complementarities, and that there is a need for more rigorous research at the product–level.

7 – Summary

The purpose of this paper is to collect and summarise the existing body of descriptive and inferential economic empirical analyses of trade mark data. Despite the widespread perception that trade marks and trade mark data have received little attention by economists, we found that this body of literature addresses a broad range of questions using trade mark data at all levels of aggregation from different countries.

The literature reviewed reveals that the use of trade marks has been growing astonishingly rapidly since 1975, about ten years before the growth in patents began to increase. This time trend is surprisingly similar for Australia, the UK, and the U.S. during the period 1975 – 2002, and recessions impede the growth of IP rights consistently. Cross–section analyses show that trade mark patterns are similar around the world, and that a high income per capita correlates with a low share of foreign trade mark registrations. As for the source of the growth in trade marks, service sectors as well as strongly deregulated and restructured industries show the highest rates of expansion of trade mark use. Taking Australia as reference point for developed countries, it appears that the increasing demand for product differentiation and products of higher quality better explains the growing use of trade marks than does the natural growth of production. The positive relation between the wealth and the size of a country and the degree of product differentiation can also be confirmed using trade mark data at the country–level. Whether this correlation can be exploited to use trade marks as proxies for innovation has also been addressed by a number of researchers. Although overall trade marks are correlated with product, marketing, and process innovation, the strength and robustness of this link strongly depends on the industries under investigation.

Studies at a more disaggregated level show that firms use trade marks to protect their brands and their identity, both of which are instruments to communicate with consumers and stakeholders. While this yields private and social benefits, it also comes at a cost, as brand reputation–building and –defending efforts reallocate resources away from other activities. It has been shown that the private value to firms from trade–marking is positive on average. However, the sign of the social value net of costs remains unclear, albeit that the efficiency–enhancing and pro–competitive effects associated with trade–marking speak in favour of a positive overall contribution of trade marks to society.

Neither the list of papers reviewed in this survey, nor the range of questions addressed thus far is exhaustive. Nevertheless, the work done using trade mark data in a time–span of just over a decade vastly contributed to a better understanding of the use of intellectual property by firms, its impact on firm behaviour and thus on the economy as a whole. It is most likely that new insights will appear as more data from more countries becomes available. It can also be expected that the large body of descriptive analyses of intellectual property data will provide theoretical scholars from different disciplines with sufficiently new insights to revisit

some of the existing beliefs of the effects of intellectual property on the economy and the society, for instance regarding their potential to create monopolies and barriers to entry.

Although not all possible applications of the existing IPR data have yet been exploited, the need for more specific product– and case–level data has become apparent. This will help not only for understanding and underpinning some of the findings of the aggregate studies, but also in answering questions regarding the misuse of intellectual property rights or the success of regional harmonization of the law. Besides the collection of more data, however, it seems that the logical next step given the progress of this line of research to date is the systematic analyses of cross–country differences between the identified effects of trade marks on competition, innovation, productivity, and profitability.

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