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# Patterns and determinants of trademark use in Portugal

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## Abstract
This paper analysis the patterns and determinants of trademark use based on a newly created database that crosses information on national trademark applications with microdata of all the firms with employees in Portugal. We describe the main patterns of trademark use in the country, and identify the characteristics of firms that are typically associated with trademarking.

The descriptive analysis shows that trademarking is: uncommon for most  firms; asymmetrically distributed across industries, with both higher-knowledge intensive and some less knowledge-intensive industries displaying higher than average use of this IPR; strongly concentrated in the metropolitan regions (with some smaller regions also showing a relatively high intensive use of trademarks); less frequent among firms with less than 10 employees than in higher firm size groups; and more common among new firms than in older ones.

Our regression results largely confirm the notion that firm-specific variables are very relevant predictors of trademark use, after controlling for industry effects. In particular, new firms reveal a higher propensity for trademarking, while

trademark use is more probable among larger firms (especially, multi-establishment ones). Human capital is also a relevant determinant of trademarking.

The regression results also show that geographical proximity plays an important role in explaining the trademark use by firms. This is especially the case for neighbouring firms that belong to the same industry, suggesting that trademarking is a characteristic feature of some local clusters.

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# Patterns and determinants of trademark use in Portugal

## 1 INTRODUCTION

A trademark is a sign used in economic activities by a producer or vendor to identify a particular product or service. It enables offerings of goods or services to be somehow differentiated, allowing consumers to distinguish between different goods and recognise their provenance (Ramello, 2006). Even though a trademark is not directly informative about the quality of a product, it often provides this type of information by reference to costumers' own, or others', past experience (Economides, 1998). Their economic value, therefore, derives from trademarks being a solution (even if an incomplete one) to problems of asymmetric information. On the other hand, as consumers' trademark loyalty also works as a barrier to entry of new competitors in a market, it may also bring adverse effects by supporting existent oligopolistic advantages (Economides, 1998).

Beyond its economic relevance in social welfare, trademarks have been a major focus of attention due to their strong association with innovation activities. Being a source of visibility and reputation, trademarks become a strategic asset to firms competing on the basis of product differentiation and customer loyalty. When successful, trademarks become associated with high perceived value to users and, consequently, are a source of higher margins for the firms that fill them. To the extent that trademarks help firms to appropriate the returns of investments in product quality, they constitute an incentive to the introduction of new or improved goods and services in the economy (Landes and Posner, 1987; Economides, 1998). In other words, by contributing to the distinctiveness of firms' offers, trademarks give them an additional incentive to innovate.

In fact, trademarks seem to be strongly related with firms' innovation activities. Mendonça et al. (2004) found that innovative firms are more intensive users of trademarks, and they use trademarks more often than patents. Millot (2009) suggests that trademarks, taken as indicators, can be particularly suited to capture the presence of non-technological innovations and innovation activities in low-tech and service industries – cases in which the availability of innovation indicators is typically poor. In this sense, trademarks can be used to deepen our knowledge about innovation dynamics, especially in the context of less knowledge-intensive economic structures.

This does not mean, however, that every new trademark is necessarily related to a new or improved product, nor do trademarks provide any measure of the degree of innovativeness of a new product. Still, firms that fill trademarks are willing to pay a cost in order to obtain and maintain an exclusive right to use a sign – which would hardly be the case if they did not believe that new trademarks will allow customers to attach a distinct value to the associated products.

Consequently, the use of trademarks as indicators of innovation or, at least, of some sort of entrepreneurial drive, has been growing in recent years. For example, Schmoch (2003) and Schmoch and Gauch (2009) have used trademarks in order to study innovation in services. Krasnikov et al. (2009), Greenhalgh and Rogers (2007), and Griffiths et al. (2005) have taken trademarks as a measure of innovativeness and assessed the impact of trademarking on firm performance. And Mangàni (2007) has used trademarks to measure the variety and quality of products.

The recent rise in the use of trademark statistics in innovation and marketing studies is partly explained by the increasing availability and reliance of official databases, both at the national and international levels. However, those databases typically include very little information about the trademark holders (e.g., legal status, size, age, industry, etc.), making it necessary for researchers to cross the information drawn from trademark databases with other sources of microdata in order to analyse the use of trademarks at the firm level. And due to different kinds of constraints (unavailability of extensive micro-databases, difficulties in matching different datasets, etc.), micro-level analyses of trademarking are usually restricted to a relatively small sample of firms.

This paper analysis the patterns and determinants of trademarking on the basis of on a newly created dataset that crosses information on national trademark applications in Portugal from 1995 to 2006 with microdata of all the firms with employees which were active in the country in the same period. We describe the main patterns of trademark use in Portugal, and identify the characteristics of firms that are typically associated with trademark use.

The paper is organised as follows. In the next section we describe the data. Section 3 presents the basic descriptive statistics of trademarking, and Section 4 puts the relevant variables in a multivariate framework (a logistic regression), in order to analyse the determinants of trademark use at the firm level. Section 5 concludes.

## 2 DATA

The integrated database used in this study was constructed by crossing two main sources of data. One is the 'Quadros de Pessoal' (QP henceforth) database, which contains information on employers and employees collected by the Portuguese Ministry of Employment on a yearly basis, and constitutes mandatory annual reporting for all firms employing paid labour in Portugal. The questionnaire that supports this database includes questions related to the characteristics of both firms (e.g., total employment, industry classification, location, legal status, etc.), and their employees (gender, date of birth, educational background, professional category, type of contract, etc.). Both firms and workers are identified by their social security or fiscal numbers, making it possible to follow them over time. On the basis of that information one can also cross the QP database with information on trademark applications in Portugal. Here we use trademark data collected by the National Institute of Industrial Property (INPI).

The INPI's data used in this paper include the identification of the main applicant of every trademark application in Portugal since 1995. It does not, however, include any detailed information about the applicant, limiting the scope of economic analysis that can be carried out with those data. By crossing the QP and the INPI's databases we were able to unequivocally identify the main applicants of about 52% of the trademarks applications between 1995 and 2006.[1] Since the QP includes all firms employing paid labour in Portugal, we believe that the remaining applications (i.e., those for which we could not identify the owner) were filled mainly by sole proprietorship firms, foreign firms without employees operating in Portugal, non-corporate public entities. Therefore, we will not consider these types of entities in this paper.

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[1] The number of trademarks applications recorded by INPI each year varies between 8.306 in 1995 and 12.894 in 2006, totalizing 102.833 applications over the period.

Moreover, we restrict the scope of the analysis to market-oriented industries. These are: Manufacturing (DA to DN, according to NACE Rev. 1.1), Electricity, gas and water supply (EE), Construction (FF), Wholesale and retail trade (GG), Hotels and restaurants (HH), Transport and communication (II), Financial intermediation (JJ), and Real estate, renting and business activities (KK). We also exclude firms with only one employee.[2]

## 3 PATTERNS OF TRADEMARKING

The percentage of firms applying for trademarks in each year since 1995 (Figure 1) remained low, increasing slightly from 0,7% (out of 141.438 firms) in the beginning of the period to 1% in 2006 (out of 214.540 firms). The percentage of existing firms that have applied for at least one trademark up to a certain year has increased from 3,5% in 1995 to 5,6% in 2006. The increase is especially noted from 2002, being explained by a higher incidence of trademark use among newer firms in this period.

Figure 1.   EVOLUTION OF THE NUMBER AND PERCENTAGE OF FIRMS APPLYING FOR TRADEMARKS
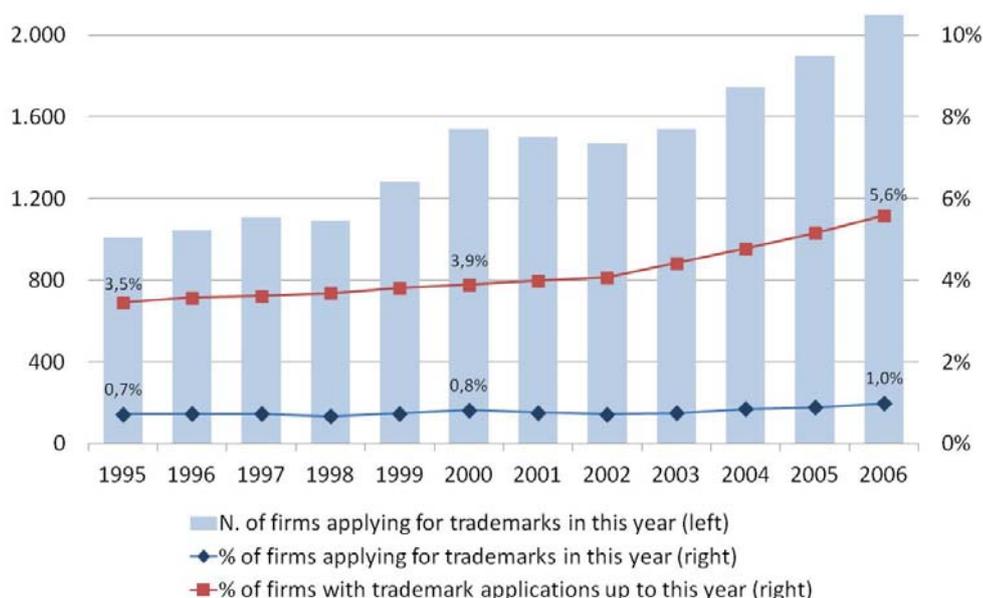


The use of trademarks varies widely across industries. Retail and wholesale trade, hotels and restaurants, and business services account for more than half of the firms applying for trademarks in 2006. However, these are also industries with a high number of total firms, and in relative terms the intensity of trademark use by firms in those industries is not particularly remarkable.

On the contrary, the proportion of firms applying for trademarks is noticeable in activities related to financial services, chemical products, R&D, ICT services, publishing and printing,

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[2] In many firms, the only employee is the firms' owner. However, there are several instances of sole-property firms in which the owner does not declare herself as an employee. The reasons that lead a firm owner to register herself as an employee are rather arbitrary. However, only those firms declaring at least one employee are registered in the QP database.

basic metals, or food products and beverages (Figure 2)[3]. In other words, among the industries that use trademarks most intensively we find many knowledge-intensive services, but also manufacturing industries with varying levels of knowledge intensity. In any case, the proportion of firms applying for trademarks is always modest (never above 9%).

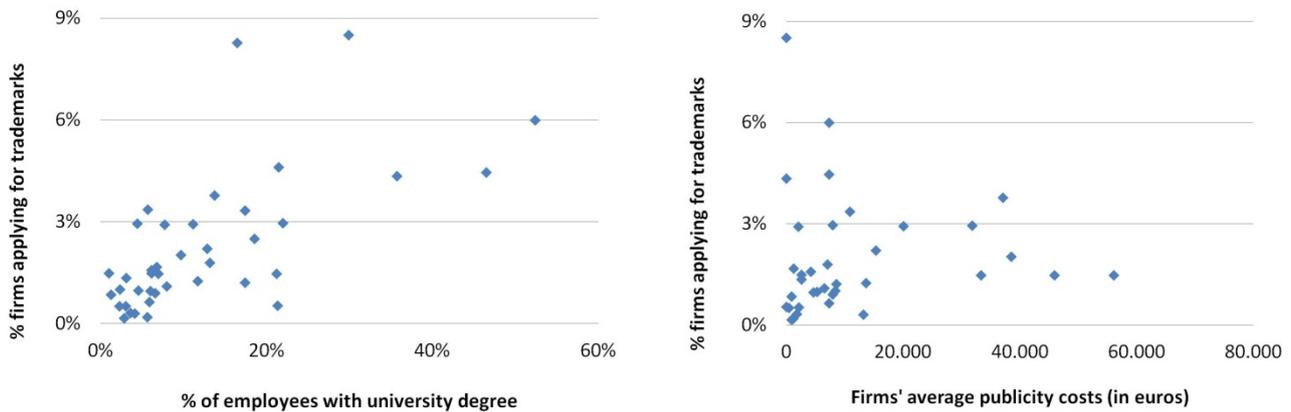Figure 2. FIRMS APPLYING FOR TRADEMARKS BY INDUSTRY, NACE REV.1.1 (2006)
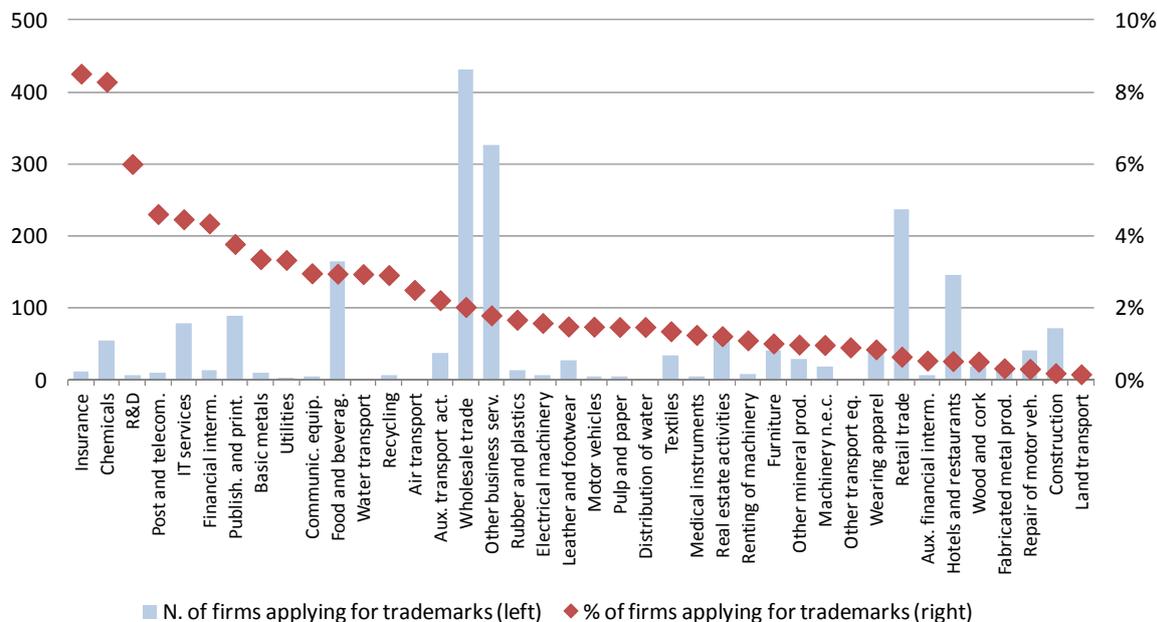


Several factors may account for the different intensities of trademark use by firms across industries. On one hand, the conditions that lead to competition being based on product differentiation and customer loyalty – features that create incentives for protecting a brand name and image, as was discussed above – are unevenly distributed among industries. Moreover, given the heterogeneity in productivity, industries also differ in their capacity to pay high wages – and, therefore, to recruit more competent managers and employers – which may translate in the adoption of more sophisticated business strategies by a higher proportion of firms in some industries (more on this below).

Such features can be approximated by two types of variables for which data is available: the qualification of the workforce (proxied by the proportion of workers holding a university degree) and, to a lesser extent, the industry's marketing intensity (proxied by the average expenditures with publicity by firm). As Figure 3 suggests, both variables are positively related with the proportion of firms applying for trademarks. At the industry level, trademarking seems to be determined by the value attached to visibility and reputation (associated with the use of trademarks) by more sophisticated firms, at least as much as the structural features of each industry.

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[3] These results largely converge with those of Baroncelli et al. (2005), who found that, at the world level, trademarks are mostly concentrated in research and development-intensive sectors (pharmaceuticals, scientific equipment, and the chemical industry), in advertising-intensive industries (clothing, footwear, detergents and food products), and also in service sectors.

Figure 3. THE RELATION BETWEEN THE PROPORTION OF FIRMS APPLYING FOR TRADEMARKS AND THE INDUSTRIES' HUMAN CAPITAL AND MARKETING INTENSITY



This idea is confirmed by analysing the relation between firm size and the frequency of trademark use. As Figure 4 shows, the proportion of firms applying for trademarks is higher for larger firms. To some extent, this suggests that either the use of trademark is associated with more professional management structures, or the net benefits of trademarking are proportional to the scale of operations (which is reasonable, given that trademarks correspond to a fixed investment), or both.

Figure 4. FIRMS APPLYING FOR TRADEMARKS BY FIRM SIZE (NUMBER OF EMPLOYEES, 2006)
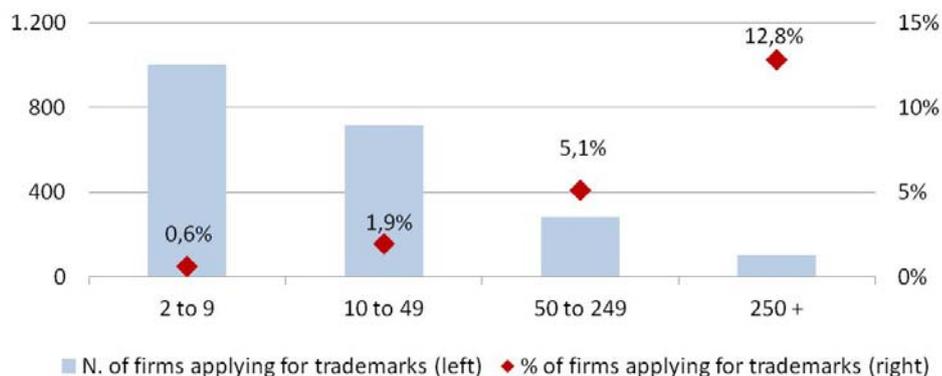


If that is the case, one should expect that in regions which concentrate a higher proportion of firms with more sophisticated management structures and wider scale of operations, the intensity of trademarking is also higher. Figure 5 confirms this intuition, by showing that the two Portuguese metropolitan regions, those of Lisbon and Porto, stand out both in relative and in absolute terms regarding the proportion of firms applying for trademarks.

It is interesting to note that trademarking is also relatively intense in some manufacturing regions (e.g., Entre Douro e Vouga and Baixo Vouga) and in regions with highly characteristic and well-known consumer products (e.g., Serra da Estrela – the home of the most famous Portuguese cheese – and Douro – where the legendary Port Wine is produced). This suggests that the use of trademarks may be a rather localised phenomenon, what may be explained by, at least, two factors. In the case of regions with typical, well-known consumer products, firms often compete by signalling to the consumers the genuine and unique character of their products, with regard to imitators and other brands; this often implies a strong investment both in product development and in branding, which can be protected (at

least partially) through trademarks. Additionally, the regional concentration of trademarking firms may result from the attempt to replicate the business strategies of successful local firms (i.e., imitative behaviours by followers), possibly with the help of business consultants with specific competences and experience in IPR management.[4]

Figure 5. FIRMS APPLYING FOR TRADEMARKS BY REGION NUTS III (2006)



Finally, the frequency of trademark use is also related with firm age. Figure 6 shows that the percentage of firms applying for trademarks is higher than average for firms in the first two years of existence, both in relative and in absolute terms, suggesting that trademarks are in many cases a relevant ingredient of firms' entry strategies.

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[4] Godinho et al. (2003) have found that firms often lack knowledge regarding the costs and benefits, as well as the administrative procedures involved in trademarking. This creates a situation of asymmetric information, increasing the capacity of consultants to influence the decisions of firms regarding the use of trademarks.

Figure 6.　FIRMS APPLYING FOR TRADEMARKS BY FIRM AGE (2006)
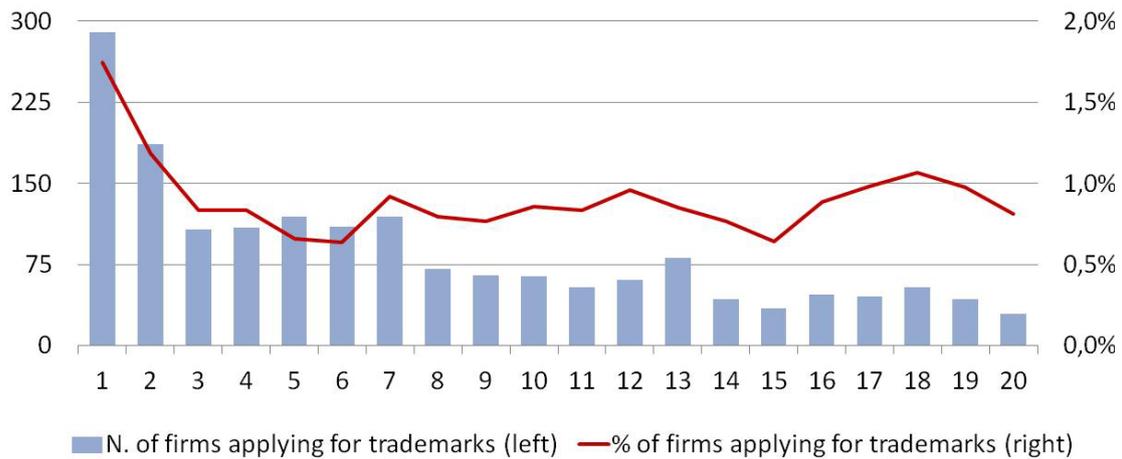


In sum, these descriptive statistics suggest that trademark use in Portugal is: (i) uncommon for most firms; (ii) asymmetrically distributed across industries, with both higher-knowledge intensive and some less knowledge-intensive industries displaying higher than average use of this industrial property right; (iii) strongly concentrated in the metropolitan regions (with some smaller regions also showing a relatively high intensive use of trademarks); (iv) less frequent among firms with less than 10 employees than in higher firm size groups (being disproportionally frequent among big firms); and (v) more common among new firms than in older ones. In what follows we put these and other variables in a multivariate regression framework, in order to identify the most relevant determinants of trademark use in Portugal.

## 4  DETERMINANTS OF TRADEMARK USE AT THE FIRM LEVEL

### 4.1  Estimation method

In order to identify the structural determinants of trademarking, we use a simple Logit Regression Model. This well-known method describes the relationship between a binary dependent variable and one or more explanatory variables, focusing on the relative probability (odds) of obtaining a given binomial result category. Hosmer and Lemeshow (2000) use the following specific form for the logistic regression model:

$$\pi = \frac{e^{\beta_0 + \beta_1 x}}{1 + e^{\beta_0 + \beta_1 x}}$$

which is bounded between zero and 1, and whose errors follow a binomial distribution (Bernoulli), instead of a normal distribution as in Linear Regression Model.

Basically, the logit transforms the previous equation into

$$g(x) = \ln\left[\frac{\pi(x)}{1 - \pi(x)}\right]$$

$$- \beta_0 + \beta_1 x \quad .$$

So that it has many of the desirable properties of a linear regression model, like being linear in its parameters and, depending on the range of x, it may be continuous and range from -∞ to +∞.

Usually, the coefficients in the logistic model describe the variation in the log-odds when the regressor x increases by one unit, ceteris paribus. The interpretation of those parameters is given by the anti-log of each coefficient, $e^\beta$, which is the change in the adjusted odds ratio. One can also compute $1- e^\beta$ to obtain the percentage increase (or decrease) in the adjusted odds-ratio for every unit increase in the regressor. So, in the present case, the adjusted odds-ratio is the variation in odds of a firm applying for trademarks when the value of the regressor increases by one.

Although it is easy to move from odds to probabilities, we will present the results in odds, since the interpretation of the coefficients is thus more straightforward.

## 4.2   Hypotheses

Following the introductory literature review and the discussion in section 3, we analyse the determinants of trademarks by testing the following hypotheses:

*Hypothesis 1: the use of trademarks is more frequent among new firms, after controlling for industry effects.*

In the descriptive section of the paper we have shown that the percentage of firms applying for trademarks is higher for new firms. We suspect that this is related to the fact that some entrants use trademarks as part of their entry strategies, either to signal the distinctiveness of their offers, or to protect their initial investments from future imitators. However, in order to test for this hypothesis it is important to control for industry effects. In fact, since industries display significant differences in both trademark use by firms (section 3) and in entry rates (e.g., Geroski, 1995), without controlling for industry effects, the correlation between the propensity for trademark use and being a new firm could result from a higher proportion in the database of firms belonging to industries that are simultaneously high users of trademarks and have a higher proportion of new firms.

*Hypothesis 2: the use of trademarks is more frequent among firms located in places with a higher density of trademark users (especially if they belong to the same industry), after controlling for metropolitan regions, industry effects, and firm size.*

The firms with a wider geographical range of operations tend to locate their headquarters in the metropolitan regions. Since those firms tend to pursue more sophisticated strategies and have more professional management structures, one should expect the propensity of firms located in such regions to be higher than in other locations. Therefore, it is reasonable to include the location in metropolitan regions as a control variable in our regressions. However, there are reasons to believe that location matters beyond the aforementioned factors. On one hand, some territories concentrate a disproportionate amount of firms which are active in specific niche activities, which may be particularly active in trademarking. On the other hand,

trademark use by firms may be partly explained by imitative behaviour at the local level: having direct contact with firms that have benefited the most from registering and maintaining their trademarks may create extra incentives for neighbouring firms to follow the same strategic option; alternatively, one may assume that a relevant underlying cause for trademark use by firms is the influence exerted by local consultants, which may be particularly keen to trademarks as a business strategy. This type of explanations is all the more reasonable when one realizes the relative ignorance that firms often reveal regarding the use of trademarks. For example, in their survey on the use of intellectual property rights (IPR) by Portuguese firms, Godinho et al. (2003) showed that the relatively low levels of IPR use in the country is largely determined by the firms' lack of knowledge about the costs and benefits of these instruments. Therefore, we expect the propensity for a firm to use trademarks to increase in regions where the use of trademarks is high, after controlling for other relevant factors.

*Hypothesis 3: the use of trademarks is more frequent among firms with higher human capital, after controlling for size, industry, and regional effects.*

It was shown above that the industries with the highest percentage of firms applying for trademarks are typically characterized by high levels of human capital (proxied by the proportion of employees with a university degree). Regardless of the industry (i.e., after controlling for this factor), we expect firms which are managed by more qualified staff to have a higher propensity of trademark use, since the latter is most probably related with the adoption of more sophisticated management practices. However, since the presence of highly qualified managers is related with size and also with location factors (since highly educated people often prefers to live in the metropolitan regions, where they benefit from better amenities), we should include such factors as controls in our regressions.

*Hypothesis 4: the use of trademarks is more frequent among multi-establishments firms after controlling for size, industry, and regional effects.*

We also expect that multi-establishment firms display a higher propensity to trademark, regardless of their size, industry, and location. Especially in the case of business strategies encompassing the direct sale to end-users in different locations, trademarks are often necessary to protect the value of substantial fixed-investments in both infrastructure and branding.

*Hypothesis 5: the use of trademarks is highly idiosyncratic, with some firms being recurrent users of trademarks.*

While we expect all the above factors to influence the firms' propensity for trademarking, the very small number of firms which actually use this IPR mechanism suggests that a substantial part of the explanation for trademark use at the firm level is not captured by the diversity of variables mentioned above. In other words, the propensity for trademark use may be largely due to unobservable, idiosyncratic characteristics of firms, which lead them to place trademarks among the valuable practices of their business strategy. We attempt to partly capture such characteristics by including in our regressions the occurrence of trademark applications of the firm in previous periods. After controlling for all the other measurable features, we expect the probability of applying for a trademark in a certain year to increase for firms that have previously applied for trademarks.

## 4.3 Variables used in the regression

Our dependent variable is the binary variable *TM Applicant*, which equals 1 if the firm *i* applied for trademarks in 2006 (the last year for which we had data from the two sources used in the paper), and zero otherwise.

Among the explanatory variables we use the following control variables:

> *Industry effect*, for each firm *i*, is the percentage of firms (excluding the firm *i*) in the same sector as the firm *i* (NACE Rev. 1.1 at three digit level) that applied for trademarks in the last three years;

> *Metropolitan centre* is a dummy variable that assumes the value 1 if the firm *i* is from Lisboa or from Porto (NUT III), and zero otherwise;

> *Size 10 to 49* and *Size 50 or more* are dummy variables for firms with 10 to 49 employees, and firms with more than 49 employees, respectively, assuming the value 1 if the firm is included in the size group, and zero otherwise.

To test the hypotheses listed in the previous section, we computed the following variables:

> For hypothesis 1, *New firm (dummy)* is a dummy variable that assumes the value 1 if the firm *i* is in its first or second year of existence in 2006, and zero otherwise[5].

> For hypothesis 2, *Regional effect*, for each firm *i*, is the percentage of firms (excluding the firm *i*) in the same region as the firm *i* (municipality level) that applied for trademarks in the last three years; and *Regional-industry effect*, for each firm *i*, is the percentage of firms (excluding the firm *i*) in the same region and in the same industry (municipality level and NACE Rev. 1.1 at two digit level) that applied for trademarks in the last three years;

> For hypothesis 3, *Employer with university degree (dummy)* is a dummy variable which assumes the value 1 if the firm *i* has one or more employers with university degree, and zero otherwise; and *Employee with business studies degree (dummy)* is a dummy variable which assumes the value 1 if the firm *i* has one or more employees with higher studies on business sciences, and zero otherwise.

> For hypothesis 4, *Multi-establishment firm* (dummy) is a dummy variable which assumes the value 1 if the firm i has two or more establishments, and zero otherwise.

> Finally, for hypothesis 4, *Recurrent TM applicant* is a dummy variable which assumes the value 1 if the firm *i* applied for trademarks in 2004 or 2005, and zero otherwise.

The bivariate correlations between the variables used in the regressions and the basic descriptive statistics are presented in the tables below.

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[5] In order to compute the age variable we considered the administrative records. In most cases, since reporting to the QP database is mandatory, the first year of activity of a firm must match its first year of administrative register. We ran several quality checks in the data in order to minimize the possibility of errors in the age variable.

# Table 1. Bivariate correlation matrix

| Variables | TM applicant | Industry effect | Metrop. center (dummy) | Size 10 to 49 (dummy) | Size 50 or more (dummy) | New firm (dummy) | Regional effect | Regional-industry effect | Multi-establ. Firm (dummy) | Employer with university degree (dummy) | Employee with business studies degree (dummy) | Reccurent TM applicant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TM applicant | 1,00 | | | | | | | | | | | |
| Industry effect | 0,13 | 1,00 | | | | | | | | | | |
| Metropolitan center (dummy) | 0,04 | 0,07 | 1,00 | | | | | | | | | |
| Size 10 to 49 (dummy) | 0,04 | 0,07 | 0,01 | 1,00 | | | | | | | | |
| Size 50 or more (dummy) | 0,09 | 0,12 | 0,03 | -0,08 | 1,00 | | | | | | | |
| New firm (dummy) | 0,02 | -0,01 | -0,02 | -0,06 | -0,04 | 1,00 | | | | | | |
| Regional effect | 0,05 | 0,12 | 0,61 | 0,02 | 0,06 | -0,02 | 1,00 | | | | | |
| Regional-industry effect | 0,08 | 0,38 | 0,28 | 0,04 | 0,09 | -0,01 | 0,43 | 1,00 | | | | |
| Multi-establishment firm (dummy) | 0,06 | 0,07 | 0,04 | 0,15 | 0,20 | -0,05 | 0,06 | 0,07 | 1,00 | | | |
| Employer with university degree (dummy) | 0,04 | 0,10 | 0,11 | 0,04 | 0,01 | 0,02 | 0,13 | 0,11 | 0,03 | 1,00 | | |
| Employee with business studies degree (dummy) | 0,10 | 0,17 | 0,10 | 0,14 | 0,29 | -0,03 | 0,14 | 0,15 | 0,16 | 0,22 | 1,00 | |
| Reccurent TM applicant | 0,19 | 0,18 | 0,05 | 0,06 | 0,11 | -0,02 | 0,07 | 0,10 | 0,08 | 0,04 | 0,13 | 1,00 |

Note: all coefficients are significant at 1% level

# Table 2. Basic descriptive statistics for the variables used in the regressions

| Dummy variables | Yes cases * | |
|---|---|---|
| | N. | % |
| TM applicant | 2.102 | 1% |
| Metropolitan center (dummy) | 70.050 | 33% |
| Size 10 to 49 (dummy) | 37.005 | 17% |
| Size 50 or more (dummy) | 6.304 | 3% |
| New firm (dummy) | 20.893 | 10% |
| Multi-establishment firm (dummy) | 16.205 | 8% |
| Employer with university degree (dummy) | 18.841 | 9% |
| Employee with business studies degree (dummy) | 16.575 | 8% |
| Reccurent TM applicant | 3.477 | 2% |

| Continuous variables | average | sd | min | max |
|---|---|---|---|---|
| Industry effect | 2,0% | 2,76 | 0% | 75% |
| Regional effect | 2,0% | 1,14 | 0% | 7% |
| Regional-industry effect | 2,0% | 2,52 | 0% | 67% |

* total number of observations = 214.540

## 4.4 Regression results

Table 1 below displays different specifications of our model, all of which confirm the hypotheses listed above.

*Table 3. Regression results*

| Variables | Coefficients for each regression* | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Industry effect | 1,10 | 1,10 | 1,09 | 1,10 | 1,10 | 1,08 | 1,07 |
| Metropolitan center (dummy) | 1,93 | 1,95 | 1,30 | 1,70 | 1,85 | 1,78 | 1,19 |
| Size 10 to 49 (dummy) | 2,95 | 3,21 | 2,91 | 2,48 | 2,68 | 2,53 | 2,29 |
| Size 50 or more (dummy) | 7,57 | 8,43 | 7,03 | 4,69 | 5,88 | 5,03 | 3,27 |
| New firm (dummy) | | 2,67 | | | | | 2,99 |
| Regional effect | | | 1,23 | | | | 1,14 |
| Regional-industry effect | | | 1,03 | | | | 1,03 |
| Employer with university degree (dummy) | | | | 1,67 | | | 1,59 |
| Employee with degree in business studies (dummy) | | | | 2,46 | | | 1,96 |
| Multi-establishment firm (dummy) | | | | | 1,82 | | 1,54 |
| Reccurent TM applicant | | | | | | 10,43 | 9,03 |
| **Model Summary** | | | | | | | |
| -2 Log likelihood | 21.218 | 21.003 | 21.082 | 20.859 | 21.124 | 20.103 | 19.493 |
| Cox & Snell R Square | 1,1% | 1,2% | 1,2% | 1,3% | 1,2% | 1,6% | 1,9% |
| Nagelkerke R Square | 10,7% | 11,7% | 11,3% | 12,3% | 11,1% | 15,6% | 18,3% |

* results presented in odds ratios; all coefficients are significant at 1% level; total number of observations = 214.540

In the first regression, we included only the control variables – the industry effect, the dummy for firms located in one of the two metropolitan centres, and the size dummies. Without considering other explanatory variables, the results show that for each 1% increase in the proportion of firms applying for trademarks in the same industry, the likelihood of being a trademark user goes up by 10%; since the value of this variable spans from 0% to 75% (table 2), this confirms that the industry effect has a substantial impact on the probability of trademarking. The results also show that medium and large firms have more than seven times the odds of applying for trademarks than very small firms (the benchmark), while firms located in a metropolitan area have nearly twice the odds of trademarking.

Regressions 2 to 6 include alternately the variables we have chosen to test the five hypotheses put forward in this paper.

In regression 2 we do not reject the hypothesis of a positive impact of being a new firm on the probability of trademarking. According to the results of this regression, comparing to other firms, entrants have 2,7 times the probability of applying for trademarks. Interestingly, the odds-ratios for non-very small firms increase after considering the effect of entrants. This is due to the fact that a substantial part of the very small firms which apply for trademarks do it soon after they enter the market[6].

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[6] Although we do not deal with this issue in the present paper, it can be shown that bigger firms that apply for trademarks in a given year tend to have already applied for trademarks in previous years.

In regression 3 we consider the effect on trademarking of being in a location where a high proportion of firms also apply for trademarks, as well as the effect of being both in a location and in an industry in which a high proportion of firms also apply for trademarks. The results confirm us that, even after controlling for the effect of being located in a metropolitan region, co-location seems to be a relevant determinant of trademarking, especially in the case of co-location of firms belonging to the same industry. The probability of trademarking increases 23% for each percentage point change in the proportion of firms applying for trademarks in the same region, and 3% for each percentage point change in the proportion of firms belonging to the same industry and located in the same region that apply for trademarks. Note, however, that the variability of the *regional-industry effect* variable is substantially higher than that of the *regional effect* variable. In other words, the high concentration of trademarking firms of the same industry in a specific region can have a relevant impact on the probability of using trademarks, even after controlling for industry effects and regional effects. As expected, after introducing those two region-related variables in the regression, the odds-ratio of being in a metropolitan area decreases considerably. Still, being in one of the two metropolitan regions increases the odds of trademarking by nearly 30%.

Regression 4 includes the variables related to human capital. On the basis of these results we do not reject the hypothesis that the use of trademarks is more frequent among firms with more qualified personnel. According to these results, having at least a university graduate in the management team increases the probability of trademarking by 2/3. More expressively, having at least one employee holding a degree in business studies increases such probability by 2,5. It is worth noting that the odds-ratio for medium and large firms has now decreased considerably, confirming the notion that bigger firms typically have more access to human capital.

The results of regression 5 show that, considering only the control variables, the probability of trademarking is 82% higher for multi-establishment firms. Introducing this variable reduces to some extent the size effect (especially for firms over 50 employees), suggesting that the higher incidence of multiple-establishment firms among larger firms with regard to smaller ones is one of the reasons why the frequency of trademarking is higher for the former size group.

In regression 6 we consider the effect of being a trademark applicant in previous years. The results of this regression seem to confirm the notion that the use of trademarks is a somewhat idiosyncratic feature of firms: for reasons that are not captured by the basic control variables (nor by the other available explanatory variables), some firms display a recurrent tendency to trademark. Using only the control variables and a dummy that identifies firms that have applied for trademarks in the previous two years, we conclude that recurrent trademark users have 7,5 times more probability of applying for a trademark in a given year than other firms. Once we consider de effect of recurrent trademark applications, the odds-ratios related to size dummies is somewhat reduced with regard to the previous regressions.[7]

In general, the results presented above remain valid when all the explanatory variables are included simultaneously, as in regression 7.

The fact that our dependent variable has a very reduced proportion (about 1%) of 'yes cases' affects the overall predictive capacity of our models (which, accordingly, fail the Hosmer and Lemeshow test). Notwithstanding, the variables in the regressions always provide a good joint

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[7] This happens mainly because the size distribution of firms applying for trademarks for the first time is different from size distribution of firms which are recurrent applicants. Although this issue is beyond the scope of this paper, it can be shown that firms applying for trademarks for the first time in 2006 are mostly very small firms (62%), while firms that have multiple applications are mainly small, medium or large firms (joint 72%).

fit (passing the Omnibus Tests of Coefficients), and the coefficients are all statistically significant, with p-values near or equal to zero, allowing us to conclude that the explanatory variables used are all relevant for understanding the still understudied phenomenon of trademarking.

# 5 CONCLUSIONS

In this paper we provide the first results drawn from an integrated database that crosses information on national trademark applications with microdata of all the firms with employees in Portugal. We describe the main patterns of trademark use in the country, and identify the characteristics of firms that are typically associated with trademark use.

The descriptive analysis lead to the conclusion that trademark use in Portugal is: (i) uncommon for most firms; (ii) asymmetrically distributed across industries, with both higher-knowledge intensive and some less knowledge-intensive industries displaying higher than average use of this industrial property right; (iii) strongly concentrated in the metropolitan regions (with some smaller regions also showing a relatively high intensive use of trademarks); (iv) less frequent among firms with less than 10 employees than in higher firm size groups (being disproportionally frequent among large firms); and (v) and more common among new firms than in older ones.

Our regression results largely confirm the notion that firm-specific variables are very relevant predictors of trademark use, even controlling for industry effects. In particular, new firms reveal a higher propensity for trademarking, while trademark use is more probable among bigger firms than in smaller ones. In the same vein, human capital (in particular, knowledge of business studies at the university level) is a relevant determinant of trademarking. Even more importantly, the probability of applying for trademarks is highly determined by the previous use of this IPR mechanism.

The regression results also show that geographical proximity plays an important role in explaining the trademark use by firms – even after controlling for the higher propensity for trademarking by firms located in metropolitan centres. This is especially the case for neighbouring firms that belong to the same industry, suggesting that trademarking is a characteristic feature of some local clusters

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