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The use of the EUIPO Trade Mark System by Small and Medium-sized Enterprises

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Abstract

In this study, we analysed structures in EUIPO trade mark filings by SME and large firms. Up to this point, the evidence on SME trade marking on a large scale data basis is scarce and most studies analysing motives and structures of SMEs when filing trade marks work with survey data. This study fills this gap by providing an SME classification for all trade mark applicants at the EUIPO from 1996 up to the most recent data based on a matching of the EUIPO trade mark data with the ORBIS company database by Bureau van Dijk. The results of our analyses show that the number of trade mark filings has been growing over the last 20 years. Yet, more recently, the number of trade marks per applicant is slightly decreasing, implying that a diversification of trade mark applications on a larger number of applicants is taking place, which is mostly due to SMEs. The sectoral differentiation shows that SMEs throughout the whole economy use trade marks, although the service sectors have a somewhat larger trade marking share. Our results further indicate that although the share of firms, in particular SMEs, that use trade marks and patents in combination is not very large, a significant relationship between a combined trade mark/patent usage and productivity could be found. In sum, it can be stated that trade marks might be used as an innovation indicator especially for SMEs as these would be missed when looking at patents only. However, still a focus on specific fields might be necessary.

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1 Introduction

The number of trade mark registrations in the developed OECD countries has been constantly increasing in recent years. In addition, trade mark filings by Chinese applicants are massively on the rise.

A trend that seems to continue over the years, however, is the strong position and slight increase of IPR activities of large multinational enterprises (MNEs), while small and medium-sized firms (SMEs) have lower propensities and probabilities to patent and to trade mark their inventions. This might be due to the fact that especially SMEs face the challenge of how to optimize the protection and use of their intellectual property as they often are not sufficiently familiar and experienced with the intellectual property protection system or are reluctant due to a feared loss of knowledge (Frietsch et al. 2013). In terms of patent filings at the European Patent Office (EPO), we know that a large share originates from large multinational enterprises (MNEs) (European Commission 2019). For European Union Intellectual Property Office (EUIPO) trade mark filings, a recent study by the EUIPO and the EPO has shown that this phenomenon is similar for the registration of trade marks (Ménière et al. 2021; Wajsman et al. 2019). Interestingly, the analyses showed, however, that SMEs contribute more with breakthrough inventions than large firms and that SMEs, which have registered at least one trade mark are 13% more likely to experience high growth in the future (Wajsman et al. 2019), which speaks for their large innovative potential.

While large enterprises and especially MNEs are responsible for the bulk of trade mark registrations, SMEs are the majority of enterprises in all countries. They are responsible for the majority of the employment and large shares of the value added and turnover in most sectors, especially in manufacturing (Frietsch et al. 2015; Rammer et al. 2015). Their lower propensities and probabilities to register trade marks might be due to decreasing innovation activities of SMEs in some countries (Schubert et al. 2016), but also due to a large (and increasing?) reluctance of technology-oriented SMEs to use IPRs for the protection of their inventions.

Reasons for this reluctance have frequently been reported in the literature (Agostini et al. 2015b; Blind et al. 2006; Kim et al. 2015; de Rassenfosse 2012): failure of SMEs to pursue their rights against larger companies in case of infringement, high costs, fear of a loss of knowledge (especially true for patenting), inexperience with the IPR system, or simply habits ("we've never used IPRs so we don't start doing it"). To cope with the lower Intellectual Property (IP) output of SMEs, a series of policy initiatives have recently been launched by the European Union Intellectual Property Office (EUIPO Strategic Plan 2025), the European

Patent Office (EPO Strategic Plan 2023) as well as the SME Strategy for a sustainable and digital Europe by the European Commission (European Commission 2020). Consequently, there is a specific policy interest in those SMEs that do not make use of the trade mark system at all, either because they lack the knowledge and skills to use the system or because they consciously prefer other means of protection.

Within this research report, we therefore aim to ask the question, how many trade marks are filed by SMEs and MNEs each year and how this ratio has changed over the last decade. In addition, we would like to find out how large the share of trade marking vs. non-trade marking SMEs (and MNEs) is, which allows us to make inferences about this share of (technology oriented) SMEs that do not use the trade mark system. These two differentiations will guide all of our analyses. Once these differentiations are available within our data, i.e. MNE vs. SME and trade marking and non-trade marking SMEs, we will analyse structural indicators, e.g. the number of employees, the region where the applicants are located as well as their sector of economic activity (NACE) and the field(s) in which they are active (NICE classes as well as an in-depth field classification). In a final step, we will analyse, whether SMEs that file trade marks have a better financial performance than non-trade marking SMEs by using a control group design. The economic indicators are thereby taken from Bureau van Dijk's (BvD) ORBIS database, which has been matched to the trade mark data at Fraunhofer ISI based on a string-matching algorithm at the level of applicant/company names.

2 Literature review

Any person or company, including authorities established under public law, may obtain an EU trade mark through registration. It may consist of any signs, in particular words (including personal names), designs, letters, numerals and the shape of goods or of their packaging, provided that such signs are capable of distinguishing the goods or services of one business from those of another; and being represented on the register of trade marks in such a way that the public and the authorities know exactly the subject matter that is being protected.[1]

In quantitative innovation research, patents have a long-standing tradition as being an established indicator of innovative performance at the level of countries, fields and firms (e.g. Griliches 1981; Grupp 1998). In the last ten years, however, trade marks have been more and more extensively used for the measurement of innovation activities (e.g. Castaldi 2020; de Grazia et al. 2020; Flikkema et al. 2014; Flikkema et al. 2019; Greenhalgh et al. 2006; Sandner et al. 2011). This is partly due to the fact that trade marks provide insights on service sector innovation, i.e. they serve as a complementary, more "close to the market" indicator to patents, which are focused on technical inventions (Gauch 2007; Sandner et al. 2011; Schmoch 2014). The publication of large-scale datasets, for instance by the EUIPO or the United States Patent and Trade mark Office (USPTO) has opened new possibilities to access trade mark data, which has also led to an uptake in the use of trade mark data (Castaldi 2020). Trade marks are often used to analyse the relationship between innovation and financial performance at the firm-level but can also be used to assess the diffusion of innovations at the macro-level (Frietsch et al. 2022b).

Earlier studies, like for example Schmoch (2003), however, have been more critical regarding the use of trade mark data as a source to study innovation. Although a correlation to innovation could be found, the study by Schmoch (2003) as well as a follow-up study by Schmoch and Gauch (2009) concluded that trade marks can be used as an innovation indicator but only with reference to technology and services. Especially in IT as well as other knowledge-intensive and product-accompanying services trade marks seem to work well as an innovation indicator, but less so in more consumer-oriented fields. Yet, the rather coarse-grained NICE classification does not allow for in-depth comparisons and specific identification of fields (Neuhäusler et al. 2021). Schmoch (2003) and Schmoch and Gauch (2009) also stated that especially the relation between trade marks and patents would be an im-

[1] Regulation 2017/1001 - EU trade mark (codification)

portant research question, as well as the analysis of the relationship between trade marks and R&D, employment and turnover.

In a similar vein, as the original study by Schmoch et al. (2003), Mendonca et al. (2004) concluded that trade marks in the 1990s boomed in information-and knowledge-based services such as business consultancy, telecommunications and education and were mainly used to protect firms' products and business identity, but also for other product differentiation and business diversification. They also found that mostly firms in high-tech sectors, which use more patents, also use trade marks as an additional IPR. Once again, this raises the question whether trade marks can only be used as indicators in certain fields, which we will analyse more deeply in this report.

When it comes to the evidence on SME trade marking in particular, the evidence in the literature is relatively scarce and most studies work with survey data. The studies can be divided into two basic strands: one identifying motives and structures that explain trade mark output and trade mark behaviour of SMEs in general, and one that tries to explain firm performance – financial or in terms of growth – based on innovative output as measured by trade mark indicators as well as other IPRs.

Agostini et al. (2014) investigate the impact of brands on SME performance in the fashion industry. Their results indicate that trade marks are positively related to SMEs' performance in terms of sales growth. In a follow-up study, they factor in marketing expenses into their model and also find positive relations to firm sales performance (Agostini et al. 2015a). Also focusing on the fashion industry, Rienda et al. (2021) found that SMEs could improve their financial performance in international markets through registered trade marks and social media based on a sample of 102 SMEs within the fashion sector of the UK and Ireland. Brem et al. (2017) study the relationship between open innovation, firm profitability and the use of IPRs in SMEs with the help of a sample of 2,873 firms from the Spanish Community Innovation Survey. They find that IP protection through trade marks is positively related to firm performance only for small firms (<50 employees), but not for medium-sized ones (50-249 employees), while the moderating effect of trade marks on the relationship between open innovation and firm performance is not supported for small firms but only for medium-sized and large firms.

The trade mark output of SMEs itself, on the other hand, is influenced by several factors. Using an exploratory factor analysis on a survey of 600 SMEs in innovative industries, Block et al. (2015) analysed the motives of SMEs to file trade marks. They showed that SMEs have three distinct motives to file trade marks, namely protection, marketing, and exchange. Masiak et al. (2018) take a closer look into the structures of SME trade marking by analysing 8,317 German high-tech firms and taking regional- and firm-level factors into account. They

find the receipt of venture capital and firm size are positively related to a firm's IP output (granted patents and trade marks). This confirms their theoretical arguments, stating that SMEs face problems regarding IPRs, e.g. less experience, less financial resources, a lower degree of absorptive capacity, and consequently having a lower IP output compared to larger firms. This is similar to what is found in the IP SME Scoreboard (2016). One result of this large-scale survey is that SMEs still perceive complexity and high costs of registration and subsequent court procedures as barriers to use IPRs, including trade marks. Singh (2018) looked at IP usage (including trade marks) of Indian firms and thereby differentiated small from medium-sized enterprises. It could be observed that Indian medium-sized enterprises were more IP aware, while small enterprises are less aware of its value or significance. Dinlersoz et al. (2018) created a linked trade mark-firm dataset for the USPTO and found that especially first-time trade mark filers tend to be younger and larger firms. This is the first analysis that takes into account large-scale data. Another large-scale dataset has been created by the EPO and the EUIPO, who matched patent-, trade mark and company data. It serves as the bases for two studies, namely Wajsman et al. (2019) and Ménière et al. (2021). They were able to show that SMEs contribute more with breakthrough inventions than large firms and that trade marking SMEs are more likely to experience high growth in the future. Finally, in a study by Incentim (K.U. Leuven) and IDEA Consult, commissioned by the Belgian Ministry of Economy and the Belgian IP Office (2022), the relation between company size and IPR profiles was analysed based on a sample of more than 15,000 Belgian IPR active companies. The results show that the highest premiums are achieved by companies owning trade marks and designs and by businesses that also own patents. They also found that, compared to large firms, SMEs focus more on national levels with their IPRs.

3 Data & Methods

Before we are able to draw inferences about trends in trade mark filings by SMEs, we have to identify SMEs within the EUIPO trade mark database. This is a quite difficult task as there is no information on the size of the trade mark applicant within trade mark databases. We therefore have to construct this information from external sources. In our case, the main source for the identification of SMEs is the ORBIS database from Bureau van Dijk, to which we matched the EUIPO trade mark database. All the datasets we used and the detailed methodology for the identification of SMEs will be described in the following paragraphs.

3.1 Data sources

The trade mark dataset we use for the analysis is the data that the EUIPO freely provides on their website in the form of XML files (https://euipo.europa.eu/ohimportal/en/open-data). We processed this data and set-up an Oracle relational database system (RDBMS), which includes information on all trade marks filed at the EUIPO since 1996. In sum, this dataset includes more than 2 million trade mark registrations targeting the European jurisdiction.

The dataset is updated once a year and provides bibliographic information on the respective trade marks (application number, application year, relevant dates, type of mark, language, etc.). It also provides names and addresses of the trade mark applicants. The data have been partially anonymized by the EUIPO due to data privacy regulations, i.e. personal information like address data from individual applicants (natural persons) is not included, implying that our analyses only cover trade mark filings by legal entities. In addition, applicant data from international registrations via the Madrid system is not available for further processing, which means that these filings can be counted but they cannot be assigned a size information as the applicant name is missing.

In addition to the EUIPO data, we made use of two further databases, namely Bureau van Dijk's ORBIS database as well as the "EPO Worldwide Patent Statistical Database" (PATSTAT).

ORBIS (https://orbis.bvdinfo.com/) is a company database provided by Bureau van Dijk (BvD). It is one of the largest of such databases worldwide, covering about 450 million companies, mainly from the private sector, with a focus on Europe and North America, but also covering a number of companies in Asia and elsewhere in the world. Orbis offers structural information on the sector, number of employees, turnover and ownership of a company etc. The EUIPO data were matched to the ORBIS database in order to establish a link of both databases at the micro-level, i.e. the level of applicants/companies. After this link has been

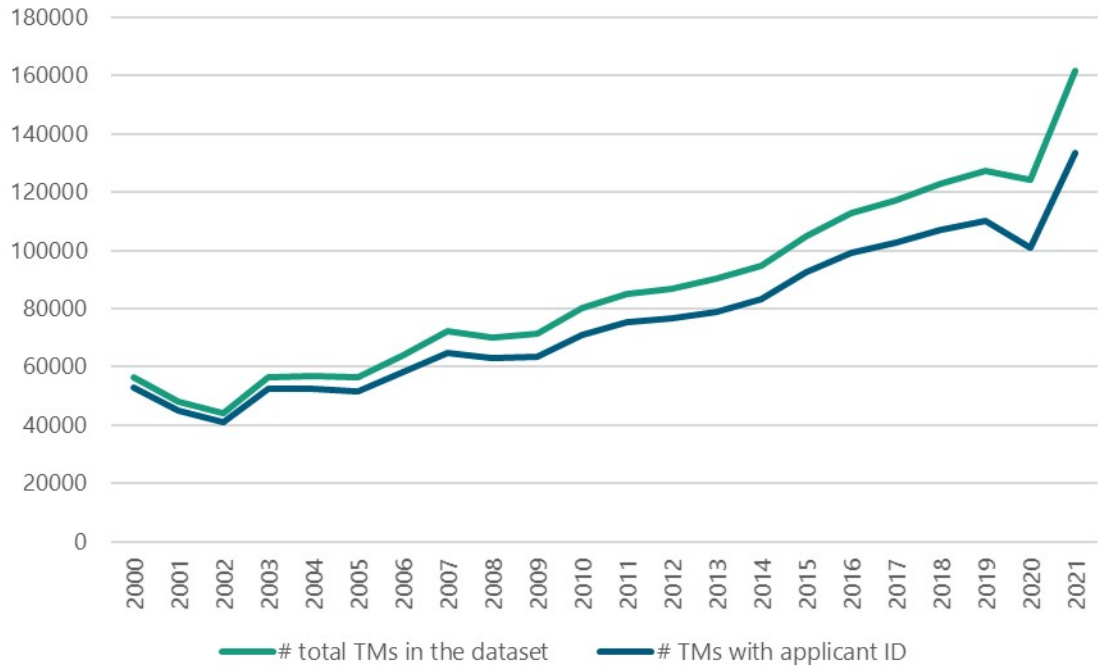
established, we will use the employee and turnover information from ORBIS to identify SMEs within the EUIPO trade mark database.

PATSTAT (https://www.epo.org/de/searching-for-patents/business/patstat) is a relational database with more than 28 tables and millions of entries which covers information about published patents from more than 80 patent authorities worldwide, dating back to the late 19th century. The database is updated twice a year and includes all information that is stated on a patent application, i.e. application authorities (patent offices), several patent relevant dates (priority, filing, publication date), the kind of an application (patent, utility model, etc.), inventor and applicant addresses, patent families (INPADOC and DOCDB), patent classifications (IPC and ECLA), title and abstract of a patent filing, technical relations and continuations, citations to patents and to non-patent literature. PATSTAT is of importance to our analysis since it is used for the identification of SMEs, i.e. by matching the EUIPO data to PATSTAT data, where a manual classification of SMEs by Fraunhofer ISI already exists. We furthermore use the match to PATSTAT to identify IPR portfolios of firms for further analyses, i.e. firms that file trade marks and patents.

3.2 Identification of SMEs

For the identification of SMEs within the EUIPO trade mark data, a stepwise approach was applied (see Table 1). As stated in section 3.1, not all trade marks in the EUIPO trade mark dataset include information on the respective applicant due to privacy reasons, i.e. data for these applicants are not included in the matching. Most of these applicants can be supposed to be physical persons or are applicants of international trade marks that are transferred to the EUIPO via the Madrid system, for which also no applicant information is included in the EUIPO data. Consequently, our statistics deviate from official EUIPO statistics as EUIPO statistics include information on transferred World Intellectual Property Organization (WIPO) filings while we are working with masked data due to General Data Protection Regulation (GDPR) reasons. All trade marks without any applicant information were excluded from the matching and from further analyses. The coverage of trade marks with and without applicant information is depicted in Figure 1. On average, there are 11% of trade marks in the database for which no further information is included. As can be seen from Figure 1, this effect is more severe in the recent years.

Figure 1 Coverage of trade marks with applicant information



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

For some applicants, we at least know that they are a physical person. This marks the first step in our matching algorithm, i.e. the categorization of physical persons. The second and most important step of the identification of SMEs is the matching of the EUIPO trade mark data with the ORBIS database. Here, a string matching algorithm was applied to link the applicant names from the EUIPO data with company names in ORBIS. Before the matching was performed, the applicant/company names were cleaned, i.e. the names were converted to lowercase letters, special characters and umlauts as well as spaces were removed etc. In addition, all legal forms, e.g. Aktiengesellschaft, AG, Limited, Ltd, were removed from the company names. For the computation of the similarity scores, which are needed to link the company names, a string matching algorithm based on the Levenshtein distance was applied. The Levenshtein distance is a calculation of how many edits would be needed in order to align two text-strings. The lower the number of edits necessary to align two text strings, the higher the similarity between the two. All values that exceeded a pre-calculated threshold (0.93)[2] were interpreted as a match and stored in the EUIPO data. For the matched companies, the last available information on the employees as well as the turnover was used for the identification of SMEs. We thereby used the SME definition provided by the EU.[3] All

[2] The threshold definition is based on a manually generated gold-standard of 1,000 applicant/company matches.

[3] https://single-market-economy.ec.europa.eu/smes/sme-definition_en

companies with less than 250 employees or an annual turnover equal or below 50 million € were categorized as SMEs. All companies with 250 employees or more were categorized as large enterprises. After the matching has been performed, manual checks on the categorization were performed in order to assign unmatched (mostly larger) applicants in the EUIPO database with ORBIS.

Table 1 Overview of the matching steps

Step	Description	# applicants	# filings	Share of matched applicants	Share of matched filings
0	Exclusion of physical persons	15.974	36.467	2,5%	2,0%
1	ORBIS	351.609	1.084.890	54,1%	59,5%
2	ORBIS manual correction	12.392	144.063	1,9%	7,9%
3	University/Public	1.192	3.192	0,2%	0,2%
4	Via PATSTAT	19.882	71.047	3,1%	3,9%
5	Applicants <3 TMs	248.780	480.136	38,3%	26,3%
6	Manual correction	33	2.467	0,0%	0,1%
	Total	649.862	1.822.262	100,0%	100,0%

Source: EUIPO; BvD Orbis; EPO - PATSTAT.

The third step in the identification process was the identification of applicants of the public research sector (universities and public research organizations) as well as other public actors. These were identified with the help of a keyword search by using a list of search terms like "univ", "institut*", "faculty", etc. Remaining non-company applicants were manually searched and coded accordingly.

Table 2 Trade mark applicants by category

Category	Description	# Applicants	# Filings	Share of matched applicants	Share of matched filings
0	SME	542.456	997.429	83,5%	54,7%
1	Large enterprise	89.499	782.911	13,8%	43,0%
2	Other	16.404	37.826	2,5%	2,1%
9	Research/public	1.503	4.096	0,2%	0,2%
	Total	649.862	1.822.262	100,0%	100,0%

Source: EUIPO; BvD Orbis; EPO - PATSTAT.

In a fourth step, a matching of trade mark applicants to patent applicants from PATSTAT was performed. This served two purposes: a) In PATSTAT, an SME identification via earlier ORBIS versions as well as manual searches already exists, so we can make use of the classification to categorize some of the remaining non-categorized applicants as being SMEs or large enterprises and b) we will use the patent information from companies to find out more about the companies' IP portfolios.

Finally, a rule based approach was applied for the remaining still uncategorized applicants. We decided to code all applicants with less than three trade mark filings within a time-window of three years as SMEs. This also underwent another manual correction step, i.e. known large enterprises within this data were coded as large firms. This, however, was effectively only done for a very small share of applicants (see Table 1).

In sum, we categorized ~1.8 million trade marks from nearly 650,000 applicants (see Table 2). About 2.5% of all trade mark applicants are marked as physical persons, though it can be assumed that this share is basically higher as there is the above mentioned share of trade mark filings, for which no information at all is available. This category was coded as "other" as no information on this group is available. About 13.8% of all applicants are large enterprises, which are responsible for 43% of all categorized trade mark filings. Nearly 83.5% of all applicants are SMEs, which are responsible for nearly 55% of the categorized trade marks. Finally, 0.2% of all trade mark applicants are grouped as belonging to research or other public actors.

3.3 Control group generation

Since we want to analyse patterns in trade marking vs. non-trade marking firms (as well as SMEs vs. large enterprises), we need to generate a control group of non-trade marking firms. For the generation of this control group, a stratified sampling technique based on the number of employees (categorized), the sector of an applicant, which is available from the ORBIS database as well as the applicant's country of origin, was employed. To be more precise, we calculated the share of trade mark applicants by country group (Europe, North America, Asia, Rest of the world), NACE sector (primary, secondary and tertiary sector) and three size categories (0-249, 250-500 and 500+ employees). For the control group generation, we deliberately added the size class of 250-500 to make sure these firms are also adequately represented in the control group. Based on the calculated shares, we drew a sample of slightly more than double the number of non-trade marking companies from the ORBIS database that resembles the basic country, sectoral and size distributions of the trade marking firms. This group of companies serves as a control group for further analyses, enabling us to make reasonable comparisons to the group of trade marking firms.

3.4 Multivariate regression models

In the first set of models, we aim to analyse the trade mark output of firms in more detail. Therefore, the annual number of trade mark filings at the EUIPO is the dependent variable in these models. Since this variable is a count outcome, we use negative-binomial regression models for our analyses. We split the model by a dummy variable that indicates whether a

company is an SME (coded "1") or a large enterprise (LE, coded "0"), so we can directly compare the coefficients of the explanatory variables of SMEs and of large enterprises. The explanatory variables used for the model are:

- **Breadth of the technology portfolio:** This variable captures whether firms with a broad technology portfolio, as measured by the spread of trade marks over NICE classes, are more prone to file trade marks than applicants with a narrower portfolio. (Agarwal et al. 2012)
- **Continuous applicant:** This variable captures whether an applicant is a continuous or a discontinuous trade mark applicant. In case a company files a trade mark in more than six time periods (years) between 2010 and 2021, it is treated as a continuous trade mark applicant (coded "1").
- **IPR Bundle:** Following the notion by Garcia-Valero et al. (2021), we control for multiple IPR usage firms by including the number of transnational patent filings into the regression model in order to find out whether also using other IPR (patents), increases the probability for a firm to also file trade marks. The number of patents of a company is taken from the match of the EUIPO trade mark database with PATSTAT. We only take into account transnational patent filings, i.e. patents that have been filed via the WIPO or the EPO system (excluding double counts) to avoid home-advantages (Frietsch/Schmoch 2010).
- **Ownership:** This variable provides the information whether a firm is (majority) owned by another company, a global ultimate owner (GUO). This information is taken from ORBIS. It can be assumed that dependent firms have less financial constraints than independent firms and costs for trade marks might be less of a hurdle.
- **Country/region of the applicant:** This structural variable is supposed to capture country-specific differences in trade marking. We run one model differentiating world regions (1=Europe, 2= U.S., 3=China/Japan/Korea, 4= rest of the world (RoW)). We then run a second model only focusing on Europe and thereby differentiating all EU-27 countries.
- **Sector of the firm (NACE):** This information can be found in the ORBIS dataset and is supposed to capture sectoral differences in trade marking behaviour, i.e. different propensities to register a trade mark. We grouped the variable to reflect the primary, secondary and tertiary sector. For the water and energy providers (NACE 34-43), we included an extra category.

- **Technology fields** address the technological areas of the trade mark filings. We have used our in-depth trade mark classification to create a concordance to the WIPO classification, which is commonly used for patent analyses (Schmoch 2008). With the help of this concordance, we are able to group trade marks according to the five WIPO fields electrical engineering, instruments, chemistry, mechanical engineering and other fields. Yet, this classification only exists for trade marks filed as product marks (NICE classes 1-34).
- **Year:** Since our data has the form of a company-level panel, we include time-dummies to control for time-specific effects.

In the second set of regression models, we aim to find out whether filing more trade marks is associated with a) a higher productivity and b) a higher firm performance. These two variables are used as dependent variables for this set of OLS regressions. We approximate the productivity of an enterprise – as direct measures are missing – by the turnover (in millions) per employee. Sectoral differences are taken into account in the regression models by sector dummies so that we see this approximation as reasonable. In order to capture firm performance, we resort to the Return on Equity (ROE). The ROE is calculated on the basis of the company's annual profit divided by its capital employed and thus indicates how many percentage points of profit have been generated from equity or, in other words, how well a company uses its own capital to generate returns. A larger ROE thus indicates a more profitable company. As independent variables, we use the same variables as in the first set of models, except that we treat the number of trade marks filed also as an independent variable to explain firm performance and productivity. We also split these models by a dummy variable indicating whether a company is an SME or a large enterprise. In addition, we control for four further variables. The first one is the lagged turnover per employee/ROE variables, which is used as independent variables in our models to control for endogeneity. Second, we have created a measure of supplementarity between the patent and trade mark profiles alongside the five WIPO fields. In the case a company has patents and trade marks within all five WIPO fields, it gets a value of "5". If no field overlap is found, it gets a value of "0". This variable is only available for firms that also have patents within their portfolio. In the case of missing information in any of our variables, we filled the gaps with information from the previous or subsequent years, if available.

4 Results

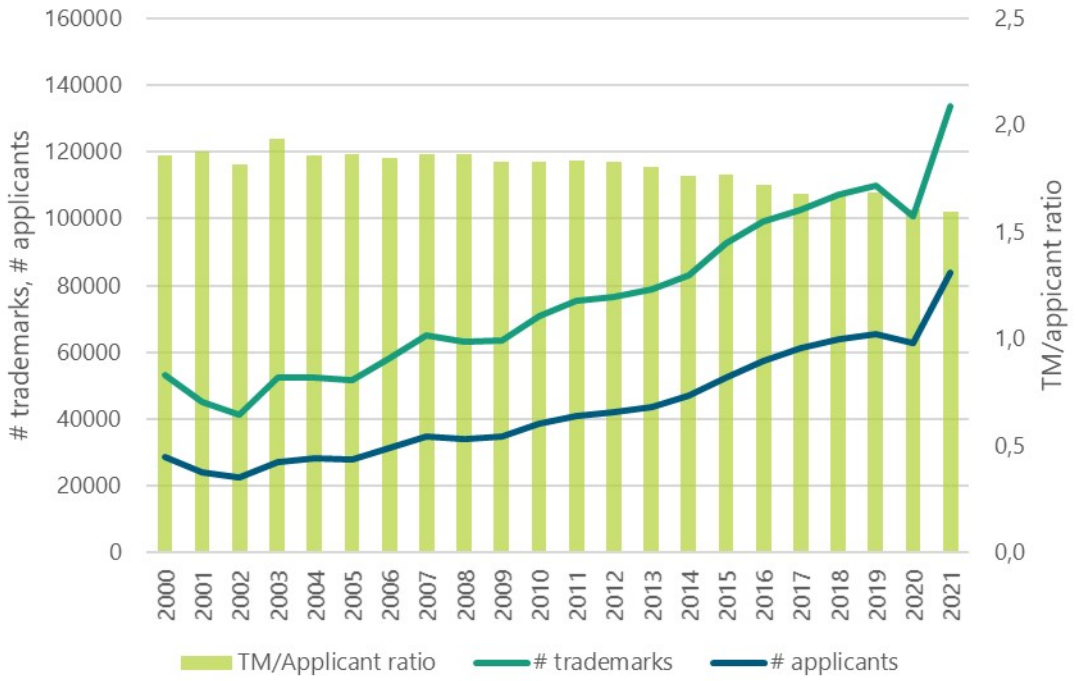
Within this section, we provide descriptive statistics on the development of trade mark filings of SMEs over time, across countries and fields. We then concentrate on the difference between trade marking and non-trade marking SMEs to identify what causes the differences in SME trade marking across Europe. In a third step, we describe a multivariate regression model in order to find out whether the described differences between SMEs and large firms hold when controlling for other factors and to find out more about the general differences between MNEs and SMEs with regard to their trade marking behaviour. Finally, we estimate another series of models to test whether filing a larger number of trade marks is associated with a higher firm productivity as well as firm performance. There, we also focus on the differentiation by SMEs and large firms, by introducing an interaction effect between firm size and the number of EUIPO trade marks.

4.1 General trends in trade mark filings

4.1.1 Overall trends

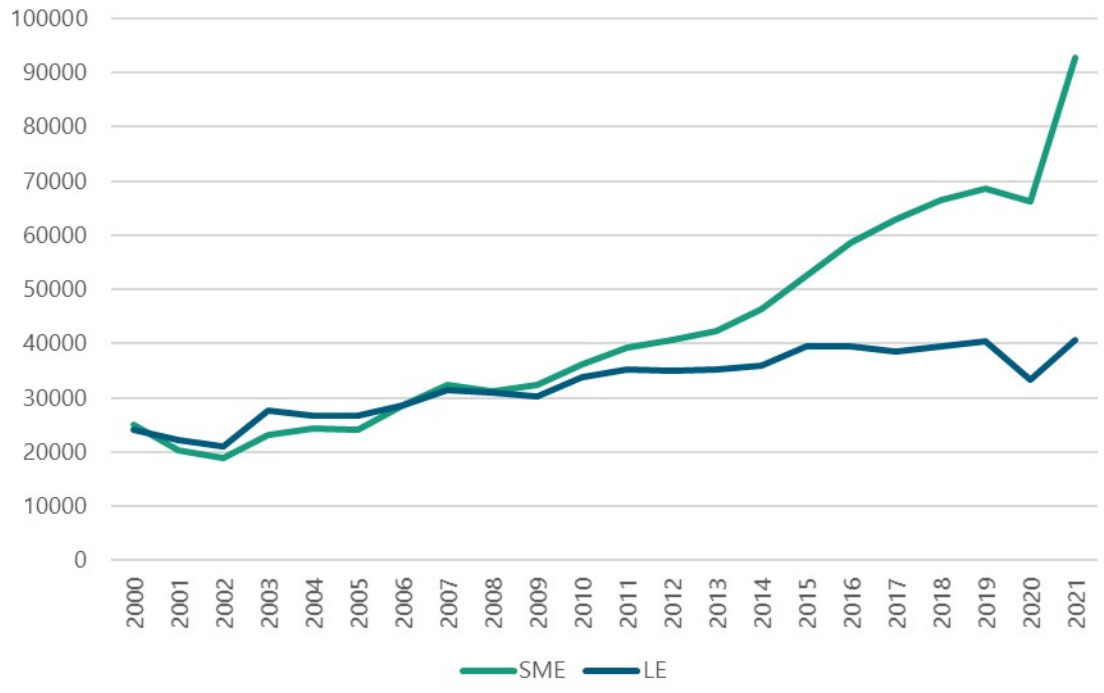
In order to get a general impression on the trends in EUIPO trade marking, the total number of trade mark filings between the years 2000 and 2021 are depicted in Figure 2. As described in the methodology section, our analyses are focusing on trade marks by legal entities (or companies and institutions). Physical persons are excluded from the analyses. The figure shows two interesting trends. The first one is the rising number of trade mark filings over time. EUIPO trade mark filings have nearly tripled since the year 2000 and grown by 6% per year on average. This is not only true for the number of trade mark filings but also for the number of trade mark applicants. Figure 2 shows that the number of applicants has also grown over the years. However, here the second interesting trend comes into play, namely the decrease in the ratio of trade mark filings over trade mark applicants. In other words, what we see is a diversification of trade mark applications on more applicants. While the trade mark over applicant ratio equaled 1.9 in the year 2000, i.e. nearly two trade marks were filed by each applicant per year, this ratio only equaled 1.6 in 2021. Interestingly, this runs contrary to what we find for patents, where a concentration to fewer patent applicants has been observed.

Figure 2 Number of trade mark filings and applicants, 2000-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

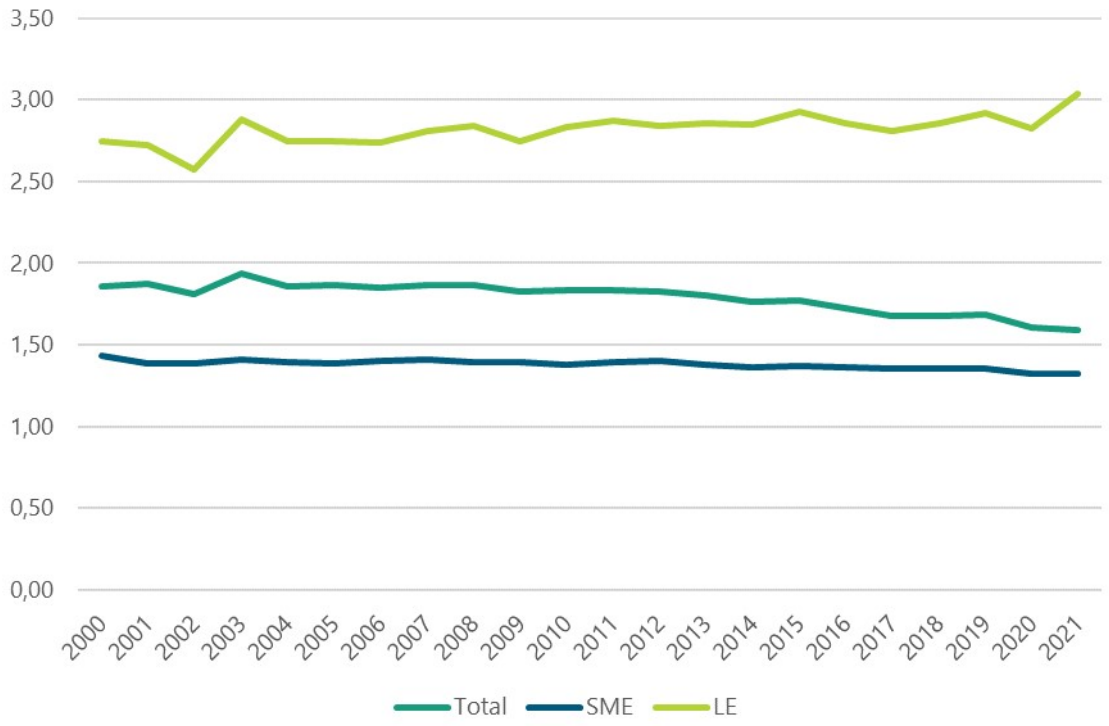
Figure 3 Number of trade mark filings by SMEs and large enterprises, 2000-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

In Figure 4, which plots the number of trade mark filings by SMEs and large enterprises over time, it can be found that the growth in the filing figures by SMEs is larger than the growth of filings by large firms. The decrease in 2020, which can mostly be attributed to the pandemic, is slightly more pronounced for large enterprises than for SMEs. The growth in 2021, however, is larger for SMEs than for large firms.

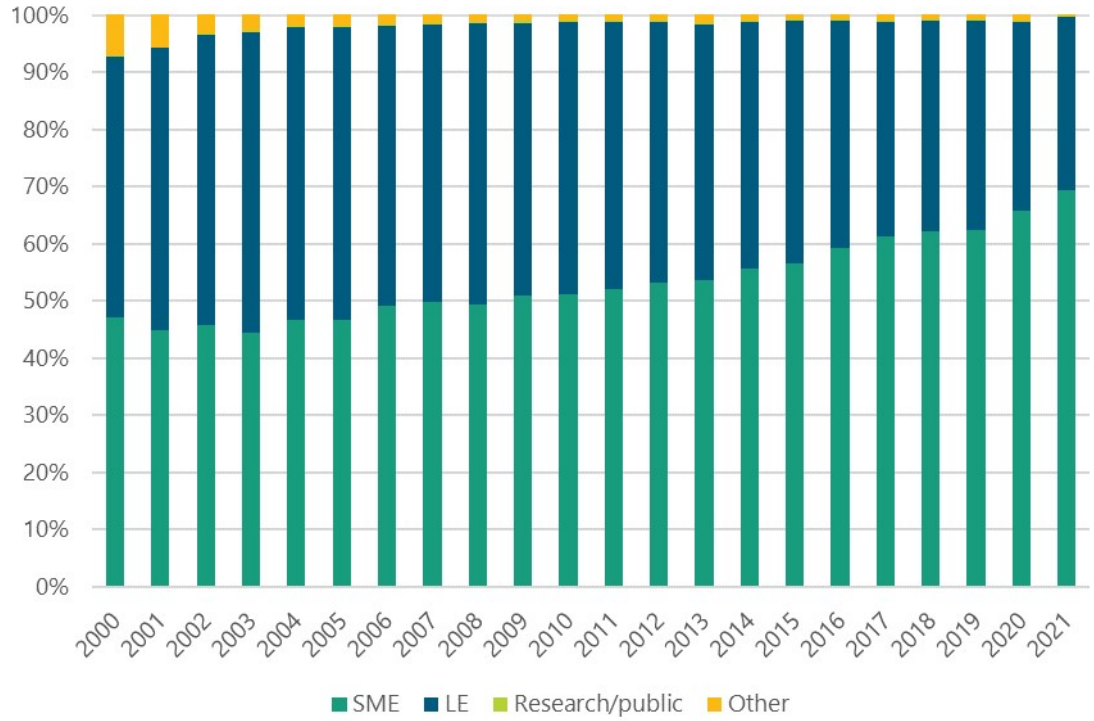
Figure 4 Trade mark per applicant ratio by SMEs and large enterprises, 2000-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

To qualify this effect, the ratio of trade marks by applicant was differentiated by SMEs and large enterprises (Figure 4). Here, we find an explanation for this effect. As we can see from the data, the ratio of trade marks per applicant is rising over the years for large firms, while it is declining for SMEs. In other words, we see a concentration of trade mark filings in large firms, which is similar to what we find in the patenting trends. For the SMEs, however, we find the effect mentioned above, i.e. more and more SME applicants are entering the scene but file less trade marks within a year. On a final note, the trade marking gap in 2020 deserves to be mentioned. There is no definitive answer on the reason of this sharp decline in trade mark filings, though it probably has to do with the Covid crisis. One explanation might be that the companies have significantly decreased their number of trade mark filings during 2020.

Figure 5 Share of trade marks by applicant groups in total trade marks, 2000-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

When looking at the shares of trade marks by applicant groups, i.e. SMEs, large enterprises, public/research and other, some further interesting trends can be observed. First of all, the share of applications of the "other" category has decreased over the years, while the share of applications from research and public actors remained quite constant at a rather low level. Second, a decline in the shares of filings by large enterprises can be found over the years, especially since around 2010, i.e. after the financial crisis. In the 2000s, the shares of trade mark filings by SMEs and large firms were rather balanced. Since 2010, however, the SME shares have grown significantly so that in 2021, the share of trade marks from large firms equaled 30% while this share equaled nearly 70% for SMEs. Therefore, the majority of the growth of filings in the recent years can be attributed to SMEs rather than large companies. However, as we can see from the analyses of trade marks per applicant in Figure 4, this is not an effect of an increase in trade mark filings per SME, it is rather an increasing number of SMEs that file trade marks that lead to this effect.

Besides the differentiation by SMEs and large firms, we can also differentiate the SMEs by some further size classes alongside the EU definition of SMEs.[4] This is plotted in Figure 6. The shares of trade marks filed by medium sized enterprises (50-249 employees) has de-

[4] This is only possible for those SMEs that have been matched to ORBIS and for which the information on the number of employees is available.

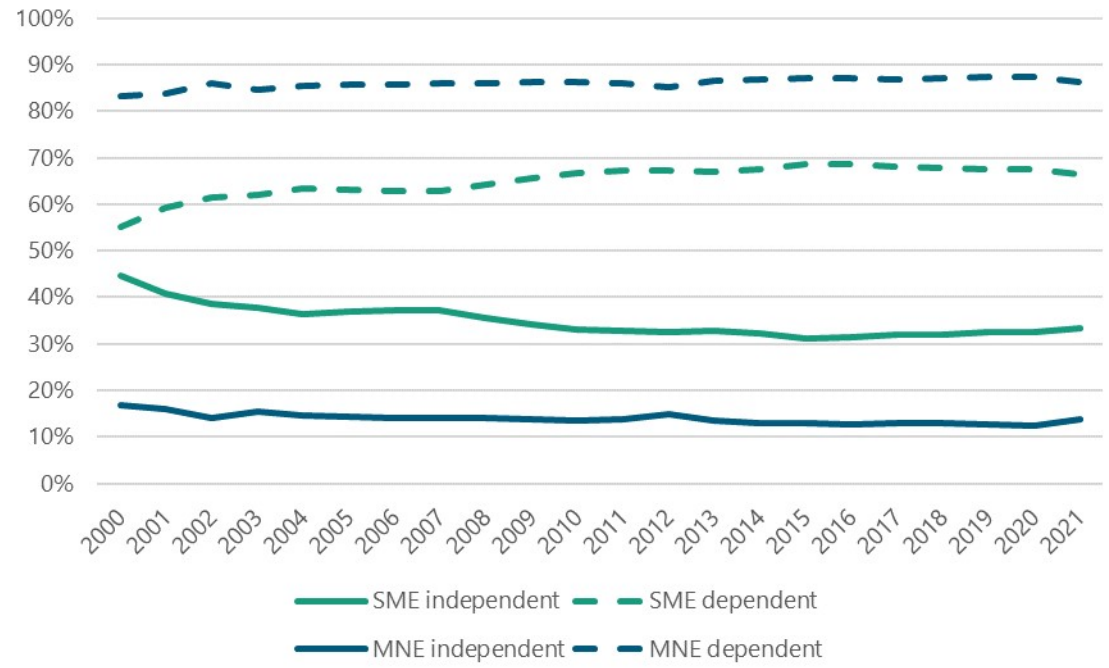
clined from slightly over 30% in the early 2000s to 23% in 2021. The shares of trade marks filed by micro firms (<10 employees), on the other hand, has increased from slightly over 35% to 48% in 2021, which pretty much compensates the decline for the medium sized enterprises. The share of filings by small enterprises (10-49 employees) has remained rather constant over the years at roughly 30%.

Figure 6 Shares of SME trade marks by size class, 2000-2021

Source: EUIPO; BvD Orbis; EPO - PATSTAT.

In a final step, we differentiate SMEs and large firms by their dependence on other firms. More specifically, we split the shares of trade mark filings by large firms and SMEs alongside the fact whether they were majority owned by another firm, i.e. whether they have a global ultimate owner (GUO) that owns the respective company with a share of more than 50%. This information was taken from the BvD Orbis database. The results of this analysis can be found in Figure 7. The share of trade marks from dependent firms is larger than the share of trade marks filed by independent firms. This is even more pronounced for large firms than it is for SMEs, i.e. in the case of large firms 86% of all trade marks were filed by firms that actually have a GUO, while this share lies at 67% for SMEs. For both size classes, however, the share of dependent firms has slightly increased especially in the early 2000s, but has remained rather stable in the past ten years.

Figure 7 Shares of trade marks by independent and dependent firms, 2000-2021

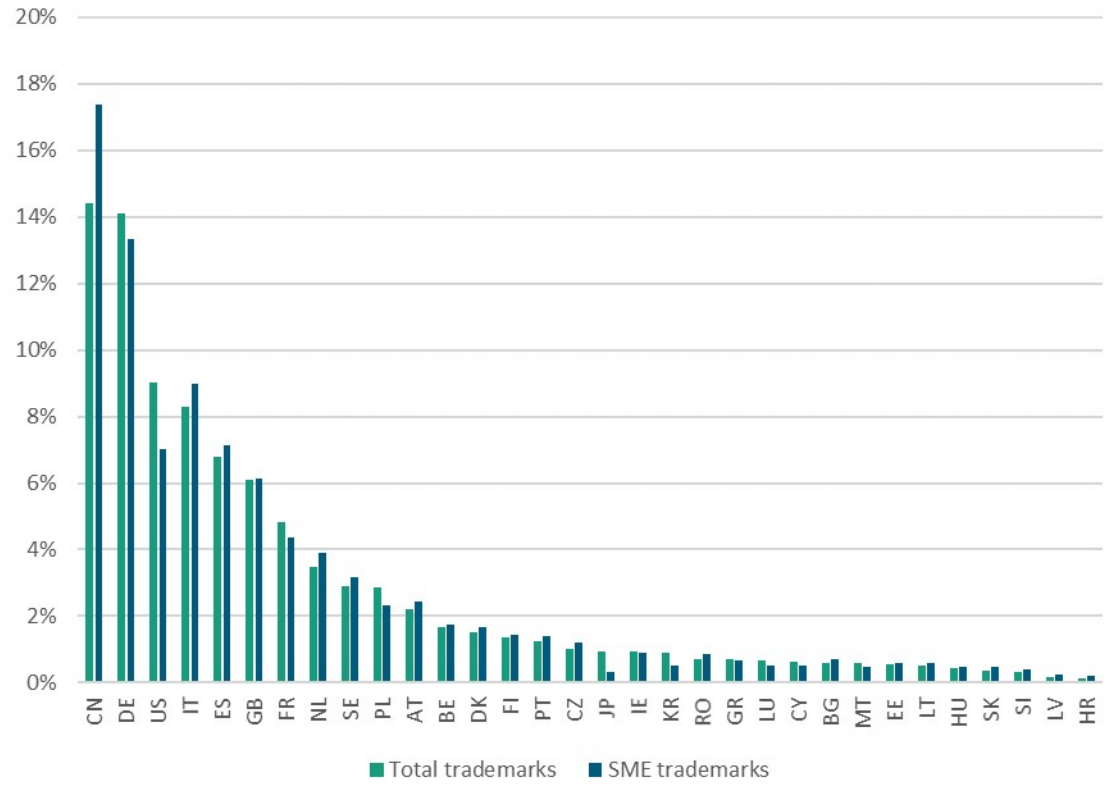


Source: EUIPO; BvD Orbis; EPO - PATSTAT.

4.1.2 Country-specific and regional trends

In this section, we will take a closer look at the country-specific trends in trade mark filings. Consequently, Figure 8 shows a country's trade mark shares in all trade marks filed at the EUIPO, for the total number of trade marks as well as the number of trade marks filed by SMEs only. A raw count of the numbers shows that China is the largest trade mark applicant at the EUIPO. About 14.5% of all EUIPO filings are filed by a Chinese applicant. Germany scores second on this ranking with a share of 14.1%, followed by the U.S., with a share of 9%. After the U.S. the European countries Italy, Spain, Great Britain, France and the Netherlands follow with shares between 4% and 7%. When looking at the SME shares only, a similar picture emerges. Here, China has even larger filing shares. About 17% of all SME trade mark filings at the EUIPO originate from Chinese SMEs. Once again, China is followed by Germany with a share of 13%.

Figure 8 Country shares in total trade marks, 2019-2021

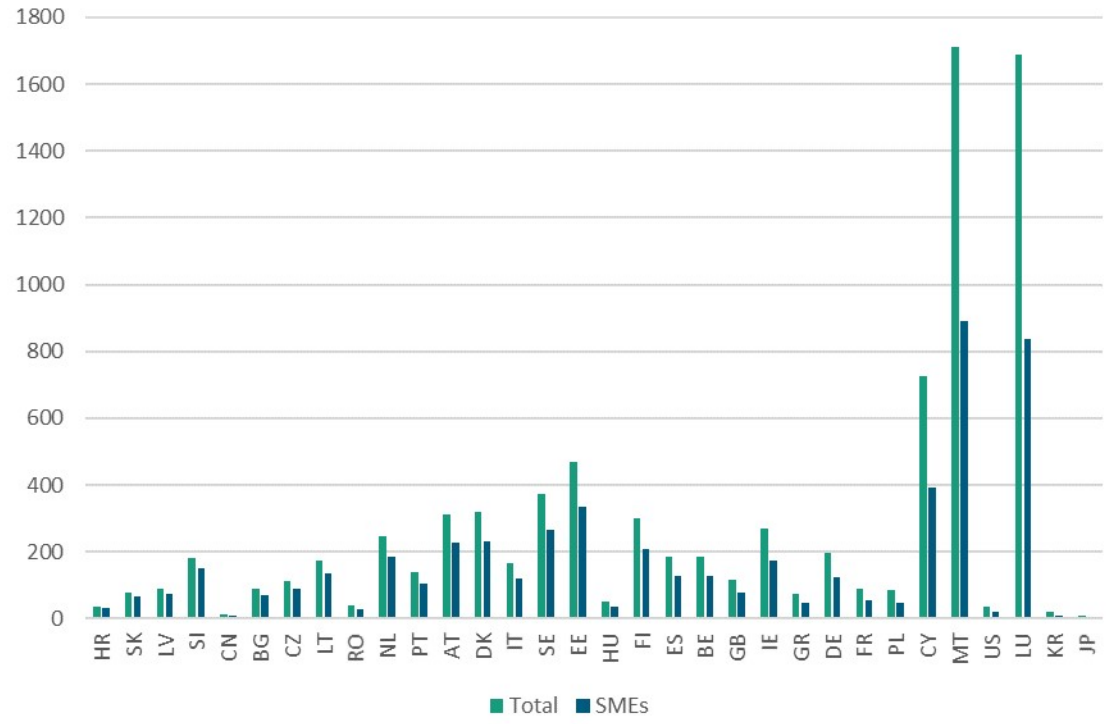


Source: EUIPO; BvD Orbis; EPO - PATSTAT.

For the U.S., the trade mark shares by SMEs are considerably smaller than the general shares (7%), so they score behind Italy and Spain on this indicator. All in all, the larger European countries show higher trade mark shares than the smaller ones like Croatia, Latvia, Slovenia or Slovakia. This, however, is different when analysing a size independent indicator, namely the trade mark intensity, which is normalized by dividing the number of trade marks of a given country by its inhabitants (in millions). This indicator is displayed in Figure 9.

Especially the smaller countries show the largest trade mark intensities. The countries with the largest general intensities are Malta, Luxembourg and Cyprus. They are followed by Estonia, Sweden, Denmark, Austria and Finland. When looking at SMEs only, a similar trend can be observed. The largest SME trade mark intensities can also be found for Malta, Luxembourg and Cyprus, i.e. the smaller countries in Europe, whereas the large countries like China, the U.S., Japan or Korea have very small trade mark intensities.

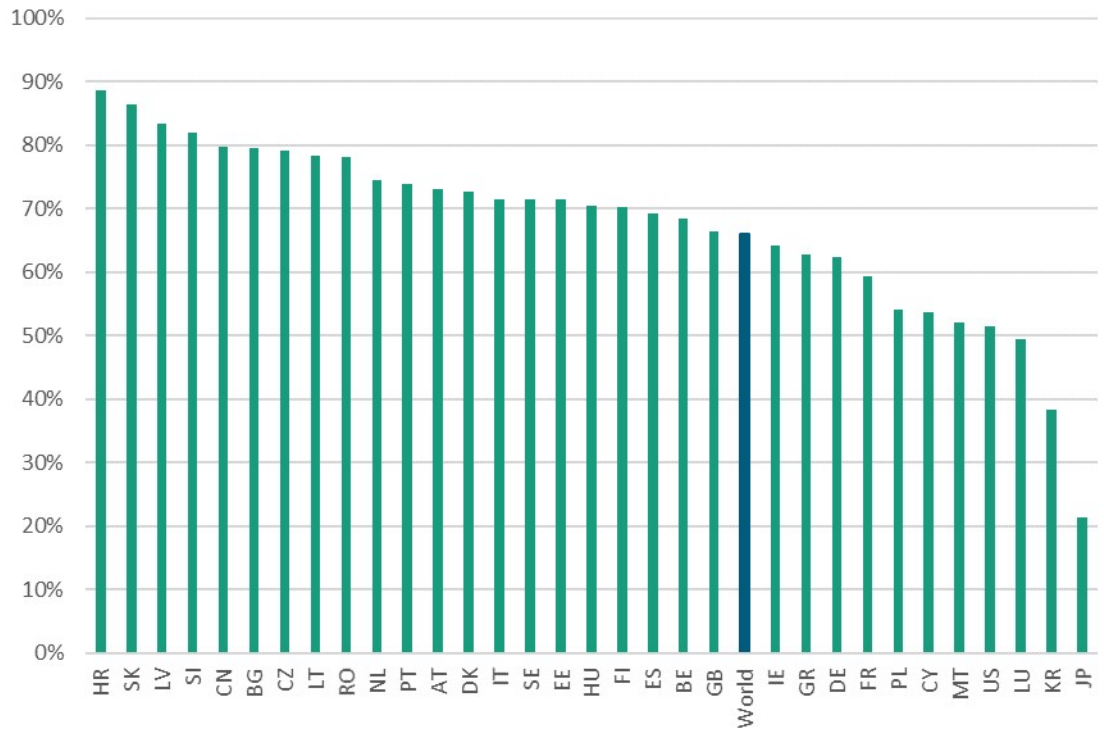
Figure 9 Trade mark intensities – per million inhabitants – by country, 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

The SME shares by country (Figure 10) show that the trade mark figures resemble the industry structure of the respective countries very well. Most of the smaller countries in terms of trade mark filings, e.g. Croatia, Slovakia, Latvia, Slovenia, Bulgaria or the Czech Republic show very high shares of trade marks filed by SMEs in their trade mark portfolio. The Asian countries Japan and Korea that are quite dominated by large firms within their industry show the smallest SME trade marking shares. This is also true for the U.S., which shows a below-average share of SME trade marks at the EUIPO, as well as for France and Germany. The UK, on the other hand, where many SMEs are located, consequently show an above-average share of SME trade marks. The most striking result can be found for China, where a very large share of trade marks are filed by SMEs, i.e. nearly 80% of all Chinese trade marks come from SMEs. The remaining 20% are heavily concentrated in a few large firms, like Huawei or ZTE. Yet, it has to be mentioned, however, that this might be an effect of a) the Chinese industry structure b) the matching rate to ORBIS, which is comparably low for Chinese companies and c) the information stored in ORBIS. Many Chinese firms lack information on turnover or the number of employees. If these firms without size information from ORBIS only filed less than three trade marks within the a three year time-frame, our algorithm automatically classifies them as SMEs, which is why the share of SME trade marks from China might be overestimated in our analysis.

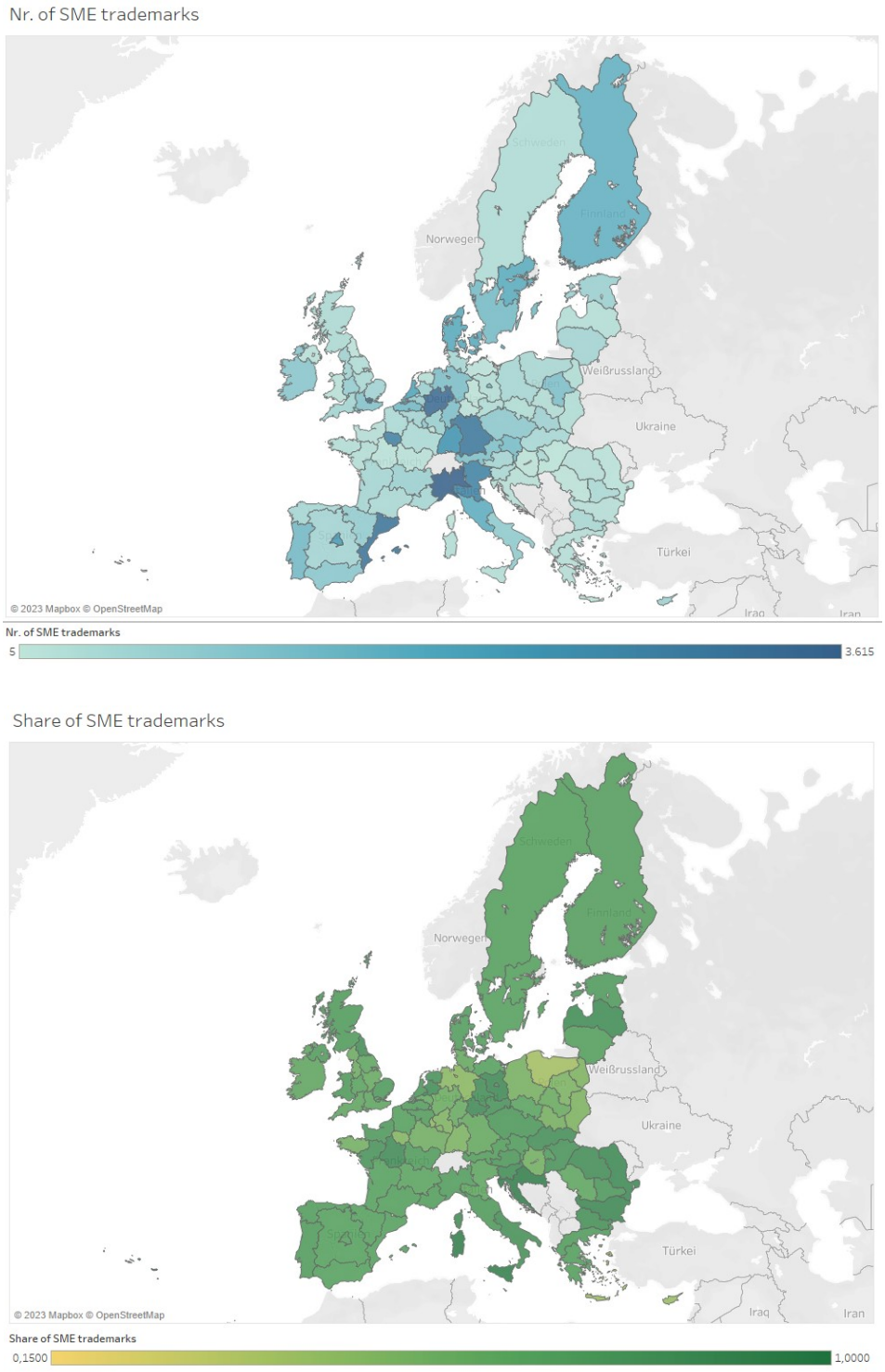
Figure 10 Share of SME trade marks in all trade marks of a the respective country, 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

Besides the country-level, we also have the chance to analyse the regional (NUTS-1) level within Europe. To reach this aim, a geocoding algorithm developed in the open-source project Pelias was employed (https://github.com/pelias). Pelias is a modular geocoder, which uses statistical NLP and open data to convert address data into a longitude/latitude location, which can be assigned to their corresponding regional zone. The number and shares of SME trade marks by region are displayed in Figure 11. As a very general statement, it can be observed that the German federal states Bavaria, Northrine-Westfalia and to a certain extent Baden-Wuerttemberg show large numbers of trade marks. In France, mostly the Paris region (Île-de-France) shows up as the largest NUTS-1 regions in terms of SME trade mark filings. In Italy, the Northwest, Northeast and Central regions stand out. In Spain, it is the Este region (Catalonia, Valencian Community and Balearic Islands) as well as the Madrid region that show rather large SME trade mark figures. In the Netherlands, the "Western Netherlands" show large SME filing figures, while in Northern Europe, West-Finland and Eastern Sweden (incl. Stockholm) stand out. Denmark also shows quite large filing numbers yet there are no sub-regions at the NUTS1-level.

Figure 11 Number (upper panel) and share (lower panel) of SME trade marks by NUTS-1 regions, 2019



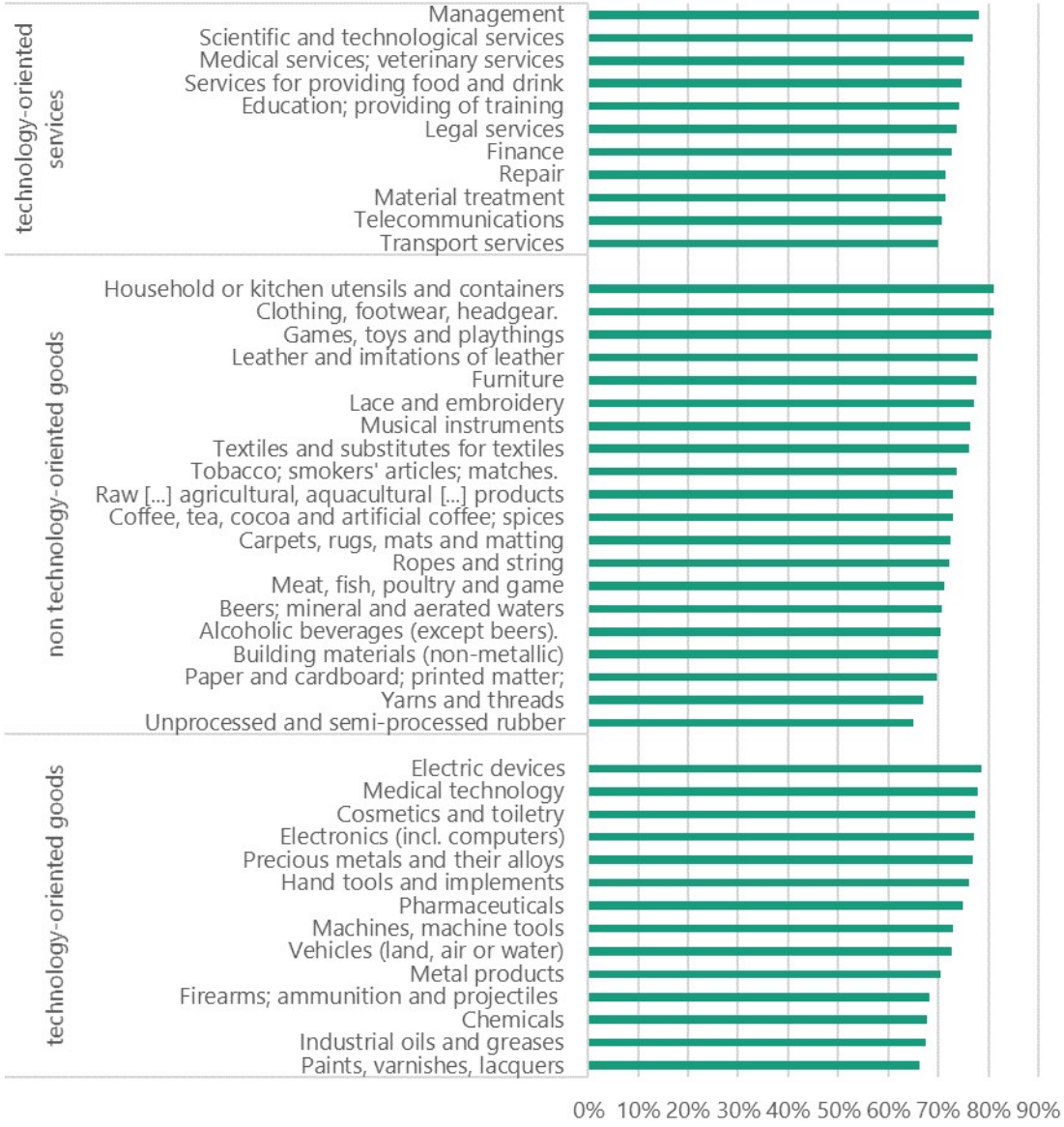
Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: The data in these two graphs include the UK as they show the situation before the "Brexit", so they apply to the EU of 28 Member States instead of 27 (currently).

4.1.3 Field-specific trends

Besides the country specific trends, the field specific trends are of interest for our further analyses. In Figure 12 the shares of SME trade mark filings by NICE classes are provided. Upon receipt of an application of a trade mark at the EUIPO (and other national offices), the trade mark will be processed, which includes a classification of the trade mark according to the NICE classification. The NICE classification has been established by the Nice Agreement in 1957 and is comprised of 45 classes. The classes 1 to 34 refer to goods, while classes 35 to 45 are services. The classes [5]define the scope and the context of each application and are provided by the applicants themselves, while mostly more than one class is assigned. In the graph, technology-oriented services (NICE classes 35-45), technology oriented goods (NICE classes 1-14) and non technology-oriented goods (NICE classes 15-34) are differentiated according to the classification by Schmoch and Gauch (2009). It can be stated that all three groups have similar SME shares on average. Within the group of the technology-oriented services, "management" has the largest share of SME filings in total filings, followed by "scientific and technological services", and "medical/veterinary services". In "telecommunications" and "transport services" the shares are lowest. As for the non technology-oriented goods, "household or kitchen utensils", "clothing, footwear, headgear" and "games, toys and playthings" have the largest SME shares. Within the group of technology-oriented goods, we find that "electric devices" show the largest shares of SME trade mark filings, followed by "medical technology", "cosmetics and toiletry" and "electronics (incl. computers)".

[5] https://euipo.europa.eu/ohimportal/en/nice-classification

Figure 12 Shares of SME trade mark filings by NICE classes, 2019-2021



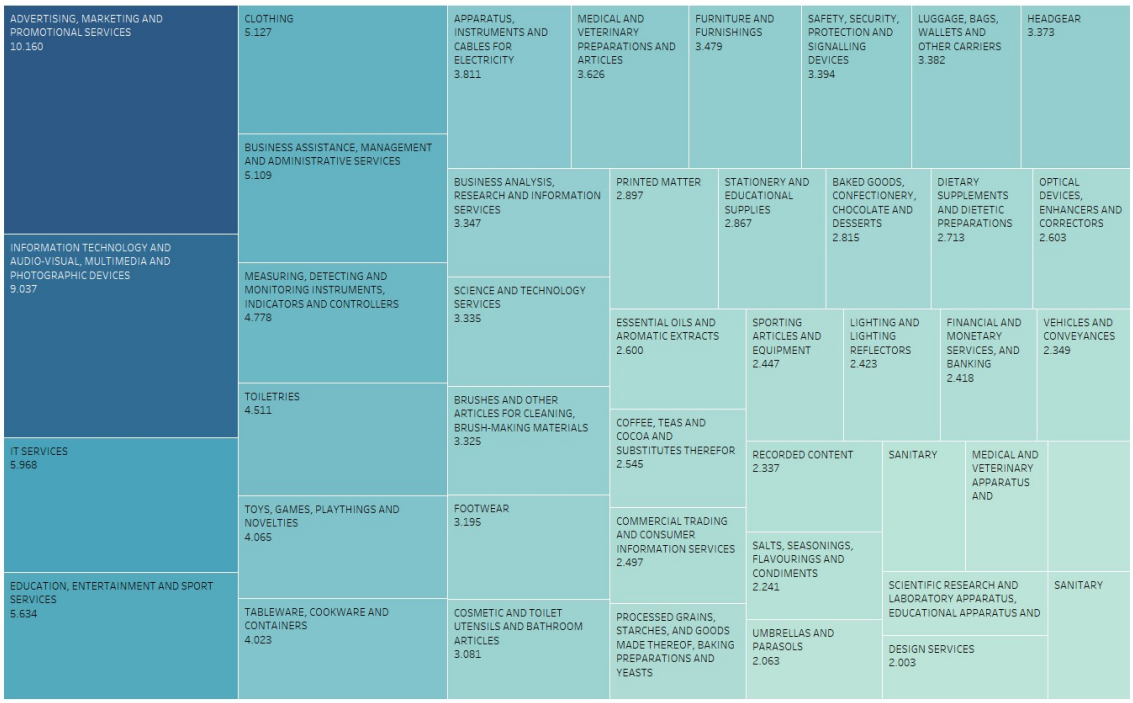
Source: EUIPO; BvD Orbis; EPO - PATSTAT.

Unfortunately, the NICE classification does not contain any subclasses, unlike for example, the International Patent Classification, and thus stays at a rather coarse-grained level. To overcome this issue, we have generated an in-depth classification of trade marks with more than 8.000 classes. It is the result of a matching of the trade mark descriptions provided by the applicant upon registration with the pre-defined list of keywords the applicant can choose

from the online platform "TMClass".[6] In sum, we were able to assign at least one class to 85% of all EUIPO trade mark filings (Neuhäusler et al. 2021).

The classification is, similar to the IPC, hierarchical with the NICE classes being the top-level. Below these are five more layers, ranging from the most aggregated "Level I" classes (234) to the most disaggregated "Level V" classes (~8,600). The largest level I classes by size (absolute numbers) for the SME trade marks at the EUIPO between 2019 and 2021 are plotted in Figure 13. "Advertising, marketing and promotional services" a sub-class of NICE class 35 ("management") shows the largest number of SME filings within the three-year time-period. The second largest class are "information technology and audio-visual [...]" (sub-class of NICE class 9 "electronics (incl. computers) ") and "IT services" (sub-classes of NICE 42 "scientific and technological services ").

Figure 13 Nr. of SME trade marks by Level 1 class, 2019-2021 (average)



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

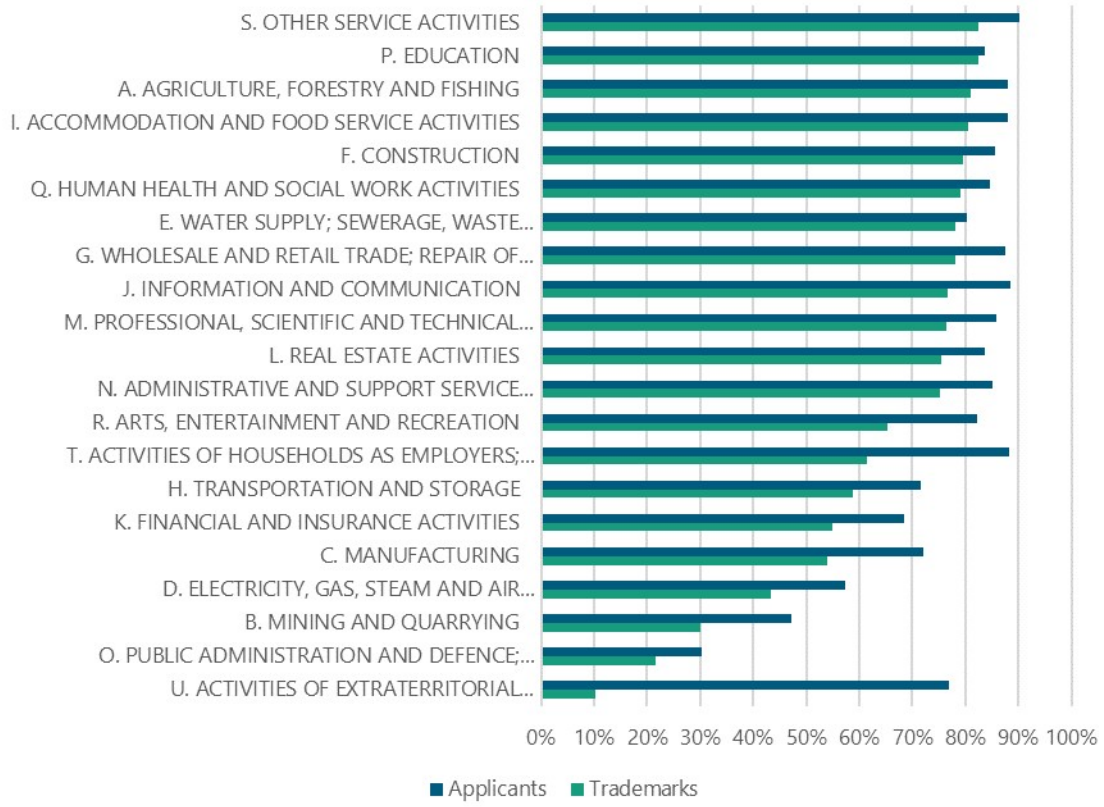
In order to also gain a sectoral view on the distribution of trade marks, we can use the trade mark applicants that have been matched to ORBIS to generate the distribution of SME trade marks across economic sectors according to the Statistical Classification of Economic Activities in the European Community (NACE classification) at the 1-digit level.[7] Here, a difference

[6] https://euipo.europa.eu/ec2/?lang=en

[7] https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

between the number of applicants and the number of trade marks is notable for some sectors, which is why both indicators are plotted (Figure 14). In manufacturing, for example, the share of SME trade marks in all trade marks from this sector is 54%, whereas the share of SME applicants in all applicants is 72%, implying that in the manufacturing sector, a comparably large share of trade marks is filed by a fewer number of large firms. This difference, however, is less strongly pronounced in most of the service sectors, where the share of SME trade marks mostly lies in the range of 70% to 80%.

Figure 14 Shares of SME trade mark filings by NACE sectors, 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Information on NACE sectors is only available for applicants that have been matched with the ORBIS database.

4.2 Trade marking vs. non-trade marking firms

4.2.1 Basic comparisons

In this section, we perform a comparison of firms that have filed trade marks in the 2019-2021 period, i.e. trade marking firms compared to firms that have not filed trade marks within that time period. The intention is to find out whether specific size-, country- or sectoral differences can be found. In order to do this, we have to limit our sample to trade mark applicants that have been matched to ORBIS, as we only have specific information, like for example the sector for this group of firms. All non-matched firms listed as "active" in ORBIS are treated as

"non-trade marking". On this basis, Table 3 shows an overview of the number of trade marking and non-trade marking firms by size class, i.e. SMEs vs. large enterprises (LEs). Since the size information (number of employees and/or sales) is not available for all firms within ORBIS, we calculated the shares of trade marking in non-trade marking firms only for those firms for which the information was available. In total, we find that 0.08% of all active firms within ORBIS are trade marking. This number might seem low at first, but it has to be noted that every firm worldwide, also the very small and 1-person firms and firms from all sectors, are included in this calculation. When we only look at large enterprises, we find that 6.28% of all large firms are trade marking firms, whereas the share is much lower for SMEs (0.15%).

Table 3 Nr. and shares of trade mark applicants in all active firms, 2019-2021

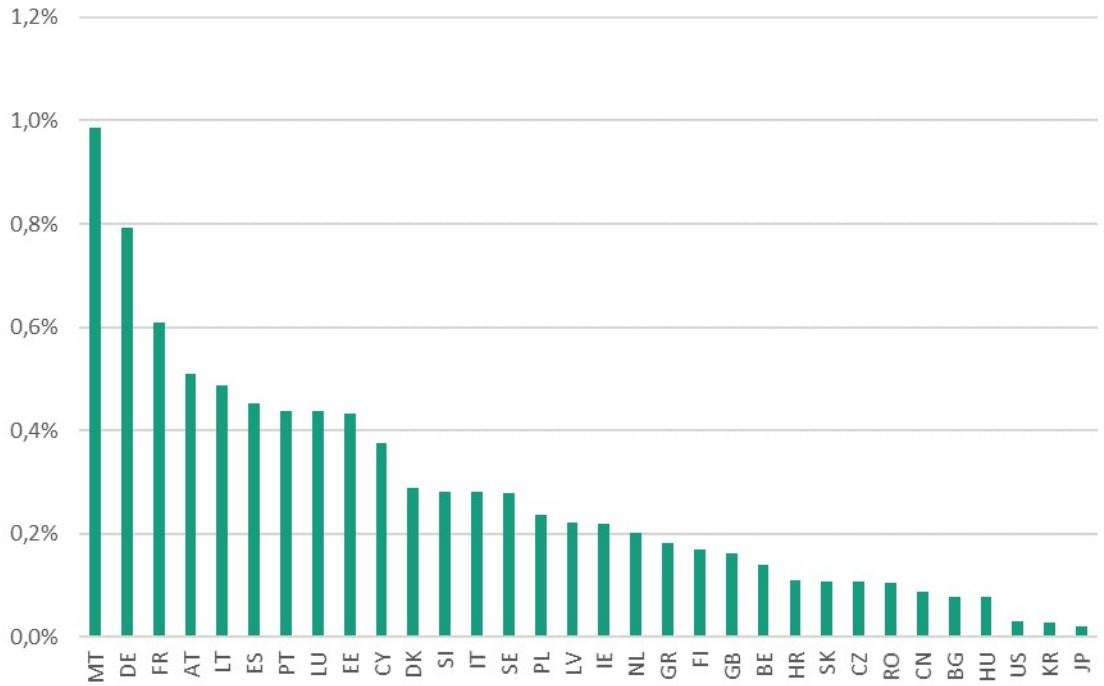
	Distinct trade mark applicants 2019-2021	Active firms (ORBIS)	Share
Total	188,563	246,288,015	0.08%
SME	158,411	107,807,924	0.15%
LE	28,117	448,053	6.28%
Unknown size	n.a.	138,032,038	

Source: EUIPO; BvD Orbis; EPO - PATSTAT.

The sectoral distribution, i.e. the shares of trade marking firms in all firms by country (Figure 15), shows that Malta has the largest share of trade marking firms. However, this might be an effect of country-size. Malta is followed by Germany, which not only files a large number of trade marks, but also has a high density of trade marking firms. This implies that the large share of trade marks filed from Germany does not only come from a small number of firms, but a large array of trade marking firms is involved. A similar statement can be made for France, for which the annual number of trade marks, however, is smaller. The opposite effect can be found for Japan and Korea but also for the U.S. and China. Here, a rather small number of firms actually files trade marks at the EUIPO. This might have to do with the different (selective) filing strategies of these firms. Typically, firms primarily use IPRs to secure their home-market. If they see an international market for their products, they might file IPRs abroad, but will probably be more selective as filing IPRs in other countries also comes with substantial additional costs.

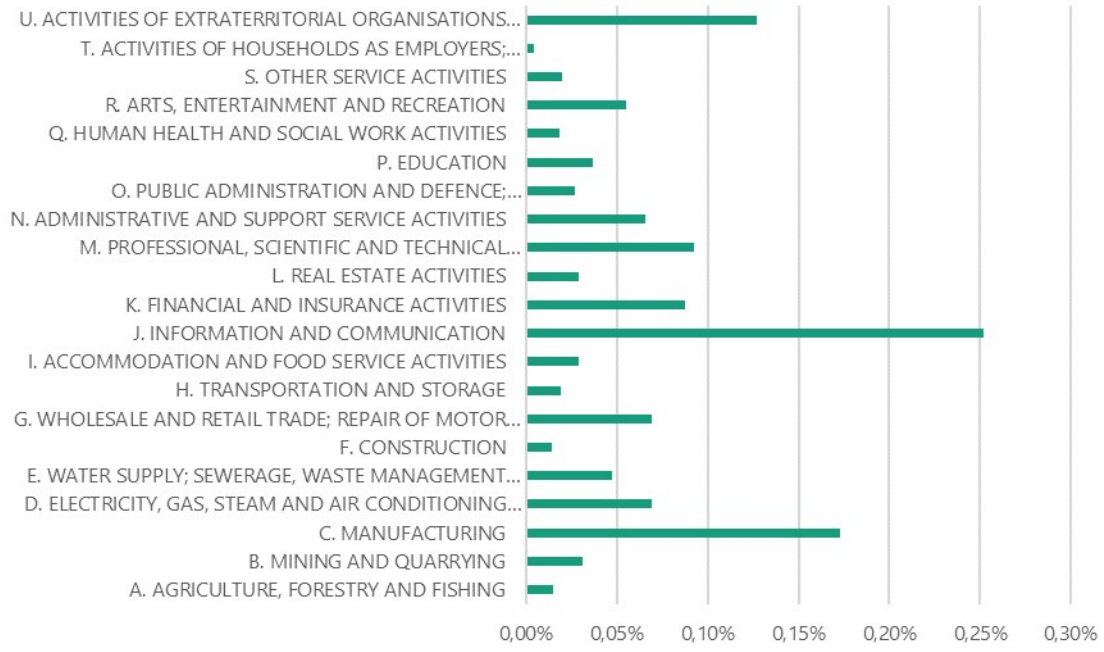
The sectoral distribution, i.e. the shares of trade marking firms in all firms by NACE (1-digit) sectors (Figure 16), shows that the largest share of trade marking firms is located in information and communication. In this sector, the density of trade marking firms is highest. Yet, also the manufacturing sector shows comparably large shares of firms that do file trade marks at the EUIPO.

Figure 15 Shares of trade marking firms in all firms by country, 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.

Figure 16 Shares of trade mark firms in all firms by NACE sectors, 2019-2021



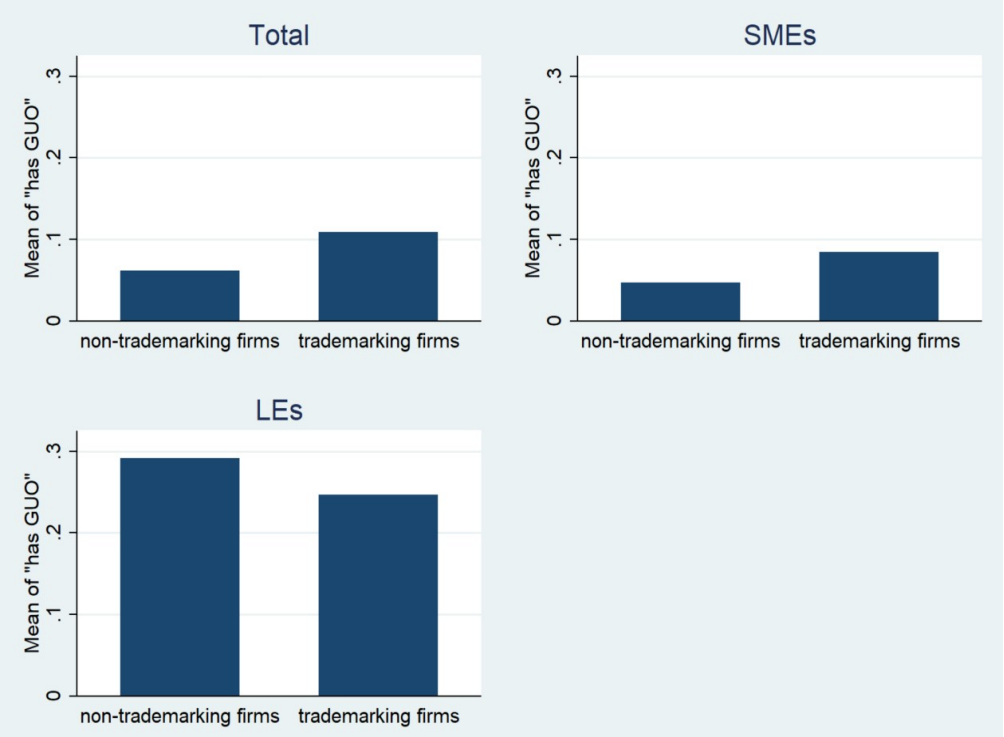
Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Information on NACE sectors is only available for applicants that have been matched with the ORBIS database.

4.2.2 Differences in ownership, productivity and financial performance

For the following analyses, we have made use of our control group that has been generated by using a stratified sampling technique based on the number of employees (categorized), the country as well as the industrial sector of an applicant in order to make sure that we have a reasonable group of non-trade marking firms that can be compared to the trade marking firms. We thus compare 8,099,592 observations from 674,966 non-trade marking firms in the control group to 3,669,252 observations from 305,771 trade marking firms.

Based on this sample, we would first of all like to answer the question whether trade marking firms, on average, are more often independent firms or firms owned by another company, i.e. a global ultimate owner (GUO). Furthermore, we would like to know whether trade marking firms are more productive than non-trade marking firms. We measure this by the turnover (in millions) generated per employee. This measure, however, does not say anything about a company's revenues or financial performance. We therefore also take a company's return on equity (ROE) into account, which, as described in the variables section above, indicates how well a company uses its own capital to generate returns, thereby measuring the profitability of a company.

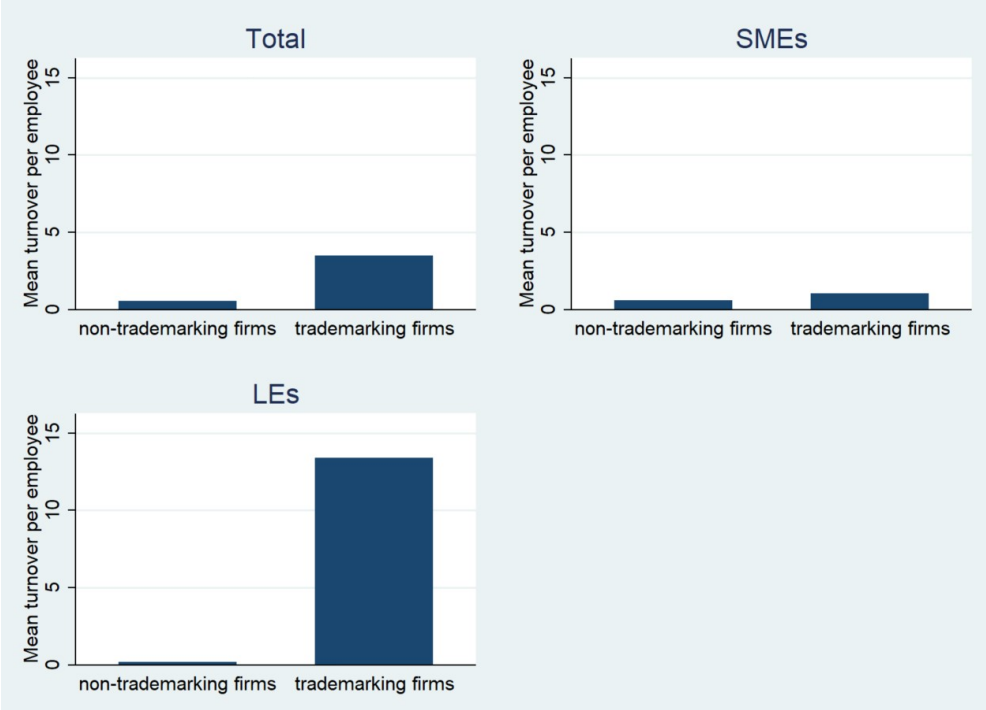
Figure 17 Shares of firms with GUOs, trade marking firms vs. non-trade marking firms (control group), 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Information on NACE sectors is only available for applicants that have been matched with the ORBIS database.

In Figure 17, we take a closer look at the shares of firms with GUOs, differentiated by trade marking firms vs. the control group of non-trade marking firms. We furthermore included the differentiation by SMEs and large enterprises. As can be observed from the figure, trade marking firms, on average, more often have a GUO than non-trade marking firms, i.e. more often are majority owned by another company. This effect, however, can mostly be attributed to SMEs, i.e. trade marking SMEs more often have a GUO than non-trade marking SMEs. For large firms, we find the opposite effect. Though large firms in total more often have a GUO than smaller firms, we find that non-trade marking large firms more often are dependent than trade marking large firms. One simple explanation might be that the trade marks of dependent companies are filed by the GUO instead of the company itself, while in cases where there is no GUO, the company files the trade marks itself. The main reason for this is that IPR usage is a matter of experience and GUOs might have more cases of IPR registration than an individual company (scaling effects). However, GUOs might also have own legal departments, while independent SMEs hardly have this.

Figure 18 Average turnover per employee, trade marking firms vs. non-trade marking firms (control group), 2019-2021



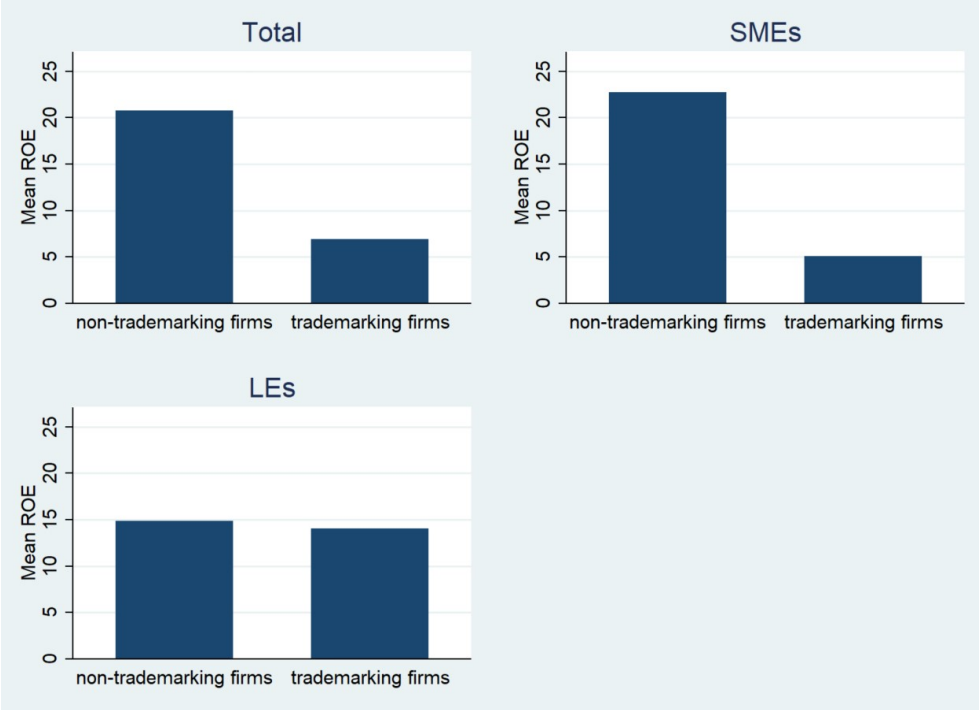
Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Information on NACE sectors is only available for applicants that have been matched with the ORBIS database.

Regarding the question of productivity, the average turnover per employee was analysed. It is plotted in Figure 18. The figure shows that trade marking firms, on average, have a larger productivity than non-trade marking firms. This effect can mostly be attributed to large enterprises, where the difference between trade marking and non-trade marking firms is especial-

ly large. It can furthermore be observed that the turnover per employee, on average, is larger in large firms than in SMEs in general, which confirms effects found in other studies. The OECD, for example, found a similar effect, particularly in the manufacturing sector, which typically reflects increasing returns to scale through capital-intensive production (OECD 2021).

Finally, Figure 19 depicts the average Return on Equity differentiated by trade marking firms vs. non-trade marking firms. Overall, it can be found that the average ROE is larger for non-trade marking firms than for trade marking firms. This effect, however, can be attributed mainly to SMEs as the difference in ROE between trade marking and non-trade marking large enterprises is rather low. It is rather the small and medium-sized enterprises where a large difference in the ROE of trade marking and non-trade marking firms can be found. It can therefore be stated that although trade marking SMEs are more productive, this is not yet resembled in their financial performance. This might have to do with the fact that trade marking SMEs are innovative firms, which are not yet performing very well financially as innovation is cost-intensive and it takes some time to generate returns from these innovations, which then are later resembled in positive ROE values, an effect that has been found in (Frietsch et al. 2022a). However, this might also simply be the result of the sector structures where a bias could be induced by companies in sectors with large intermediate inputs.

Figure 19 Average Return on Equity, trade marking firms vs. non-trade marking firms (control group), 2019-2021



Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Information on NACE sectors is only available for applicants that have been matched with the ORBIS database.

4.3 The interrelations between the number of trade marks, firm size and firm performance

In this section, we will describe the multivariate analyses that we have performed to find out more about size differences in trade marking and the financial performance of firms. Before we dig deeper into the multivariate analyses, Table 4 first of all shows the summary statistics of our variables for the overall sample as well as differentiated by SMEs and large firms. In the last column of the table the significance level of the t-tests for the differences in means between SMEs and large enterprises are provided.

For the multivariate analyses, we created a panel dataset for the years 2010 to 2021 for the trade marking firms in the dataset. In case information was missing on some variables the values of the given years were imputed, i.e. the values from previous or subsequent years were used to fill in the gaps where necessary. However, for some firms no information at all was available for some variables, therefore the dataset contains missing values.

As we can see from Table 4, there are 305,771 trade marking firms in our sample, of which 259,420 are SMEs and 46,351 are large companies. There are significant differences between large enterprises and SMEs across nearly all variables in our dataset. However, these differences in means will be explored more deeply in the following multivariate analyses.

Table 4 Summary statistics

	Variable	Mean	Std. Dev.	Min	Max	Nr. of obs.	Nr. of groups	Sig. diff.
Overall	SME Dummy	0.85	0.36	0	1	3669252	305771	--
	Nr. of trade marks	0.21	1.35	0	942	3669252	305771	--
	Breadth of TM portfolio	3.11	2.64	1	45	451136	299038	--
	Continuous applicant	0.02	0.12	0	1	3669252	305771	--
	Nr. of transnational patent filings	0.69	23.94	0	4383	3669252	305771	--
	TM/Patent portfolio supplementarity	3.08	1.29	0.00	5.00	40587	23136	--
	Operating revenue	489.46	4987.74	-2504.00	363380.00	2044654	176270	--
	Nr. of employees	1236.26	12627.38	0.00	1298000.00	1797762	156714	--
	GUO Dummy	0.11	0.31	0.00	1.00	1593035	136210	--
	Turnover per employee	3.65	203.86	-298.40	35040.00	2526953	217793	--
	Return on Equity	6.79	114.87	-999.23	999.79	3669252	305771	--
	World region	1.49	0.98	1.00	4.00	2376876	198073	--
	Country (EU-27 only)	11.68	7.12	1	27	3164976	263748	--
	NACE Sector	3.47	0.89	1	4	3669252	305771	--
	Field: Electrical engineering	0.11	0.84	0	700	3669252	305771	--
	Field: Instruments	0.07	0.60	0	343	3669252	305771	--
	Field: Chemistry	0.09	0.74	0	604	3669252	305771	--
	Field: Mechanical engineering	0.08	0.60	0	365	3669252	305771	--
	Field: Other fields	0.12	0.83	0	232	3669252	305771	--
SME	SME Dummy	1.00	0.00	1	1	3113040	259420	--
	Nr. of trade marks	0.15	0.55	0	83	3113040	259420	***
	Breadth of TM portfolio	2.90	2.13	1	45	338760	253293	***
	Continuous applicant	0.005	0.07	0	1	3113040	259420	***
	Nr. of transnational patent filings	0.14	6.55	0	3429	3113040	259420	***
	TM/Patent portfolio supplementarity	3.22	1.25	0	5	17569	13529	
	Operating revenue	181.97	3405.12	-2504	363380	1673122	144698	***
	Nr. of employees	417.22	7211.47	0	1298000	1443726	126391	***
	GUO Dummy	0.08	0.28	0	1	1267166	108639	***
	Turnover per employee	1.10	96.21	-298	25720	2154873	186128	***
	Return on Equity	4.95	122.10	-999	1000	3113040	259420	***
	World region	1.46	0.95	1	4	2067504	172292	--
	Country (EU-27 only)	11.74	7.16	1	27	2711844	225987	--
	NACE Sector	3.51	0.87	1	4	3113040	259420	--
	Field: Electrical engineering	0.08	0.38	0	68	3113040	259420	***
	Field: Instruments	0.05	0.31	0	62	3113040	259420	***
	Field: Chemistry	0.06	0.34	0	62	3113040	259420	***
	Field: Mechanical engineering	0.05	0.32	0	62	3113040	259420	***
	Field: Other fields	0.08	0.41	0	71	3113040	259420	***
LE	SME Dummy	0.00	0.00	0	0	556212	46351	--
	Nr. of trade marks	0.57	3.20	0	942	556212	46351	--

Variable	Mean	Std. Dev.	Min	Max	Nr. of obs.	Nr. of groups	Sig. diff.
Breadth of TM portfolio	3.73	3.72	1	45	112376	45745	--
Continuous applicant	0.075	0.26	0	1	556212	46351	--
Nr. of transnational patent filings	3.79	59.40	0	4383	556212	46351	--
TM/Patent portfolio supplementarity	2.97	1.31	0.00	5.00	23018	9607	--
Operating revenue	1874.17	9074.72	-878.75	360950.00	371532	31572	--
Nr. of employees	5979.64	27483.27	0.00	1298000.00	354036	30323	--
GUO Dummy	0.25	0.43	0.00	1.00	325869	27571	--
Turnover per employee	14.05	416.11	-298.40	35040.00	372080	31665	--
Return on Equity	13.92	80.44	-996.43	999.79	556212	46351	--
World region	1.68	1.08	1	4	309372	25781	--
Country (EU-27 only)	11.25	6.88	1	27	453132	37761	--
NACE Sector	3.24	0.98	1	4	556212	46351	--
Field: Electrical engineering	0.27	1.96	0	700	556212	46351	--
Field: Instruments	0.19	1.34	0	343	556212	46351	--
Field: Chemistry	0.24	1.72	0	604	556212	46351	--
Field: Mechanical engineering	0.20	1.33	0	365	556212	46351	--
Field: Other fields	0.31	1.89	0	232	556212	46351	--

Source: EUIPO; BvD Orbis; EPO - PATSTAT. Note: SME Dummy (1=SME, 0= LE), Continuous applicant (1=yes, 0=no), GUO Dummy (1=yes, 0=no), World region (1=Europe, 2= U.S., 3=China/Japan/Korea, 4= RoW), NACE Sector (1=1-9, 2=10-33, 3=34-43, 4=>45), Field: Electrical engineering (1=yes, 0=no), Field: Instruments (1=yes, 0=no), Field: Chemistry (1=yes, 0=no), Field: Mechanical engineering (1=yes, 0=no), Field: Other fields (1=yes, 0=no).

To test whether the differences between SMEs and large firms hold when controlling for other variables as well as sector and time-specific controls, we ran a series of multivariate regression models. The first model series, showing the effects of our independent variables on the number of annual trade mark filings as the response variable, is depicted in Table 5. The model is provided in four different versions (M1-1 to M1-4) including either NACE sectors of technology fields (WIPO35 aggregate) and world regions or countries. As described in the methodology section, the model is split alongside the size class information, i.e. SME vs. large firm, to find out whether the coefficients of the selected variable differ between firms of different sizes.

The model shows that the breadth of the trade mark portfolio, i.e. the spread of trade marks across NICE classes, is positively related to the trade mark output. The same holds for the variable capturing whether an applicant is a continuous or a discontinuous applicant. Continuous applicants, on average, file more trade marks than discontinuous applicants. This might sound obvious, however, this also implies that it is not a common case that a firm files a lot of trade marks in one year and then stops using the trade mark system. Applicants that also file patents, ceteris paribus, also file more trade marks. This confirms the results by Garcia-Valero (2021) who found that there is a positive effect of the "IPR bundle" on the probability of filing trade marks. However, here we can show that this effect is independent of firm size as we find a significantly positive coefficient for large firms as well as SMEs. This most likely has to do with experience in the IPR system. Firms that use a given IPR, in this case patents, have gained experience with using IPRs in general, which increases the probability to use other IPRs as well. In general, it has to be noted that the number of trade marking firms that also file patents is quite low. Only about 8% of the firms in our sample have both, patents and trade marks, in their IPR portfolio.

All in all, the relationships mentioned up to this point hold true for large firms and SMEs, however, they are more strongly pronounced for large firms. A relationship that is different

for large firms and SMEs is the effect of the GUO. Here, the coefficient is significantly positive for SMEs across all models, but negative for large firms (at least in M1-1). The effects for the world regions show that the average number of trade marks per firm from other world regions is larger than in Europe. It thus seems that if non-European firms use the EUIPO system to file a trade mark, they on average file more trade marks than a European firm does, independent of firm size. This means that once a company decides to file trade marks abroad, it does so on a more frequent basis than European firms. The only exception to this pattern are SMEs from Asia. However, especially the Korean and Japanese firm structures are dominated by large enterprises, which serves as an explanation for this effect. The sectoral differentiation shows that there are fewer trade mark filings per applicant in service sectors than in the primary sector. Finally, when including the technology fields as control variables, it can be found that on average fewer trade marks are filed in the field of mechanical engineering (only true for SMEs), whereas there are more trade marks filed by firms in electrical engineering, chemistry and other fields.

Table 5 Multivariate models I – Structural effects on the number of trade marks

SMEs

dV: Nr. of trade marks	M1-1		M1-2		M1-3		M1-4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Breadth of TM portfolio	0,042 ***	0,001	0,039 ***	0,001	0,027 ***	0,001	0,022 ***	0,001
Continuous applicant	0,532 ***	0,007	0,516 ***	0,009	0,360 ***	0,007	0,349 ***	0,008
Nr. of transnat. patent filings	0,000 ***	0,000	0,000	0,000	0,001 ***	0,000	0,000 **	0,000
GUO Dummy	0,069 ***	0,007	0,111 ***	0,025	0,090 ***	0,006	0,148 ***	0,022
World region								
U.S.	0,126 ***	0,006			0,111 ***	0,006		
China/Japan/Korea	-0,069 ***	0,011			-0,070 ***	0,009		
RoW	0,050 ***	0,006			0,014 **	0,005		
Country (EU-27 only)								
BG			-0,005	0,025			0,098 ***	0,024
CZ			-0,012	0,018			0,119 ***	0,017
DK			0,025	0,016			0,162 ***	0,015
DE			0,040 ***	0,011			0,191 ***	0,011
EE			-0,026	0,045			0,103 **	0,043
IE			0,112 ***	0,020			0,206 ***	0,017
GR			0,014	0,033			0,126 ***	0,031
ES			-0,020 *	0,012			0,114 ***	0,012
FR			0,042 ***	0,012			0,165 ***	0,013
HR			-0,004	0,047			0,139 ***	0,046
IT			0,008	0,012			0,149 ***	0,012
CY			0,048	0,031			0,125 ***	0,023
LV			-0,055	0,042			0,080 *	0,041
LT			-0,035	0,029			0,091 ***	0,028
LU			0,102 ***	0,021			0,202 ***	0,020
HU			0,012	0,032			0,139 ***	0,030
MT			0,272 ***	0,031			0,250 ***	0,023
NL			0,019	0,012			0,150 ***	0,013
AT			0,043 ***	0,014			0,179 ***	0,014
PL			0,063 ***	0,016			0,165 ***	0,016
PT			-0,026	0,017			0,116 ***	0,017
RO			-0,023	0,023			0,092 ***	0,023
SI			-0,037	0,035			0,111 ***	0,032
SK			-0,018	0,027			0,098 ***	0,027
FI			0,023	0,016			0,176 ***	0,016
SE			0,052 ***	0,013			0,186 ***	0,013
NACE sector								
10-33	0,003	0,015	-0,017	0,017				
34-43	-0,087	0,019	-0,124 ***	0,021				
>45	-0,038 **	0,015	-0,071 ***	0,017				
Field								
Field: Electrical engineering					0,069 ***	0,001	0,096 ***	0,002
Field: Instruments					-0,105 ***	0,002	-0,130 ***	0,003
Field: Chemistry					0,096 ***	0,001	0,094 ***	0,002
Field: Mech. engineering					-0,055 ***	0,002	-0,075 ***	0,003
Field: Other fields					0,084 ***	0,001	0,100 ***	0,002
Constant	0,184 ***	0,016	0,211 ***	0,021	0,072 ***	0,006	-0,078 ***	0,013
Time Dummies	YES		YES		YES		YES	
Obs.	296815		209945		338760		228571	
LR Chi2²	10966,26		6748,25		47299,2		29381,9	
Prob > Chi²	0,000		0,000		0,000		0,000	
Pseudo R²	0,014		0,0124		0,053		0,0496	

MNEs

dV: Nr. of trade marks	M1-1		M1-2		M1-3		M1-4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Breadth of TM portfolio	0,074 ***	0,001	0,062 ***	0,001	0,018 ***	0,001	0,009 ***	0,001
Continuous applicant	0,859 ***	0,006	0,817 ***	0,008	0,557 ***	0,005	0,518 ***	0,007
Nr. of transnat. patent filings	0,001 ***	0,000	0,002 ***	0,000	0,000 ***	0,000	0,001 ***	0,000
GUO Dummy	-0,035 ***	0,011	0,018	0,019	0,039 ***	0,008	0,095 ***	0,016
World region								
U.S.	0,239 ***	0,012			0,205 ***	0,009		
China/Japan/Korea	0,145 ***	0,016			0,086 ***	0,012		
RoW	0,170 ***	0,012			0,078 ***	0,009		
Country (EU-27 only)								
BG			0,027	0,061			-0,008	0,051
CZ			-0,042	0,047			-0,096 **	0,040
DK			-0,024	0,031			-0,025	0,026
DE			-0,024	0,024			-0,029	0,019
EE			0,081	0,112			-0,025	0,093
IE			0,022	0,037			0,039	0,028
GR			0,069	0,075			-0,111 *	0,058
ES			-0,047 *	0,026			-0,090 ***	0,021
FR			0,005	0,025			-0,056 ***	0,021
HR			0,069	0,160			-0,072	0,144
IT			-0,091 ***	0,025			-0,109 ***	0,020
CY			0,481 ***	0,048			0,185 ***	0,033
LV			0,022	0,115			-0,079	0,102
LT			-0,062	0,077			-0,108	0,066
LU			0,289 ***	0,038			0,022	0,031
HU			-0,140	0,106			-0,114	0,077
MT			0,569 ***	0,059			0,277 ***	0,043
NL			-0,037	0,027			-0,048 **	0,022
AT			-0,069 **	0,030			-0,059 **	0,024
PL			0,150 ***	0,032			0,026	0,026

PT				0,051		0,041				0,013		0,034
RO				0,051		0,062				-0,128	**	0,054
SI				-0,295	***	0,092				-0,290	***	0,073
SK				0,208	***	0,078				0,031		0,069
FI				-0,099	***	0,032				-0,061	**	0,026
SE				-0,008		0,028				-0,043	*	0,023
NACE sector												
10-33	0,033		0,028	-0,005		0,035						
34-43	-0,256	***	0,036	-0,281	***	0,042						
>45	-0,061	**	0,028	-0,109	***	0,035						
Field												
Field: Electrical engineering							0,050	***	0,001	0,068	***	0,002
Field: Instruments							-0,048	***	0,001	-0,066	***	0,002
Field: Chemistry							0,059	***	0,001	0,071	***	0,001
Field: Mech. engineering							0,018	***	0,001	0,035	***	0,002
Field: Other fields							0,059	***	0,001	0,050	***	0,001
Constant	0,323	***	0,030	0,455	***	0,043	0,325	***	0,009	0,401	***	0,021
Time Dummies	YES			YES			YES			YES		
Obs.	90900			54957			112376			66162		
LR Chi2²	41378,43			20885,59			91407,77			52133,49		
Prob > Chi²	0,000			0,000			0,000			0,000		
Pseudo R²	0,1046			0,0904			0,1868			0,1863		

Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Significance Level: ***p<0.01, **p<0.05, *p<0.1. Reference category for World region=Europe, Country=BE, NACE Sector=1 (=NACE 1-9). Since patents and trade marks can be assigned to more than one field, there is no reference category for these variables. They have to be interpreted as 0/1 dummies.

Further interesting effects can be revealed when looking at the regression models with productivity as the dependent variable, indicated by the turnover per employee (M2-1 to M2-3, Table 6). It can be observed that the breadth of the trade mark portfolio is positively related to productivity. However, this is only true for large firms. For SMEs, having patents in the portfolio seems to be the important explanatory factor for an increase in the number of trade mark filings. Having a GUO is negatively associated with productivity, which is true for SMEs and large firms, implying that independent trade marking firms are less productive than dependent firms. Reasons for this might be economies of scale/experience as well as broader market accesses.

As for the country differences, no significant coefficients can be found except for trade marking U.S. SMEs, which seem to be more productive than their counterparts from other parts of the world. The supplementarity measure (M2-2 and M2-3) shows a significantly negative coefficient for large firms, implying that a complementary patent/trade mark portfolio. Having trade marks and patents in different technology fields, seems more beneficial than the supplementarity of patent and trade mark portfolios, i.e. patenting and trade marking in the same fields.

The series of regression models measuring the relationship between firm performance, indicated by the Return on Equity (ROE), and several trade mark related indicators is depicted in M3-1 to M3-3 in Table 7. As we can see from the model, the breadth of the trade mark portfolio is negatively related to ROE, i.e. the coefficient is significantly negative. However, this is only true for SMEs. For large firms, we also find a negative coefficient, yet it is not significant (except for M3-3). Being a continuous applicant is positively related to firm performance, independent of firm size and also when controlling for country/sector differences. In contrast to the model on productivity, having a GUO is positively associated with firm performance, although this is only true for large companies. When looking at M3-2, it can be

found that the supplementarity of the patent & trade mark portfolio has a significantly negative coefficient for SMEs. Taken together with the results for productivity, where also a negative coefficient for supplementarity for large firms could be observed, it can be stated that the complementarity of the patent/trade mark portfolio seems to be the better choice, independent of firm size.

Table 6 Multivariate models II – Trade marks & productivity

	MNEs						SMEs					
dV: Turnover per employee	M2-1		M2-2		M2-3		M2-1		M2-2		M2-3	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
L1.Turnover per emp.	0,469 ***	0,003	0,386 ***	0,007	0,386 ***	0,007	0,782 ***	0,002	0,969 ***	0,036	0,965 ***	0,036
Nr. of trade marks	-0,283	0,229	-0,432	0,506	0,076	1,422	0,193	0,195	1,072	2,504	5,072	3,378
Breadth of TM portfolio	1,329 ***	0,432	4,225 **	1,738	4,717 **	1,826	-0,041	0,105	-1,435	2,241	-0,750	2,357
Continuous applicant	-2,189	3,558	-15,294	12,860	-12,255	12,886	-0,104	1,177	-6,189	15,466	-6,240	15,332
Nr. of transnat. pat. filings	0,022	0,017	0,012	0,033	0,004	0,034	0,097 ***	0,031	0,026	0,138	0,035	0,137
GUO Dummy	-11,320 *	6,240	-44,175 **	18,266	-37,270 **	17,942	-2,019 **	0,939	-27,874 **	11,183	-23,708 **	10,901
Supplementarity			-11,466 **	4,701	-11,935 **	4,690			-4,473	3,355	-6,119 *	3,503
World region												
U.S.	-1,651	6,868	-11,764	19,455	-12,805	19,432	2,290 ***	0,802	23,437 **	11,245	20,989 *	11,221
China/Japan/Korea	3,494	8,501	0,760	28,649	3,548	28,333	0,795	1,603	4,322	31,343	5,291	30,330
RoW	-1,670	7,470	-15,771	25,065	-13,873	24,972	0,336	1,005	4,096	15,044	2,739	14,952
NACE Sector												
10-33	18,338	14,686	38,870	56,934			-0,020	2,073	10,837	46,781		
34-43	1,455	17,721	-22,625	71,066			-1,051	2,488	-6,853	52,761		
>45	7,899	14,626	15,886	57,317			-0,964	2,051	-6,945	46,706		
Field												
Field: Elec. eng.					1,747	2,428					-4,568	4,260
Field: Instruments					-2,920	3,788					2,805	5,945
Field: Chemistry					-0,202	2,092					-4,248	5,004
Field: Mech. eng.					-1,310	2,926					2,093	5,711
Field: Other fields					-0,821	1,504					-6,032	4,814
Constant	1,959	16,187	75,474	65,164	101,342 ***	32,715	1,454	2,337	46,843	52,201	51,051 **	24,345
Time Dummies	YES		YES		YES		YES		YES		YES	
Obs.	68496		14776		14826		158684		8451		8508	
F	850,43		134,26		124,23		4510,07		31,2		28,95	
Prob > F	0,000		0,000		0,000		0,000		0,000		0,000	
R^2	0,2222		0,1793		0,1792		0,395		0,082		0,0815	

Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Significance Level: ***p<0.01, **p<0.05, *p<0.1. L1. means that the variable is lagged by one year. Reference category for World region=Europe, Country=BE, NACE Sector=1 (=NACE 1-9). Since patents and trade marks can be assigned to more than one field, there is no reference category for these variables. They have to be interpreted as 0/1 dummies.

Table 7 Multivariate models III – Trade marks & firm performance

	MNEs						SMEs					
dV: Return on Equity	M3-1		M3-2		M3-3		M3-1		M3-2		M3-3	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
L1. Return on Equity	0,608 ***	0,003	0,669 ***	0,007	0,674 ***	0,007	0,646 ***	0,002	0,684 ***	0,009	0,686 ***	0,009
Nr. of trade marks	0,023	0,035	0,002	0,034	0,038	0,099	0,326	0,220	0,261	0,671	0,507	0,927
Breadth of TM portfolio	-0,070	0,067	-0,167	0,121	-0,213 *	0,129	-0,424 ***	0,117	-0,697	0,566	-0,797	0,593
Continuous applicant	2,855 ***	0,555	4,021 ***	0,887	3,889 ***	0,900	4,601 ***	1,297	10,950 ***	3,998	10,872 ***	3,996
Nr. of transnat. pat. filings	0,000	0,003	0,001	0,002	0,001	0,002	0,016	0,039	0,034	0,039	0,035	0,039
GUO Dummy	1,789 *	1,018	3,677 ***	1,270	3,554 ***	1,256	-1,287	1,557	-0,662	3,644	-0,678	3,574
Supplementarity			-0,295	0,325	-0,285	0,328			-2,250 **	0,886	-2,119 **	0,937
World region												
U.S.	-1,988 *	1,185	-3,159 **	1,367	-2,946 **	1,383	-6,696 ***	2,066	-0,361	3,886	0,005	3,873
China/Japan/Korea	-3,526 ***	1,346	-5,052 **	1,950	-4,695 **	1,952	-0,563	1,772	7,603	8,130	7,478	8,059
RoW	-0,013	1,173	1,132	1,717	1,164	1,727	-0,833	1,483	-8,064 *	4,605	-7,656 *	4,588
NACE Sector												
10-33	3,843 *	2,291	4,487	3,965			3,115	2,212	-7,756	12,146		
34-43	6,081 **	2,756	6,268	4,999			7,954 ***	2,700	12,752	13,808		
>45	5,381 **	2,282	3,628	3,993			2,567	2,187	-10,704	12,133		
Field												
Field: Elec. eng.					-0,137	0,166					-0,589	1,129
Field: Instruments					0,049	0,260					1,003	1,547
Field: Chemistry					-0,154	0,143					-2,201 *	1,300
Field: Mech. eng.					0,330	0,204					2,551 *	1,488
Field: Other fields					0,046	0,105					-0,254	1,367
Constant	5,889 **	2,545	3,929	4,558	9,159 ***	2,323	1,727	2,568	16,035	13,587	6,476	6,444
Time Dummies	YES		YES		YES		YES		YES		YES	
Obs.	62793		13676		13738		138605		6801		6863	
F	1587,87		414,8		385,57		4104,38		233,78		219,25	
Prob > F	0,000		0,000		0,000		0,000		0,000		0,000	
R^2	0,3678		0,4217		0,4223		0,4052		0,453		0,4547	

Source: EUIPO; BvD Orbis; EPO - PATSTAT.
Note: Significance Level: ***p<0.01, **p<0.05, *p<0.1. L1. means that the variable is lagged by one year. Reference category for World region=Europe, Country=BE, NACE Sector=1 (=NACE 1-9). Since patents and trade marks can be assigned to more than one field, there is no reference category for these variables. They have to be interpreted as 0/1 dummies.

5 Conclusion

In this study, we analysed structures in EUIPO trade mark filings by SME and large firms. Up to this point, the evidence on SME trade marking on a large scale data basis is scarce and most studies analysing motives and structures of SMEs when filing trade marks work with survey data. This study fills this gap by providing an SME classification for all trade mark applicants at the EUIPO from 1996 up to the most recent data.

The results of our analyses show that the number of trade mark filings has been growing over the last 20 years. It could also be found that the share of trade mark filings by SMEs has increased. Yet, a trend can be observed more recently: the number of trade marks per applicant is slightly decreasing, implying that a diversification of trade mark applications on a larger number of applicants is taking place. This is mostly due to SMEs. More and more SME applicants are entering the scene, but file less trade marks within a year, whereas this is not the case for large firms, where the ratio of trade marks per applicant has increased. For large firms, we therefore see a concentration to fewer applicants.

As for the country trends, we found that the largest number of SME filings originate from China and Germany. In addition, we could observe that trade marking entities from non-European countries are more often large firms than SMEs. This makes sense against the background that large firms more often are internationalized. Consequently, they aim to sell their products on international markets and file IPRs to protect their innovative assets. An interesting pattern can also be revealed when looking at the sectoral shares. In manufacturing, a comparably large share of trade marks is filed by a rather small share of large firms. This difference, however, is less strongly pronounced in most of the service sectors, where the share of SME trade marks on average is higher than in manufacturing. These trends resemble the structure of the sectors very well, i.e. in manufacturing there are more large firms on average than in the service sectors per se.

In an attempt to explain the trade mark output of SMEs and large firms when controlling for other factors and to get an impression of the interrelations between the number of trade marks, firm size and firm performance, a series of regression models was calculated. The models show that the breadth of the trade mark portfolio, continuity in application and being experienced with other IPRs are positively related to a company's trade mark output.

The regressions on productivity and firm performance show that large firms are more productive than SMEs, which is a result that has already been found in earlier studies (see e.g. OECD 2021). For productivity, the breadth of trade mark portfolio and actively using other IPRs, namely patents, are explanatory factors. Being a continuous applicant rather seems to

matter for firm performance. The supplementarity in trade mark and patent portfolios across fields is negatively associated with productivity and firm performance, implying that it makes more sense to build complementary patent/trade mark portfolios.

Apart from these specific results, some general implications emerge when taking a holistic view on the results generated within this report. Earlier studies pointed towards the fact that trade marks can only be used as innovation indicators in certain sectors, especially in knowledge-intensive business services as well as IT (e.g. Schmoch 2003; Schmoch and Gauch 2009). We also find that IT is the largest field when it comes to trade mark filings of SMEs. The in-depth classification showed that it is not only IT-devices but also IT services, where trade marks are heavily used, as well as in marketing and education.

In our analyses, we did not specifically target the question whether trade marks are related to innovation. What we find, however, is that the share of firms, in particular SMEs, that use trade marks and patents in combination is not very large. It rather seems that most of the firms rely on only one IPR. Yet, a significant relationship between a combined trade mark/patent usage and productivity could be found for SMEs. Though a direct relation between trade marking (in isolation) and productivity as well financial performance could not be observed, the continuity in application as well as the breadth of the trade mark portfolio are related to both output indicators.

This study provides a comprehensive overview on the structures and trends in SME trade marking over time. Yet, it comes with some limitations that deserve to be mentioned. First, the study results remain at a rather descriptive level, providing correlations and give the potential to ask more in-depth questions. Causal explanations, however, can only be made to a limited extent. Second, and even more important, we only look at EUIPO data. As Schmoch and Gauch (2009) pointed out, country comparisons with data from single offices might lead to distortions or biases of the data due to home advantages, which is what we see in the models that takes the world regions into account. Here, complementing that data with data on international trade mark registrations from the WIPO would be the preferred alternative, but this data is not easily available. Adding to this, at the moment, we can only work with a subset of EUIPO data, as applicant information from WIPO filings that reach the EUIPO are missing and other data is flagged due to GDPR regulations.

6 Literature

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