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Trademarks as an indicator of innovation and industrial change

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Abstract

As innovation becomes an ever more central issue for the development of firms and world economies, so the need for improved assessments of innovative performance grows more urgent. This paper suggests that trademark analysis can contribute in capturing relevant aspects of innovation phenomena and the process of industrial change. We propose trademarks as a complementary indicator in the portfolio of available empirical tools of innovation studies and industrial dynamics. Our empirical exploration is based on a study of community trade marks (CTM), an intellectual property right granted in the European Union, and draws on recent research on trademarking trends in Portugal. Quantitative as well as qualitative data, including survey data from a representative sample of Portuguese manufacturing and services firms, are used to identify the advantages and limitations of this indicator.

Keywords: Indicators; Trademarks; Innovation; Industrial dynamics

1. Introduction

The business of branding products has long been part of ordinary economic life. Trademarks are the outcome of establishing recognisable designations and symbols for goods and services, as well as firms' identities. They play a crucial role in the process of marketing innovations, being instrumental in differentiating the attributes of goods and services in the marketplace. These characteristics make trademarks a potential indicator of product innovation and sectoral change. Moreover, recent developments in the institutions for the international regulation of trademarks, as well as the increasing availability of digital databases, have increased the case for using trademark statistics as a new source of information in industrial and innovation studies.

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Trademarks are of interest for social science research for at least three reasons: they confer the exclusive right to use a brand, therefore enhancing companies' ability to appropriate the economic returns on new and existing products; they are an important aspect of contemporary culture world-wide; and they constitute a source of qualitative and quantitative information on socio-economic activities. This paper focuses on the third of these features. It does not address the more complex issue of the contribution of trademarks to welfare, which might be considered an urgent question for political economy in its own right.[1] More specifically, the paper assesses the possibilities and problems of using trademark data when analysing the introduction of new or improved products in competitive markets. Along with a methodological reflection, the paper offers a concrete empirical application of the indicator to the EU-15 countries[2] together with an in-depth study of an intermediate European economy, Portugal, for which we analyse: (i) statistical data on trademarks for the period since 1980; (ii) survey data collected from a representative sample of 724 firms in 2003; and (iii) information from thematic workshops held with entrepreneurs, managers and consultants. Data for the EU-15 countries was obtained from publicly available documents of the Office for Harmonization in the Internal Market (OHIM), which is responsible for managing community trade marks (CTMs). The lessons learned from the Portuguese case synthesise and elaborate on a study recently published by the Portuguese Patent and Trademark Office, INPI (Godinho et al., 2003).

We argue that trademark-based indicators provide a partial measure of the innovative *output* of profit-oriented organisations. In its most simple formulation innovation can be understood as the introduction into the market of a new idea, product or production process. As an intellectual property right (IPR), trademarks are designed to differentiate certain products from those provided by other firms. In this context, the filing of new trademarks by economic actors partially reflects the introduction of new offerings aimed at persuading potential buyers that the range of their problems is not being solved by the supply of solutions currently available in the market. In this way, since companies have to pay fees to register and renew their rights in national and international offices, the effort involved in filing for a new brand name or logo reveals an economic decision that is worth investigating. Furthermore, given the growing demand from governments, firms and academics for more reliable information on innovation, we find here an opportunity to test trademarks as a complementary indicator to the more traditional measures of innovative activity, namely R&D expenditure and patents. Trademarks are used by a wider set of business firms, capturing change in service activities as well as in small and medium-sized enterprises (SMEs).

Trademark-based indicators show promise for advancing research agendas concerned with (i) the rates and directions of product innovations in different industrial sectors, (ii) international patterns of specialisation, (iii) links between technological and marketing activities; and (iv) the evolution of economic organisations and structures. However, simple counts of trademarks are affected by various sources of bias, such as difficulties in data consolidation (e.g. one brand can be protected simultaneously by a combination of words, symbols and 3D design), sectoral differences (the international trademark classification system follows the characteristics of the product and not of the industrial sector; cf. Appendix), and weaknesses in international comparability (given, for example, the different export markets and niches targeted by firms from different countries). All of these issues cannot be completely explored here. The full assessment of trademarks as indicators of innovative activity and industrial competitiveness requires further research, including econometric analysis and in-depth case studies.

The paper is organised as follows. Section 2 discusses what a trademark is from both the IPR and economic perspectives. The third section addresses the conceptual and analytical issues that arise when we consider trademarks as an innovation indicator and a tool for assessing structural transformation. This is followed, in Section 4, by an analysis of the use of CTMs in the EU-15 countries. Section 5 presents detailed data on the use of trademarks in Portugal, based on a survey of a representative sample of Portuguese firms. The final section concludes by summarising the main findings and identifying avenues for further research.

[1] For a recent book related to this subject see Klein (2000).

[2] The data, for the period 1996–2002, does not include the 10 new member states.

2. Brands and logos in business life

People show a tendency to label other beings and things surrounding them, as well as to exert ownership over them. It is thought that the first marks served to indicate the legitimate owner of livestock in Neolithic times, 7000 years ago.[3] Marks later evolved to designate the author of an object and to establish his or her obligation in ensuring the quality of the product. The first documented example of this economic use of trademarks is found in the Roman Empire: Roman bricks bore the stamp of the manufacturer, the date and the place of production. During the Middle Ages, corporations of craftsmen started to identify their workmanship with a mark. In the absence of modern means of advertising, the reputation of trade guilds was carried through marks inscribed in the merchandise. A century after the dawn of the industrial era, a series of explicit trademark laws were enacted in France (1857), the UK (1862) and the US (1870). In this field, as well as in others, framing institutions co-evolved with the actors' behaviour and goals. This section deals with the key institutional features of trademarks as a part of the IPR system and briefly examines the strategic rationale and the historical practice of their use by business firms.

2.1. Trademarks as a property right

According to the World Intellectual Property Organization (WIPO), a trademark is defined as a "distinctive sign, which identifies certain goods or services as those provided by a specific person or enterprise " (WIPO, 2004). The two objectives of protection and dissemination built into this definition are practically indistinguishable. Like patents, a trademark affords the owner legal protection by granting the exclusive right to use it to identify goods or services, or to license its use to another entity in return for payment. Rights are granted at the national level but, unlike patents and copyrights, once trademarks are registered they can be renewed indefinitely on payment of additional fees. The common expectation in trademark regimes is that a registered trademark is used, otherwise it may be cancelled and applied for by another company after a period of grace. Its maintenance by economic agents can thus be seen as indicating the exercise of regular business activities; an unused trademark is implicitly regarded by IPR law as a barrier to economic activity.

Trademarks are an IPR issued by an authorised national government agency following an examination process that is dependent on legal criteria and on a mix of limited human and technical resources administered by that agency. Once an application has been filed, examiners search available databases to detect any other marks in use that may come into conflict with that of the applicant. Whereas patents are granted to inventions on the basis of non-obviousness, inventiveness in the face of prior art and the potential for industrial application, a commercial sign, on the other hand, may be denied registration, but only if judged deceptive to consumers (e.g. if it can be confused with other marks, if it contains a misleading description of the character or quality of the goods or services, etc.), if it is deemed contrary to morality or if it denotes symbols reserved for the use of the state or public organisations. A successfully registered trademark is recognisable by having one of these two symbols attached: "®" or "^{TM}". The lag between the trademark filing and its formal registration is much shorter than that for patents. For instance, while it normally takes up to a year to register a CTM, it can often take over 5 years to obtain a patent from the European Patent Office.

The first international trademark settlement was reached at the Paris Convention of 1883, whereby the countries involved agreed to provide foreign applicants with the same protection regarding marks as that provided to nationals. In this context, the WIPO eventually emerged as the global coordinating institution promoting the development of IPR laws and facilitating the international registration of trademarks. This role stems from the 1891 "Madrid Agreement Concerning the International Registration of Trademarks," which opened up the scope for the protection of marks beyond their market of origin. A more recent international development was the establishment of the CTM in Europe, which came into being with the establishment of the OHIM, a EU institution, in 1994.

Today, trademarks may consist of one word or a combination of words, slogans, letters and numerals; they may also be drawings, symbols, three-dimensional

[3] http://www.lib.utexas.edu/engin/trademark/timeline/tmindex.html—website maintained by the Library of the University of Texas at Austin, which compiles and synthesises information on the history of trademarks from a wide collection of previous works on the topic.

signs such as the shape and packaging of goods, audible signs such as musical or vocal sounds, or distinguishing fragrances, colours and holograms. Notwithstanding the traditional neglect by IPR analysts, trademarks constitute a crucial part of innovation and commercial processes, helping to attract scarce attention from the public and differentiate the nature and quality of products. In addition, as stated by Doern (1999, p. 72), who carried out over 70 interviews with officials of seven agencies, trademarks generate the second highest volume of IPR revenue after patents.

2.2. Brands and business strategy

Brands are commercial signatures that firms create, maintain, protect and reinforce for a number of different marketing goals, in which the introduction of new products is a very relevant one. Brand names have multiple origins. Some are linked to the names of the company founders (Ford, Nestlé), others show a connection to a particular line of business (Microsoft, Airbus), whilst yet others are neologisms (Kodak, Xerox). Brands have become genuine cultural references, especially since the late 19th century with the rise of consumer product industries oriented toward mass markets in western societies. Brands such as Coca-Cola, Campbell's Soup or McDonald's are liked (or disliked) by many, but surely they mean something to everybody. Many brands have even become industrial eponyms, i.e., synonyms in many languages of iconic innovations in the 20th century (Hoover, Gillette, Black & Decker). Many others have established themselves as true national symbols (Ferrari, Nokia) or even come to signify the achievement of transnational partnerships (Airbus).

For better or for worse, brands are with us, and their influence on our lives is not set to diminish in the near future. Judging from newspaper interviews with CEOs and popular business literature, branding is becoming an ever more central concern in corporate strategy. Evidence from everyday life tells us that hardly anything goes unbranded. Even fruits are branded, e.g., Chiquita bananas. But, where does all this interest in brands come from? Surely brands are obviously of interest to buyers. However, the ways in which the awareness and loyalty commanded by brands translates into a competitive asset are not completely clear.

The rationale and influence of trademarks is a relatively neglected aspect in the study of the development of modern corporations. Economics has notoriously little to say about the activity of branding. From the point of view of conventional economics, prices and quantities are still the most important economic variables. The complex deliberation process concerning other attributes, such as quality, features, reputation, support services and so forth, has scarcely been dealt with in economic theory, not to mention applied research (Trajtenberg, 1990, p. 8). Standard industrial organisation textbooks tend to group together issues such as product differentiation and advertising in the same chapter and focus on the relationship between market structure and the advertising-to-sales ratio. Brand decisions are implicitly considered part of advertising policy.[4]

The only paper that we found dealing explicitly with the "economics of trademarks" (an interesting, but seldom cited paper) gives us the usual cost-benefit perspective (Economides, 1987) – a trademark should be filed when its expected value (probability of being accepted times the revenue associated with the brand) exceeds the opportunity cost of applying for it (including the present value of the fees needed to maintain the trademark). The author points out that the key reason why brands are indispensable for the efficient provision of products is because they are a device that facilitates consumer choice in the wide range of variety and quality combinations available in a modern economy. Nevertheless, the argument concedes, monopoly power embedded in the IPR is bound to cause inefficiencies and distortions in resource allocation, with informational benefits to consumers counterbalanced by the barriers to new competition.

In management literature, the question "to brand or not to brand" is dealt with by marketing studies. In terms of the classic marketing framework, brands are

[4] Luís Cabral, a former editor of the *Journal of Industrial Economics* and author of a popular textbook in the field, makes an interesting remark on this subject. Under the heading "Price and non price strategies" of a teaching note available in the companion site to his book, he states that: "(a)dvertising is not one of the core topics of IO this chapter may therefore be omitted from a course directed primarily at economics majors," and he goes on to admit that "(n)ot much economics research has been done on this topic. As a consequence, most of the points presented are rather tentative: more questions are raised than answered." (Cabral, 2000).

Table 1
The world's most valuable brands

	1990	1992	1996	1997	1999	2000
1	Coca-Cola	Marlboro	McDonald's	Coca-Cola	Coca-Cola	Coca-Cola
2	Kellogg's	Coca-Cola	Coca-Cola	Marlboro	Microsoft	Microsoft
3	McDonald's	Intel	Disney	IBM	IBM	IBM
4	Kodak	Kellogg's	Kodak	McDonald's	GE	GE
5	Marlboro	Nescafe	Sony	Disney	Ford	Nokia

Sources: www.interbrand.com/, Kotler et al. (1999), Granstrand (1999).

included in the Product variable of the marketing mix. The "marketing mix" refers to the conventional view of the set of tools that a firm blends to influence the demand for its product – it comprises the well-known "four Ps": Product, Pricing, Promotion and Placement (Kotler et al., 1999). In this literature, however, brands are not seen as a tactical tool for promotion, which instead refers to communication activities including advertising, the sales-force approach to customers, special promotions, public relations, etc. This is evidence that marketers regard brands as a key product characteristic that helps deliver the core benefits of the product to the consumers. The implication of this understanding is that brands do more than just transmit persuasive signals (spurious differentiation[5]), they also have a deeper role in transforming customers' experiences of using the product (actual differentiation).

Customer benefits such as trust and satisfaction have a direct translation into the strategic motivations that underlie trademark management. According to the marketing literature (e.g. Kotler et al., 1999; Aaker, 1991), there is a proliferation of strategic intentions when a company introduces new brands. Since there are no established taxonomies, we give our own incomplete list of the motives and strategies behind the uses of brands—see Box 1.

Box 1: Strategic motivations behind the creation of a brand.

- Building inelasticity around the product and achieving a premium pricing (differentiation, line extensions).
- Improving the conditions for appropriating the returns on innovation whenever other means are not effective.
- Extending the protection conferred by other IPRs after their expiry date (namely patents).
- Opening up opportunities for entering new product segments or entirely new lines of business (brand-stretching or diversification).
- Penetrating new geographical markets (geographical market diversification).
- Signalling changes in strategy or changes in corporate identity (internal and external marketing).
- Entering the market for trademarks (licensing).
- Saving on promotion expenditures (building loyalty).
- Achieving greater bargaining power against suppliers (supply chain coordination).

Naturally, as in the case of patents, trademarks are not all identical in value. The value of a patent is equated to the net money equivalent stemming from the exploration of the rights associated with a particular idea or innovation (Griliches, 1990, p. 1690). That value is generally considered proportional to the magnitude of the innovation protected (Trajtenberg, 1990, p. 5). In management literature, what counts in determining trademark equity is a set of characteristics, such as name awareness, customer loyalty, perceived quality and associations with the brand, that add value to the product being offered (Aaker, 1991). Trademark or brand equity influences the market value of a firm, namely of the large corporations acting on the global market. Interbrand, a specialised consultancy firm regularly releases reports in which it estimates which are the world's most important brands—see Table 1.

Summing up, in seeking and maintaining trademark rights, companies make important economic decisions. Companies decide to create or enhance a protected

[5] See Carlton and Perloff (1994), p. 284.

brand to distinguish themselves from other suppliers and to rise above the competition. By monitoring what happens to trademarks, we can learn a great deal about the entrepreneurial dynamics of firms or aggregates of firms, as well as gain a lever for making inferences about their innovative capacity and marketing capabilities. The central conjecture here is that the analysis of new brands, understood as the development of complementary assets to product innovations, might shed some light upon the innovation process. This is the reason why trademark statistics are interesting in spite of all the difficulties involved in their use and interpretation.

3. Towards a trademark-based innovation indicator

Trademarks match patents in terms of the accessibility and quantity of available data. Although they do not exhibit the same detail of explicit information (patents contain a description of a technological invention and provide the name of the individual inventors that contributed to it, together with citations made to prior art), it is important to understand what trademarks actually indicate. This section will argue that trademarks constitute a unique and underused data source for analysing product innovation and industrial evolution. We will briefly scan the panorama of innovation indicators, to concentrate afterwards on the analytical and empirical factors that lend support to our claim. Finally, some practical aspects of establishing the new indicator will be discussed.

3.1. Indicators in innovation studies

Indicators are means of obtaining quantitative information about certain aspects of a phenomenon. There are, of course, no perfect or complete indicators of innovation, just as there are no perfect indicators of other socio-economic phenomena. The particular problem with the innovation phenomenon is its multidimensional nature, involving qualitative changes in economic, strategic, organisational and institutional factors. Thus, in order to operationalise a trademark indicator, it is important to understand the ontological requisites for achieving reliable knowledge.

Innovation indicators are expected to convey behavioural information on social entities. They detect and register the "levels" and "dynamics" of individuals, companies, institutions and countries. The imperfect nature of the information they afford is always present; they can only provide 'indications'. Indicators capture, but only partially, some aspects of the object in question. One therefore needs to be aware of the intrinsic limitations of an indicator; it is not an objective, direct and complete measurement. Indicators are institutionally created and maintained and often turn out to be put to uses other than those originally intended (Patel and Pavitt, 1995). They are socially constructed, growing more out of practice than theory.[6]

Numbers can be as misleading as words. As Keith Smith (2004) stresses, indicators are not simple numbers. They tend to come with strings attached; they imply associations with given theories or views of the world that shape the way quantitative information is produced and/or interpreted.

The study of the sources and patterns of technological change has progressed enormously since the mid-1960s when the first internationally comparable statistics on R&D activities were published by the OECD, based on the work of Chris Freeman and others. Despite having such a long history, science and technology (S&T) indicators remain contested even today, one paramount reason being the emphasis on inputs rather than outputs and impacts (Godin, 2003).

Hence, we believe that a trademark-based indicator has the potential for making an additional contribution to the understanding of innovation and industrial change. Trademarks have been used by firms as a means of reinforcing the differentiation of their products, and in this context they can emerge as strongly correlated with innovative efforts.

But, in contrast to our view of innovation as an evolving and recursive process of interaction and feedback, we know that trademark data only refers to two specific events (filing and registration) while saying nothing about interactions, inputs, outcomes or differential impacts. This invites us to follow the recommendation of Martin and Irvine (1983) and take trademarks as a partial indicator of innovative performance, which

[6] It must be said that patents are subject to registration processes that are often as judgmental and context-dependent as trademarks (Doern, 1999; Griliches, 1990).

should be combined with complementary data to produce reliable conclusions. The new data should therefore be treated seriously, together with such opportunities as they might contain for future research (Pavitt, 1985).

3.2. Trademarks as an indicator in recent studies

To our knowledge, the first explicit reference to trademarks as an indicator of innovation is the Germany's Technological Performance 2001 Report, written on behalf of the Federal Ministry of Education and Research by a group of eight German research centres (Velling, 2002). The team of authors argue that trademarks can no longer be considered a subordinate industrial right. The fact that the number of trademark registrations filed in Germany tripled during the 1990s is considered a "clear indication that trademarks are being assigned considerably more importance than in the past" (Velling, 2002, p. 20). Although novelty is not a requirement for registering a trademark, the authors say that one can safely assume that trademarks are filed primarily for new products and services. They also point out that commercial enterprises constitute the largest number of applicants. Another aspect emphasised is the extent to which the indicator keeps pace with the market; in Germany it takes just 6 months for a trademark to be entered into databases after application.

In a recent study, Schmoch (2003) also highlighted the suitability of trademarks as an indicator of innovation. Specifically, he argues that "they meet essential preconditions, in particular correlation to innovation, good data access by electronic databases, and the possibility of operationalising them in relevant dimensions of desegregation" (p. 155).

3.3. Why use trademark-based indicators in innovation studies?

The use of trademarks as a complementary indicator in innovation studies can be justified on both analytical and empirical grounds. Research into innovation has shown that firms use different strategies to protect their innovations. Large-scale industrial surveys carried out over recent decades (Levin et al., 1987; Cohen et al., 1996, 2000) have made it clear that firms improve the conditions for appropriating the returns on their innovations through different channels, including lead time and moving quickly down the learning curve, secrecy, exploiting their reputation and implementing sales and services efforts, or using patents. The ranking of these strategies varies according to the sector of the firm, as well as between product and process innovations. A common finding of these studies is that, as a means of appropriating innovation returns, patents tend to rank lower in these hierarchies, with the exception of a few industries in which they play a strategic role. In contrast, marketing activities and assets tend to play a wider and more significant role.

It was also pointed out long ago that "R&D activities typically account for half of the expenditures of launching an innovation (excluding normal investment expenditures), the other half being spent on production engineering and marketing" (Pavitt, 1985, p. 81). These results have been reiterated by many other more recent studies, including the European Community Innovation Surveys. These sorts of findings only confirm the importance of marketing and its tools in connection with innovation activities.

The critical role ascribed to marketing activities and assets within innovation research does not, however, mean that every new trademark is necessarily connected to a new innovative product. As is known, some trademarks are filed to protect products that have no substantive differences in relation to their competitors. But we believe that such applications represent only a minority in the overall demand for new trademarks. This happens because firms would not be able to sustain a trademark (with its associated costs of renewal fees, etc.) if their products had no distinctive advantages or attributes in relation to other offerings in the market.[7]

Many new trademarks are mainly associated with new consumer products, but they also play a role in the marketing of intermediate inputs and capital goods. As is well known, some renowned brands protect this sort of products (Airbus, Komatsu, Bosch). This variation

[7] A distinct situation is to be found when important product innovations are launched in the market together with protective trademarks. After many years of brand-building, these products may still be able to obtain extra profit even when the market has been invaded by clones. An example of this is Bayer aspirin, which has been able to maintain a price differential a long time after the original patent expired and when more than 400 brands of plain aspirin have joined it in the market (Carlton and Perloff, 1994, p. 284).

Table 2
Indicators of innovative activities

Indicator	Type	Advantages	Limitations	Level of analysis	Sources
R&D expenditure	Input	Availability Economic variable	Lack of detail Overestimates large electrical and chemical firms	Country Industry Firm	OECD National statistical offices
Technical personnel	Input	Captures different formal competencies Complement to R&D statistics	Qualifications are not homogeneous Does not capture informal competencies	Country S&T field Industry Firm	OECD national statistical offices
Patents	Output	Detailed Regular and very long-run	Uneven propensities to patent Underestimates small firms, design, mechanical, software and service activities	Country S&T field Firm	OECD National patent and trademark offices European patent office
Trademarks	Output	Captures small firms Covers both manufacturing and service industries	Product classes are considerably aggregated and heterogeneous Captures innovations coming out of universities and public research organizations	Country Firm Product Class	OHIM WIPO National patent and trademark offices

among types of products and sectors shows some similarities to patenting patterns. But, in contrast to patents, trademarks seem to do particularly well in industries where patenting data provides no reliable information about innovation activities, as in many service sectors and also in low-tech industries where smaller firms contribute to most of the final output.

In sum, we argue that trademarks appear to be highly complementary to other widely used innovation indicators (see Table 2). New trademarks are a critical instrument in helping to position new products in the market. When compared to patents, they are closer to commercialisation and cover a broader range of activities from manufacturing product classes to service classes.

3.4. The link between innovation and trademarking

There is also empirical evidence showing a correlation between innovation and the use of trademarks. In his study, Schmoch (2003) finds a highly significant correlation between innovation and trademarks, namely in the manufacturing sector. Focusing on service trademarks, he found considerable differences between sectors, namely in the case of knowledge-intensive services.

The above-mentioned report on the use of IPRs by resident Portuguese firms (Godinho et al., 2003, p. 154) also found sharp and statistically significant trademarking differences across manufacturing sectors according to their technological intensity. Trademark use is not randomly distributed across sectors at the 1% significance level, with high technology-intensive manufacturing industries being heavy users of trademarks. As far as services are concerned, information-intensive services sectors were also found to be associated with a greater use of trademarks than the low information-intensive sectors at the 5% significance level.

The results from the Third Community Innovation Survey (CIS 3) offer further supporting evidence. The

Table 3
CIS 3 results

	Trademark use (%)		Patent use (%)	
	Innovative firms	Non-innovative firms	Innovative firms	Non-innovative firms
Belgium	22	6	15	1
Denmark	25	8	14	1
Germany	21	6	21	2
Greece	23	6	6	0
Spain	15	4	12	2
France	34	9	27	5
Ireland	–	–	–	–
Italy	17	6	13	2
Luxembourg	19	10	8	1
The Netherlands	15	7	14	1
Austria	21	8	18	1
Portugal	18	7	6	3
Finland	25	5	20	2
Sweden	41	15	28	5
United Kingdom	37	14	14	1
Iceland	–	–	5	0
Norway	27	8	18	1

Source: European Commission (2004).

information collected on the use of different forms of protection, such as the registration of patents and trademarks, is presented in Table 3. The table presents the proportion of firms, for the different EU countries, Iceland and Norway, which made use of patents or trademarks to protect their products. The results for each protection method are presented according to the innovative character of the responding firms.

The CIS results indicate that the use of trademarks is higher than that of patents, which is not surprising. But what is relevant for our argument is that innovative firms consistently use more trademarks and patents. The differences in the use of patents and trademarks between innovative and non-innovative firms are evident. The fact that non-innovative firms report considerably less trademark use than innovative firms is reassuring news in relation to the value of trademarks as an innovation indicator.[8]

3.5. Advantages and disadvantages of trademarks as a product innovation indicator

Given the experience with using patents as an output indicator of technological activities (e.g. Griliches, 1990), we will take advantage of this accumulated knowledge and techniques to explore the potential of trademark data as an indicator of product innovation. As with patents, trademark statistics have the advantage of a reasonably unambiguous legal definition, being collected and classified by (the same) specialised institutions in accordance with international agreements, and long time-series are also available. The basic classification system of trademarks follows from the 1957 Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks. The Nice classification system distinguishes between goods and services. It is regularly revised and is now in its 8th edition, which has been in force since January 1, 2002; it has 34 classes of manufactured goods and 11 classes of services (three new classes of services were added in the last edition). One difficulty, however, is that these classes do not have a direct connection with sectoral nomenclatures such as NACE (Statistical Classification of Economic Activities in the European Community). For the purpose of the analysis of innovation and industrial dynamics, the greatest limitation of this classification is that the different classes are highly aggregated.[9]

Another characteristic of trademark data is that a given trademark for a word or symbol can be requested for either just one or several or even all Nice classes. This means that the number of counts in all classes will be much higher than the total number of trademarks applied for, even if it is possible to identify such multiple classifications. This is a limitation for cross-sectoral analysis, and it is different in this respect from other output indicators. Furthermore, trademark applications are not classified according to the main product line or productive sector of the applicant company. Conversely, a given product or supplier can also be protected by more than one trademark. For instance, the Coca-Cola beverage is protected by the word mark

[8] The fact that a higher proportion of non-innovative firms stated that they used trademarks (4–15%) rather than patents (0–5%) does not contradict our point, since we are arguing that what should be taken as an indicator is the flow of new trademarks and not the total stock of existing trademarks, which naturally includes many older products that can no longer be considered as “innovations”.

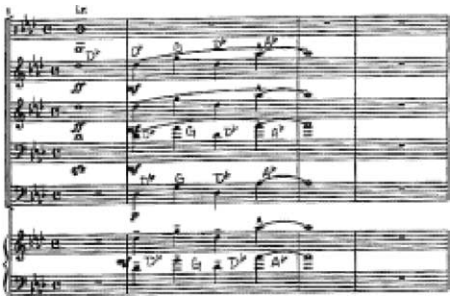
[9] For example, Class 5 covers the product categories of pharmaceutical, medical and veterinary preparations, being mixed together with dental wax, disinfectants, fungicides, herbicides and even baby food.

Box 2: Examples of overlapping protection using trademarks and other IPRs.

According to the Coca-Cola corporation, its flagship brand is the most widely recognised trademark in the world, with 94% of the world's population recognising it, and it is also the most widely recognised word after "OK". The trademark for the word "Coca-Cola" was obtained in 1887. The type of print used for the logo is called "Spencerian Script". In an effort to safeguard the shape of the bottle, it was registered in 1977 as a three-dimensional mark. The argument was that the packaging distinguished the beverage from others.

In another example, Intel has also registered its well-known jingle. The musical notation describing Intel's registered jingle is pictured below.

The relationship between trademarks and other IPRs, namely industrial design and copyright, is gradually evolving. Another aspect of these times of change is the institutional tension created by the disputes between companies over trademarks and domain names on the Internet.



Sources: www.coca-cola.pt, www.dww.com/articles/protect.htm

"Coca-Cola", by its distinguishing logo (the stylised letters composing the word underlined by a ribbon) and by a three-dimensional mark protecting the distinctive shape of the bottle. Intel Corporation did not only protect its Intel name with a word mark and a corresponding logo, it also applied for a sound mark (see Box 2). These considerations imply that there is no one-to-one correspondence between a new product and a new trademark. Raw data can lead us to overestimate the patterns observed. However, the multiplication of trademarks in certain product categories surely constitutes evidence of increased dynamic competition, whether through horizontal and/or vertical differentiation.

A further limitation is that there are many unregistered brands in use in the market place, for instance many small firms such as shops, restaurants and the like work under the official firm designation and do not register it as a brand name. This problem is similar to the one that is found in patents: not all inventions can be patented and not all patentable inventions are patented. In the case of trademarks, brands take the place of inventions. Unlike inventions, however, a given brand might be protected by many trademarks (words, logos, 3D mark, sound, etc.) whereas a novel device is supposed to be protected by just one patent. The effect of this on different companies, product categories, industries and countries is not yet fully clear, and other limitations are possibly not yet identified. One lesson to be drawn from patent analysis is that decisions to file an IPR vary among different companies, technologies, industries and countries. Likewise, there is no reason why decisions to trademark should not vary as well.

On the positive side, the large and increasing numbers of trademarks allow us to remain confident that many aspects of corporate commercial activities can be revealed through this indicator. Because they are cheaper and do not require a technological breakthrough, a much wider range of SMEs are likely to be involved in applying for trademark rights compared to patent rights. The nature of the products offered by service companies also make them more appropriate for trademark protection than for patent protection. This allows us to cover a wide range of traded products and a broad spectrum of the industrial structure.

3.6. The sources of trademark information

Only with methodological care can trademarks be used as an indirect measure of innovation and a tool for assessing structural change in the economy. So far, trademark data has not been widely used as an indicator of innovative and economic activity. As such, the sources for trademark information have to be found in places other than amongst the standard producers of S&T indicators, like, for example, national institutions, such as statistical offices, or international institutions, such as the OECD. Amongst the national sources, the

Patent and Trademark Offices are the public agencies traditionally entrusted with registering and keeping the records of trademarks. The problem, however, is that the data supplied by those entities is not easily accessible or ready for statistical treatment, since providing data is not the main mission that these institutions are entrusted with. The major international public agencies responsible for trademarks are WIPO and OHIM. OHIM has published monthly and annual surveys of trademark activity since 1996, broken down according to the applicant's country, year of filing and registration, trademark classes of goods and services and trademark types (word mark, figurative mark, three-dimensional mark, etc). Finally, amongst private sources, there is an increasing variety of firms compiling and selling databases on trademarks, mostly for consultancy purposes.

In this paper, we use CTMs as a source of internationally comparable trademark statistics. Why use OHIM data? This EU trademark system is certainly biased towards the member states' commercial activities, thereby giving rise to an over-representation of European trademarks. However, as the enlarging EU is the world's largest market, it is certainly an important space for protecting brands. Moreover, given the fact that CTMs are attractive to non-EU applicants and that applications from all countries are considered on an equal footing, we have, henceforth, a useful basis for international comparisons. Furthermore, different trademark applications are judged by precisely the same criteria, using the same database. From an instrumental perspective, OHIM presents the researcher with a wealth of comparable trademark data and reports are freely accessible online. It should also be noted that we will focus on the flux of new trademarks and not on the stock of existing trademarks. This perspective will gear our study towards capturing dynamic behaviour and identifying the evolution of the trademarking performances of firms from different countries.

4. Empirical exploration of CTM data

This section addresses two main questions: (1) can innovation and industrial change be assessed through trademark data? and (2) can significant differences and distinct trends be identified in the trademarking performance of individual countries? We will answer both questions affirmatively. Although the methodological understanding of the use of trademarks is far from mature, our results show that this indicator can generate useful insights for researchers, policy-makers and managers.

This sub-section presents data on the rate and direction of CTM applications. We start with the basic observation of aggregate trademark applications. Fig. 1 shows the total number of CTM applications since the EU Community Trademark was instituted. In 7 years, 294,625 CTMs were applied for by companies from the EU and around the world, corresponding to an average of about 42,000 trademarks a year. Of this total, 65% were word marks and 34% were figurative marks (logos).

The high level of trademark applications in the first year (1996) is explained by the start of the new registration system, since many firms were waiting for its establishment. If we compute the average rate of growth for the period 1996–2002, we have a 0.6% change. But if we disregard the first year figure, there has been a growth of 8.7% in annual applications. Later years reveal a downward trend in the number of applications, a phenomenon probably caused by the general macroeconomic downturn and the readjustment of business investment expectations.

What about the territorial origin of those applications? As expected, Table 4 shows that applications are dominated by the EU-15 member states.

Within the EU-15 countries, trademark applications are heavily concentrated (Table 5). Germany, the UK and Italy alone account for 59% of the EU-15 total applications in the period from 1996 to 2002. The first five countries in trademark applications correspond to the largest European economies and are responsible for 80% of all applications. Outside the EU-15 group, the

Table 4
Origin of CTM applications, 1996–2002

	Annual average 1996–2002	
	Number of applications	Share (%)
EU-15	26,216	62
Non-EU countries	15,874	38
Total	42,089	100

Source: OHIM (2003).

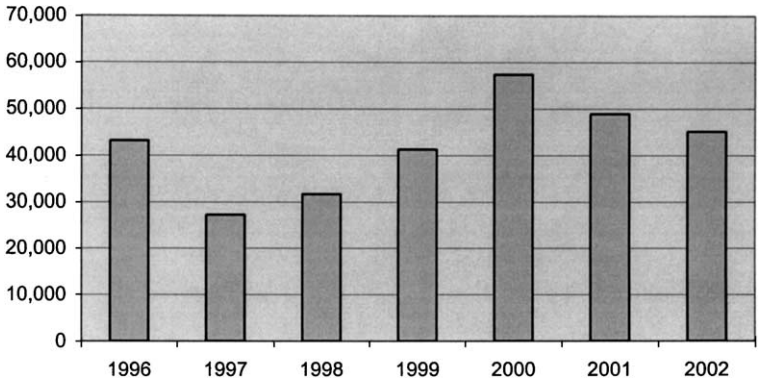


Fig. 1. CTM applications, all countries, 1996–2002. *Source*: OHIM (2004).

US represents 62% of the applications made in this period. The US is the biggest single user of the CTM system, with 25% of all trademark applications in the period under analysis.

The normalisation of these figures in keeping with population size and the size of the economy provides yet further information. Besides Luxembourg, where a high number of MNC headquarters are located, a number of small countries appear at the top, including the Nordic countries, Ireland and Austria. In the European context, their pattern of business activity appears to be trademark-intensive relative to their population size and GDP. The UK, and to some extent Germany, perform particularly well among the largest countries.[10]

Table 5
Trademark performance among the EU-15, 1996–2002

1996–2002		CTM/population		CTM/GDP	
DE	48,667	LU	3,383	LU	72
GB	38,524	DK	870	DK	29
IT	21,432	IE	732	SE	29
ES	19,438	SE	714	GB	26
FR	18,355	GB	645	IE	25
NL	7,641	DE	592	ES	24
SE	6,331	AT	545	DE	23
DK	4,642	Fl	538	Fl	21
AT	4,417	ES	493	AT	20
BE	4,253	NL	482	NL	17
Fl	2,785	BE	414	BE	16
IE	2,773	IT	375	IT	15
PT	1,921	FR	312	FR	13
LU	1,485	PT	192	PT	11
GR	845	GR	80	GR	5
EU	183,509	EU	488	EU	20

Sources: OHIM (various years); OECD (population and GDP). *Note*: BE—Belgium; DK—Denmark; DE—Germany; GR—Greece; ES—Spain; FR—France; IE—Ireland; IT—Italy; LU—Luxembourg; NL—The Netherlands; AT—Austria; PT—Portugal; Fl—Finland; SE—Sweden; GB—United Kingdom.

In dynamic terms, the overall EU performance has been ahead of the "rest of the world". The annual average of CTM applications, for the EU-15, during the last 3 years of the period analysed (2000–2002) was 55.8% greater than the average for the first 3 years (1996–1998), as revealed in Table 6. Within the EU, Greece, Luxembourg and Ireland, followed by Portugal, France, Italy and Spain have been increasingly active in applying for new CTMs. Belgium and The Netherlands have had the lowest growth rates during this period.

Heterogeneity is also evident in terms of the distribution of applications by Nice classes. Table 7 shows the ten most "trademarked" product classes between 1996 and 2002. These accounted for 53.2% of total applications. In 2002, the most sought after product categories were: instruments (Class 9), research (Class 42), business consultancy (Class 35), paper products (Class 16) and education (Class 41). It is interesting to note that service categories account for half of the most trademarked classes. Among these, the classes with the highest level of use broadly correspond to what Miles

[10] We should stress that European patent data points to a similar pattern (Eurostat, 2002). Within the EU, Germany accounts for the largest share of all patent applications at the European Patent Office (EPO) with 42.4%. France and the UK accounted for 14.4% and 12.9%, respectively, showing that European patent applications at the EPO are largely skewed towards the large economies. However, when population size is taken into consideration, we again have the small Scandinavian economies outperforming the larger economies, with Sweden and Finland displaying the highest rates.

Table 6
Detailed CTM annual data for the EU-15, 1996–2002

	1996	1997	1998	1999	2000	2001	2002	Growth (%) between annual averages 2000–2002/1996–1998
BE	643	418	562	574	767	687	598	26.4
DK	706	473	526	621	813	767	727	35.3
DE	7,714	3,911	4,811	7,040	9,935	8,285	7,113	54.1
GR	85	65	78	111	163	148	197	122.8
ES	2,794	1,468	1,965	2,609	3,466	3,426	3,759	71.0
FR	1,610	1,891	2,131	2,735	3,402	3,171	3,411	77.2
IE	282	217	289	436	640	484	429	97.1
IT	2,211	2,070	2,378	3,263	4,227	3,570	3,719	72.9
LU	137	112	148	227	281	279	233	99.7
NL	1,069	908	877	994	1,518	1,106	1,055	28.9
AT	678	393	537	615	739	711	717	34.8
PT	161	183	232	274	350	297	378	78.0
FI	358	282	330	387	513	483	438	47.8
SE	855	713	787	870	1,375	959	801	32.2
GB	5,705	3,659	4,234	5,303	7,930	6,141	5,860	46.6
EU	25,008	16,763	19,885	26,059	36,119	30,514	29,435	55.8

Source: OHIM.

(2004) and Godinho et al. (2003), respectively classify as knowledge-intensive business services (KIBS) and information-intensive service sectors.

How do intangible products measure up to tangible ones, on the whole? Table 8 shows that, while classes of goods still represent the major segment, services have generally been increasing in importance. This might be interpreted as evidence of structural change in the EU economies.[11] The study by Velling and his colleagues (2002) finds a similar pattern for German home trademark applications. Godinho et al. (2003) report similar conclusions for the Portuguese case (cf. the next section).[12]

If services are a dynamic category, how have they changed in terms of structure? A look at the individual service classes can give further insight into the evolution of service industries and their relative dynamics. As Table 9 shows, the service industries with most trademark applications are all part of the knowledge-based services: research (Class 42); business consultancy and advertising (Class 35); education (Class 41); and telecommunications (Class 38). The Nice classes growing above the average of the services sector are also part of knowledge-based services: business consultancy and advertising (Class 35) and telecommunications (Class 38).

Two difficulties do, however, limit our capacity to produce more precise conclusions. On one hand, as

Table 7
Most "trademarked" Nice product classes in CTMs

	Nice class	Accumulated applications 1996–2002	Share (%)
1	9. Instruments	92,335	11.9
2	42. Research and other services	72,661	9.4
3	16. Paper products	52,956	6.8
4	35. Advertising and business consultancy	48,476	6.2
5	41. Education	39,172	5.0
6	25. Clothing and footwear	35,340	4.6
7	38. Telecommunications	34,089	4.4
8	5. Pharmaceutical and hygiene products	25,638	3.3
9	36. Finance	24,415	3.1
10	3. Detergents and cosmetics	21,271	2.7
Total			57.5

Source: OHIM.

[11] The latest OECD figures show that the service sectors now account for 70% of the OECD's GDP (OECD, 2003).

[12] A suggestion advanced in the latter study is that a contributory factor to the spectacular increase in service trademarks in the 1990s was the rise in this type of trademark application amongst manufacturing companies, which it is not possible to confirm with these data.

Table 8
Sectoral dynamics of CTM "trademarking"

	Share (%)							Growth (%) between annual averages 2000–2002/1996–1998
	1996	1997	1998	1999	2000	2001	2002	
Goods	76	72	71	66	57	62	66	37
Services	24	28	29	34	43	38	34	150

Source: OHIM.

Table 9
Composition of CTM service class applications

Nice class	Descriptor	1996–2002	Share of service classes (%)	Growth (%) between annual averages 2000–2002/1996–1998
35	Business consultancy	49,564	18.7	218
36	Finance	24,025	9.1	144
37	Construction	17,814	6.7	66
38	Telecommunications	33,654	12.7	244
39	Transportation	17,346	6.6	94
40	Processes	6,607	2.5	94
41	Education	39,172	14.8	124
42	Research	72,661	27.4	136[a]
43	Restaurants and hotels	1,883[b]	0.7	–
44	Medical care	1,501[b]	0.6	–
45	Personal services	506[b]	0.2	–
Total services		264,733	100	150

Source: OHIM.
[a] "Trend" figures for research (Class 42) include the 2002 data for Classes 43–45, which have only existed as a breakdown of the former Class 42 since 2002.
[b] Only 2002 data.

already mentioned, Nice classes are highly aggregated, containing many different kinds of products under the same heading. On the other hand, the short life of this EU IPR regime calls for caution in the discussion of the trends and comparative dynamics of product classes.

5. Patterns of use of national trademarks by Portuguese firms[13]

In this section, we explore the data for the Portuguese case in greater detail, drawing on an extensive study on IPR use in Portugal (Godinho et al., 2003). The information provided by this study has the distinct advantage of combining publicly available statistics of Portuguese national trademarks with data from a firm-based survey of business attitudes and behaviour towards IPRs. In this section, we will concentrate on a relatively recent period, from 1980 to 2001, and on the use of national trademarks (those that provide protection exclusively within the Portuguese territory).

With a yearly growth of about 10% a year, trademarks granted to resident companies by the Portuguese Patent and Trademark Office (INPI) surpassed annual GDP growth. Portuguese trademarkers are mostly business firms (80%), the rest being private individuals (most of whom are likely to be owners of small firms). During this period, concession rates (trademarks registered on the base of trademarks applied for) were 86% for residents and 96% for non-residents. Non-residents tend to have trademarks that last longer: the total dropout rate for this group in the period men-

[13] Trademark use in Portugal has a long history. The oldest trademark in Portugal still in use today was registered on February 20, 1890. The trademark *Real Companhia Vinícola do Norte de Portugal* was given to the company with the same name for the specific use of stamping it on Port wine casks (this trademark was registered as an International Trademark in 1925). Among the 10 oldest registered trademarks, the majority of them correspond to the wine and olive-oil businesses, reflecting the productive profile of the Portuguese economy at the time.

Table 10
Distribution of Portuguese national trademark filings

	Residents			Non-residents		
	Goods (%)	Services (%)	Total	Goods (%)	Services (%)	Total
1980–1984	89.7	10.3	4,665	87.8	12.2	4,435
1985–1989	87.1	12.9	9,285	87.4	12.6	9,971
1990–1994	80.5	19.5	22,669	84.6	15.4	22,563
1995–1999	66.3	33.7	31,279	78.9	21.1	17,700
2000–2002[a]	51.0	49.0	27,751	72.4	27.6	7,575
Total	68.4	31.6	95,649	82.2	17.8	62,244

Source: Godinho et al. (2003).
[a] Until June 2002.

tioned was 11%, while for residents it was 19%. Non-residents, however, have a lower growth rate of trademark filings, as the curve of their applications peaked just after Portugal became a member of the European Community in 1986 and then flattened out. Among non-residents, USA is the largest applicant with 39% of all non-resident applications, followed by the UK (15%), Spain (12%), Japan (6%), France (4%), Germany (3%) and Brazil (3%). On the whole, EU-15 filings account for 42% of the total non-resident trademarking. From the mid-1990s onwards, Spanish and Brazilian companies became the most dynamic foreign trademarkers.

Portuguese national trademarks are also classified on the basis of the Nice Agreement. The trademark classes most sought after by residents are pharmaceutical and hygiene products (Class 5), instruments (Class 9), detergents and cosmetics (Class 3), paper products (Class 16), and clothing and footwear (Class 25). This pattern reveals some differentiation by trademark filings between residents and non-residents and, above all, an overall predominance of goods classes in relation to services. However, over the last decade, some changes have been witnessed, with several service classes showing a much higher demand, namely Class 41 (education), Class 42 (research) and Class 35 (business consultancy). As in the case of the CTM applications observed in the previous section, these transformations are essentially characterised by a gradual fall in the proportion of tangible goods and by increases in service products, with trademark filings now divided equally between goods and services. Table 10 shows this pattern. Also as expected, non-residents do not trademark as much in service classes as residents. This is due to the fact that a good deal of service products are non-tradable.[14]

The information about the use of IPRs by a representative sample of 724 resident firms, collected by a survey carried out in 2003, shows that the interest in and actual use of IPRs is still very limited. Only 39% of business firms claim to have any knowledge of INPI's activities, while a smaller proportion (19%) acknowledges actual use of IPRs or the intention to use them in the near future. As indicated in Godinho et al. (2003), these values have a statistically significant variance across sectors and display a positive association with firm size. These results are not surprising. They stem from a variety of reasons, the most important ones being: (1) the structure of the Portuguese economy (a relatively low weight of both high-tech industries and information-intensive services and a virtually complete absence of large firms acting on global markets); (2) a low supply of critical competencies (required to explore IPRs commercially and manage complementarities within IPR portfolios); (3) low access both to lead users and to technology markets. This last hurdle inhibits the capacity to commercially exploit any IPR undertaken by firms, inventors or public research organisations.

In terms of strategic attitudes towards IPR, more than half of the surveyed firms expressed a "low interest" in IP issues with responses varying between 54.0% and 86.7% for different IPR types. Trademarks are the most attractive IPR instrument, with 17.8% of the

[14] This pattern is likely to see some changes in the future given that negotiations are now underway for the expansion of the General Agreement on Trade in Services (GATS).

firms showing "high" interest and an additional 28.2% "medium" interest. In terms of actual use, 4.2% of the surveyed firms state that they have applied for patents or utility models, while 17.7% applied for trademarks and 2.6% for protection related to technical designs and industrial models.

As reported in Godinho et al. (2003), a number of variables reveal a statistically significant degree of association with the importance attributed to trademarks or their effective use in the past. These factors include the existence of an autonomous marketing department in the company, the relationship with specialised consultancies, the size of marketing and R&D budgets, or the knowledge of the national IPR agency's services and role. However, whether a firm is geared to intermediary products or final consumer products does not discriminate the firms in terms of the importance attributed to trademarks, but only in terms of their actual use: consumer goods firms tend to use more trademarks.

Within each sector, the results generally indicate a positive correlation between the use of patents and the use of trademarks, which is in line with the hypothesis of using trademark filings as a complementary indicator of innovation. The results from the survey mentioned above reveal that the OECD technological intensity classification discriminates particularly well in relation to the use of trademarks by Portuguese firms. For manufacturing as a whole, the differences between the OECD sectors are statistically significant for the importance attributed to, as well as the actual employment of, both patents and, particularly, trademarks during the past 10 years. Analysing the sectors pair-wise, the differences are found to be significant for the use of trademarks in manufacturing industries (with the exception of the difference in the use of trademarks between medium-low-tech and low-tech manufacturing sectors). This means that "higher-tech" sectors tend to care about, and actually use, more trademarks in the course of their business activities than "lower-tech" sectors. In spite of the fact that the "higher-tech" equivalence to innovative industries is not at all unproblematic,[15] the fact that "higher-tech" sectors tend to have their core competencies in fast-growing technologies lends additional support to the claim that trademarks can be used as an ancillary yardstick in innovation studies.

As far as the service sectors are concerned, highly information-intensive services, such as consultancies, telecommunications and banking are also found to make greater use of trademarks in their business strategies than low information-intensive sectors (at 10% level). It should be noted that the analysis does not provide the same conclusion regarding differences in the use of patents between the high and low information-intensive service sectors. This suggests that trademarks can reveal aspects of innovation and industrial dynamics that are not fully apprehended by patent analysis, namely within the service sector.

6. Concluding remarks

The question this paper set out to answer was "what can we learn from trademarks as an indicator of innovation and industrial evolution?" The objective was to test trademarks as an indicator of product innovation activity and as a measure correlated with structural change in contemporary economies.

Brands are a very important part of firms' marketing plans and strategies. They are used to protect firms' products and business identity, but also for other purposes, such as product differentiation and business diversification. Firms make a huge (and increasing) use of brands as a (dynamic) competition tool. As a result, applications for service trademarks boomed in the 1990s, and this trend was led by information-(or knowledge)-based services such as Business Consultancy, Telecommunications and Education. Within the EU-15 group, a number of small countries seem to exhibit very strong marketing capabilities, namely the Nordic countries, plus Ireland and Austria.

The analysis of more detailed data on Portugal revealed that the country is lagging behind in terms of marketing capabilities, which are critical for supporting innovation and trade competitiveness in external markets. However, Portugal is showing clear signs of

[15] Recent contributions have questioned the OECD classification, mainly on the grounds that "lower-tech" sectors should not be regarded as incapable of innovating (Smith, 2002; von Tunzelmann and Acha, 2004). Hence, "high-technology industries" and "high-technology" should not be confused. However, the fact that "lower-tech" sectors are increasingly competent in the new technologies of the emergent techno-economic paradigm does not mean that the "higher-tech" sectors are acquiring knowledge in older and more mature areas (Mendonça and von Tunzelmann, 2004).

structural change. It has been following the general trend towards an increase in service trademarking. This observation is compatible with the evidence from the CTM database on the dynamism of knowledge services in recent years. Moreover, the composition of this trend is biased towards education, research and business consultancy categories. Evidence from the Portuguese case suggests that companies which tend to use one kind of IPR also use other IPRs. This is in keeping with the CIS results that were analysed in Section 3. And it further implies that high-technology sectors, which use more patents, also make a more intensive use of trademarks. The data from a survey of Portuguese firms also shows that the service industries usually classified as intensive users of information are the ones that use most trademarks.

Combined with the increasing availability of electronic data, these results indicate an interesting opportunity for using trademarks as indicators of innovation and industrial change. We have argued that trademark data can serve the purpose of acting as a partial output indicator of innovations introduced into the goods and services markets and can therefore be used as an empirical yardstick for measuring overall changes in the patterns of economic activity. This can be especially useful for advancing research in innovation studies, industrial dynamics and international economics, as well as in economic and business history. We therefore conclude that new knowledge about innovation and industrial change can be acquired by including trademark analysis in the box of empirical tools. However, more work needs to be done in order to better understand the potential uses and limitations of this new source of data. The fact that much still remains to be learned is the best of the good news.

There are a variety of ways in which trademark data can be further analysed. Aspects that can be researched include the life cycle of brands, as well as factors and trends in trademark licensing. The relationship between trademarks and other IPRs in the context of integrated IPR management can be further explored using quantitative data. The cross analysis of trademark data, regarding the ways in which different trademarks (word marks, logos, 3D, sound, etc.) are combined in order to protect given products or applications across different Nice classes (requiring extensive data cleaning and database management) is promising, but not very clearly understood. Seen from this perspective, trademarks can also be taken as indicators of the marketing capabilities of profit-oriented firms. Studying how firms exploit trademark positions in certain classes in order to make inroads into other classes could also yield valuable insights into the dynamics of product diversification. Trademark analysis could also be of help for those researching the innovative performance of traditional industries and intermediate industries. Since “lower-tech” firms are found to be patenting in “high-technologies”, they may also be found to be trademarking in “higher-tech” product classes. In a parallel way, scholars studying the dynamics of service innovation may find it fruitful, for instance, to investigate those long-established manufacturing firms that are increasingly active in service trademarking. Finally, the extent to which trademark data can contribute towards our understanding of why some countries grow faster than others constitutes a research challenge that is worth exploring in the future. In sum, our paper claims that trademarks display a high potential for revealing new stylised facts and for illuminating puzzles about innovation that are still in need of explanation. This potential needs to be realised with further theoretical, methodological and empirical work.

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Appendix A. Nice classification system

1. Chemicals used in industry, science and photography, as well as in agriculture, horticulture and forestry; unprocessed artificial resins, unprocessed plastics; manures; fire extinguishing compositions; tempering and soldering preparations; chemical substances for preserving foodstuffs; tanning substances; adhesives used in industry.
2. Paints, varnishes, lacquers; preservatives against rust and against deterioration of wood; colorants; mordants; raw natural resins; metals in foil and powder form for painters, decorators, printers and artists.
3. Bleaching preparations and other substances for laundry use; cleaning, polishing, scouring and abrasive preparations; soaps; perfumery, essential oils, cosmetics, hair lotions; dentifrices.
4. Industrial oils and greases; lubricants; dust absorbing, wetting and binding compositions; fuels (including motor spirit) and illuminants; candles and wicks for lighting.
5. Pharmaceutical and veterinary preparations; sanitary preparations for medical purposes; dietetic substances adapted for medical use, food for babies; plasters, materials for dressings; material for stopping teeth, dental wax; disinfectants; preparations for destroying vermin; fungicides, herbicides.
6. Common metals and their alloys; metal building materials; transportable buildings of metal; materials of metal for railway tracks; non-electric cables and wires of common metal; ironmongery, small items of metal hardware; pipes and tubes of metal; safes; goods of common metal not included in other classes; ores.
7. Machines and machine tools; motors and engines (except for land vehicles); machine coupling and transmission components (except for land vehicles); agricultural implements other than hand-operated; incubators for eggs.
8. Hand tools and implements (hand operated); cutlery; side arms; razors.
9. Scientific, nautical, surveying, photographic, cinematographic, optical, weighing, measuring, signalling, checking (supervision), life-saving and teaching apparatus and instruments; apparatus and instruments for conducting, switching, transforming, accumulating, regulating or controlling electricity; apparatus for recording, transmission or reproduction of sound or images; magnetic data carriers, recording discs; automatic vending machines and mechanisms for coin-operated apparatus; cash registers, calculating machines, data processing equipment and computers; fire-extinguishing apparatus.
10. Surgical, medical, dental and veterinary apparatus and instruments, artificial limbs, eyes and teeth; orthopaedic articles; suture materials.
11. Apparatus for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, water supply and sanitary purposes.
12. Vehicles; apparatus for locomotion by land, air or water.
13. Firearms; ammunition and projectiles; explosives; fireworks.
14. Precious metals and their alloys and goods in precious metals or coated therewith, not included in other classes; jewellery, precious stones; horological and chronometric instruments.
15. Musical instruments.
16. Paper, cardboard and goods made from these materials, not included in other classes; printed matter; bookbinding material; photographs; stationery; adhesives for stationery or household purposes; artists' materials; paint brushes; typewriters and office requisites (except furniture); instructional and teaching material (except apparatus); plastic materials for packaging (not included in other classes); printers' type; printing blocks.
17. Rubber, gutta-percha, gum, asbestos, mica and goods made from these materials and not included in other classes; plastics in extruded form for use in manufacture; packing, stopping and insulating materials; flexible pipes, not of metal.
18. Leather and imitations of leather, and goods made of these materials and not included in other classes; animal skins, hides; trunks and travelling bags; umbrellas, parasols and walking sticks; whips, harness and saddlery.
19. Building materials (non-metallic); non-metallic rigid pipes for building; asphalt, pitch and bitumen; non-metallic transportable buildings; monuments, not of metal.
20. Furniture, mirrors, picture frames; goods (not included in other classes) of wood, cork, reed, cane,

wicker, horn, bone, ivory, whalebone, shell, amber, mother-of-pearl, meerschaum and substitutes for all these materials, or of plastics.
21. Household or kitchen utensils and containers (not of precious metal or coated therewith); combs and sponges; brushes (except paint brushes); brush-making materials; articles for cleaning purposes; steel wool; unworked or semi-worked glass (except glass used in building); glassware, porcelain and earthenware not included in other classes.
22. Ropes, string, nets, tents, awnings, tarpaulins, sails, sacks and bags (not included in other classes); padding and stuffing materials (except of rubber or plastics); raw fibrous textile materials.
23. Yarns and threads, for textile use.
24. Textiles and textile goods, not included in other classes; bed and table covers.
25. Clothing, footwear, headgear.
26. Lace and embroidery, ribbons and braid; buttons, hooks and eyes, pins and needles; artificial flowers.
27. Carpets, rugs, mats and matting, linoleum and other materials for covering existing floors; wall hangings (non-textile).
28. Games and playthings; gymnastic and sporting articles not included in other classes; decorations for Christmas trees.
29. Meat, fish, poultry and game; meat extracts; preserved, dried and cooked fruits and vegetables; jellies, jams, fruit sauces; eggs, milk and milk products; edible oils and fats.
30. Coffee, tea, cocoa, sugar, rice, tapioca, sago, artificial coffee; flour and preparations made from cereals, bread, pastry and confectionery, ices; honey, treacle; yeast, baking-powder; salt, mustard; vinegar, sauces (condiments); spices; ice.
31. Agricultural, horticultural and forestry products and grains not included in other classes; live animals; fresh fruits and vegetables; seeds, natural plants and flowers; foodstuffs for animals, malt.
32. Beers; mineral and aerated waters and other non-alcoholic drinks; fruit drinks and fruit juices; syrups and other preparations for making beverages.
33. Alcoholic beverages (except beers).
34. Tobacco; smokers' articles; matches.
35. Advertising; business management; business administration; office functions.
36. Insurance; financial affairs; monetary affairs; real estate affairs.
37. Building construction; repair; installation services.
38. Telecommunications.
39. Transport; packaging and storage of goods; travel arrangement.
40. Treatment of materials.
41. Education; providing of training; entertainment; sporting and cultural activities.
42. Scientific and technological services and research and design relating thereto; industrial analysis and research services; design and development of computer hardware and software; legal services.
43. Services for providing food and drink; temporary accommodation.
44. Medical services; veterinary services; hygienic and beauty care for human beings or animals; agriculture, horticulture and forestry services.
45. Personal and social services rendered by others to meet the needs of individuals; security services for the protection of property and individuals.

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