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Smart Specialization in a Subnational Context: Evidence From Greece

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Abstract

Regional domestic activity can provide valuable insights on whether these activities can fuel innovation activity of international impact. This paper provides an alternative strategy in measuring regional innovative activity based on the number of applications of various forms of Intellectual Property Rights (IPRs). Our analysis focuses particularly on Greek regions over the last two decades and documents a strong relationship between domestically- and internationally-filed IPRs. Class-level analysis, however, shows substantial heterogeneity across fields highlighting the role of smart specialization and in particular the usefulness of a regional innovation policy targeting on specific capabilities for each region. The fact that domestic patents and trademarks follow more closely the recent economic crises in Greece is also an issue we need to consider when operationalizing regional innovation policy.

JEL Classification: O34, O38, R11
Keywords: smart specialization, regional innovation, patents, trademarks.

1. Introduction

Innovation is the driver of economic growth (Jones, 2005). This strong relationship between innovation and growth is perhaps more relevant for regions that are lagging in innovation activity. Within Europe, a major challenge is the notable disparities across regions with a seemingly lengthy and difficult road towards convergence (Ezcurra and Pascual, 2008). This issue brings forward the important role of innovation for these lagging regions.

Perhaps the most important concept for regional innovation in later years is that of smart specialization. Smart specialization urges regions to focus on their existing capabilities and employ these as vehicles to branch out to new related endeavors (Foray *et al.*, 2009; Foray and van Ark, 2007). This seemingly simple concept provides a roadmap for policy makers to direct resources and frame operational programmes at the regional level. To this end, both the EU Innovation Plan and the EU Cohesion Policy have included the smart specialization principle in their operationalization (Crescenzi *et al.*, 2018).

The concept of smart specialization is perhaps most important for laggard regions. However, the difficulty for these regions is that of measurement. Such regions are unlikely to engage systematically in innovation rendering its observation at the initial stages a daunting task.

In this paper we provide an alternative strategy in measuring innovative activity based on Intellectual Property Rights (IPRs). In a knowledge-driven economy the different types of intangible assets of a business are often more important and valuable than its tangible assets. A key subset of intangible assets is protected by what are labelled collectively as IPRs. These include trade secrets protection, copyright, design and trademark rights, and patents, as well as other types of rights. By fostering fair play in the marketplace, the IPR system benefits users, consumers and society at large by supporting the creation of innovative, new and improved products and knowledge.[1]

We proxy the innovative business activity in a region with the number of applications of various forms of IPRs of the region and examine whether international and domestic (regional) IPRs display similar patterns. Understanding regional domestic activity can provide valuable insights on whether these activities can fuel innovation activity of international impact. In doing so, we map the IPR activity filed at the domestic offices and two major international offices.

We focus on Greece's NUTS-3 regions as a testbed. Greece is an ideal case in point since the majority of its regions are laggard in terms of innovation activity. The country generally lags behind in innovation development. It holds the 19th position in the relevant charts among 27 Member States, deviating significantly from the European Union (EU) average (Innovation Union Scoreboard, 2015). The sharp decline in private investment after the world financial crisis has reduced the already low levels of private research and innovation expenditure within Greek regions. Reduced liquidity in the private sector combined with the limited funding provided by the banking sector to private investment especially to new businesses, significantly reduced resources available to support innovative enterprises. Among the various types of IPRs we concentrate on patent applications filed at the Hellenic Industrial Property Organization (HIPO) and the European Patent Office (EPO) originating from Greece's NUTS-3 regions. Similarly, we measure trademarks applications filed at Greece's General Secretariat for Commerce (GSC) and the European Union Intellectual Property Office (EUIPO).

Our paper contributes in three important areas. First, most of the literature on smart specialization approximates innovation activity via IPR activity in large patent offices as the EPO and the United States Patent and Trademark Office (USPTO); see (Kogler *et al.*, 2013; Boschma *et al.*, 2015; Petralia *et al.*, 2017; Apa *et al.*, 2018; Balland *et al.*, 2019, Santoalha 2019; Castellacci *et al.*, 2020; Mewes and Broekel 2020). However, laggard regions exhibit sparse activity in these types of IPRs. The main reasons are two: i) these offices have higher standards of novelty (Webster *et al.*, 2014) whereas domestic offices such as HIPO have lower standards, ii) filing and registering a patent in a large office such as the EPO is expensive with recent estimations reaching 30,000 Euros for validating a single patent across the 28 EU countries as of 2016 (Berger 2005; European Commission 2011). We contribute to this literature by examining IPR activity of modest quality and scope which however can function as input for international IPR activity signifying the upgrading and extraversion of regions' innovation activity. There are numerous studies examining domestic patents across countries and various contexts to capture the early stages of technological innovation activity (Gabaldón-Estevan *et al.*, 2018; Hall and Helmer, 2019),

1 "Intellectual Property: Powerhouse for Innovation and Economic Growth", 2 February 2011, ICC.

Second, the literature has mainly focused on technological inventions that regions produce. However, this stage is merely one stage of the innovation activity. Recently scholars have shown that trademarks can approximate innovation activity (Mendonça *et al.*, 2004; Schmoch, 2003). Trademarks can protect innovations that do not satisfy the patentability standards or they may protect the commercial endeavors that embed technological inventions (Flikkema *et al.*, 2019). To this end, trademarks are able to capture the innovative marketing activities associated with added value to products and services. The role and importance of trademarks has only been recently examined at the regional level (Filippetti *et al.*, 2020; Drivas 2020a; Castaldi and Drivas 2021). We contribute to this latter literature by examining both domestically- and internationally-filed trademarks.

Lastly, there is scarce evidence on regional innovation performance for the EU periphery and particular for Greece and even fewer concerning regional smart specialization. The study of Chrysomallidis and Tsakanikas (2017), for example, is among the very few that presents and assesses the main aspects of smart specialization and its implementation in Greece. We add to this literature by providing some evidence at a high disaggregation level on the Greek regional innovation performance. For instance, we find that Greek regions exhibit intense marketing activities, as evident by trademarks, in products including stationary and agrifood and services including advertising, business management as well as education. Further, in the technological inventions, as evident by patents, there is some overlap with marketing activities as the highest intensity is in human necessities while there is also disjoint since regions also engage in operations and transporting.

2. Data Construction

We collect data from four independent sources. To obtain the domestically filed patent applications, we extracted the data from HIPO. After an elaborate geocoding of the assignees (i.e., the patent owners) we were able to assign patent applications to a NUTS-3 region. For each patent application, we also collected their primary International Patent Classification (IPC). To obtain the EPO patent applications filed by Greek-located entities, we employed the OECD dataset which has already geocoded patent applications in NUTS-3 regions (Maraut *et al.*, 2008).

To collect the trademarks filed at the GSC, we used the public records from the GSC and similarly to HIPO, we performed an elaborate geocoding. In a similar fashion we obtained all trademark applications filed at EUIPO by Greek located entities. Based on the postal code recorded, we once again assigned the trademarks to a NUTS-3 region based on the European Commission's concordance. For both groups of trademarks, we obtain the Nice classifications they each claim. To provide a consistent picture we focus on the years 2000-2016 for all the IPRs.

3. Empirical Analysis

Figure 1 displays the trends of all IPRs. It is clear that domestic IPRs are more volatile with trademarks following the recent crisis more closely. On the other hand, international IPRs are more resilient to the financial crisis while in recent years EUIPO trademark applications almost doubled. Figure 2 excludes Attica. While results are similar the volatility of GSC trademark applications is higher indicating that peripheral regions responded more abruptly to the financial crisis. These trends reveal two interesting insights. First, domestic patents and trademarks display similar trends. Second, while GSC and EUIPO trademarks exhibit a

similar increase in later years, it is unclear whether domestic and international marketing activities are aligned since in earlier years the two trends were different.

Figures 3A and 3B display the frequency of EPO patent applications and EUIPO trademark applications by NUTS-3 regions respectively. There is a high overlap of patent and trademark activity further signifying their complementarity at least at this level of aggregation. Figures 4A and 4B examine the 'efficiency' of domestic innovative endeavors in the international arena. We calculate the ratio of the number of EPO patent applications over the number of HIPO patent applications (Figure 4A) and the ratio of the number of EUIPO patent applications over the number of GSC patent applications (Figure 4B). Similar ratios have been calculated to examine the efficiency of technological production over scientific production for US States (Thomas *et al.*, 2011). These Figures display notable differences when compared to Figures 3A and 3B where the raw numbers are displayed. For instance, while Attica is the biggest producer of EPO and EUIPO applications, it is not as efficient especially when considering trademarks. The same holds for Thessaloniki, the second biggest metropolitan region in Greece. These differences highlight the need to understand in detail the innovation profiles of NUTS-3 regions by using both domestic and international IPRs.

Figures 5 and 6 display the frequency of trademarks and patents by Nice and IPC class respectively; a useful exercise to identify fields and industries displaying comparative advantages (Drivas, 2020b). First of all, we do observe similar trends both for the domestic and international IPRs. While there are differences in the percentages, the similar trends indicate that Greece engages in the same fields of innovation activity both domestically and internationally. Namely, for trademarks Greece specializes in products including stationary and agrifood and services including advertising, business management as well as education. For patents it specializes in human necessities and operations and transporting.

Overall, we find a strong overall relationship between domestically- and internationally-filed IPRs. This finding points to the need to better understand the generation of the modest and reduced scope innovation endeavors approximated by domestically-filed IPRs. However, class-level analysis shows substantial heterogeneity across fields highlighting the role of smart specialization and in particular the usefulness of a regional innovation policy targeting on specific capabilities for each region. The fact that domestic patents and trademarks follow more closely the recent economic crises in Greece is also an issue we need to consider when operationalizing regional innovation policy.

4. Conclusion

The European Union is firmly oriented towards economic and social development based on knowledge, human resources, research and innovation. Within the framework of the "Europe 2020" strategy, the European Commission adopted a flagship initiative to create an 'Innovation Union' (European Commission, 2011), to strengthen Europe's capacity to achieve smart, sustainable and inclusive growth while bridging the gap between science and the market, so that research results may be converted into new products and services. This initiative led to the birth of the concept of smart specialization in research, allowing countries and each region to independently focus on supporting specific categories of investments that will provide competitive advantages to their economy.

As from 2010 and onward, in spite of a deep recession, the Greek economy has been in a process of correction of the various internal and external imbalances which accumulated as a result of chronic structural problems, whose main characteristics are a gradual loss of

productivity and competitiveness in the primary and secondary sector, the lack of a clear production model and the lack of export orientation.

Our findings show that there is a strong overall relationship between domestically- and internationally-filed IPRs. When we examine efficiency by region however, we find significant heterogeneity highlighting the need to examine the origins of innovation activity as evident by domestically-filed IPRs.

To achieve a competitive advantage Greece and its regions should set priorities and formulate national and regional research and innovation strategies. An important element in the choice of activities is the presence or creation of a critical mass (or dynamics) in businesses and knowledge-generating bodies. Strengthening the capabilities and developing structures between local authorities, educational and research centers and private small and medium-sized enterprises could enhance the potential of the Greek regions into leading centers for research and innovation production.

Greece's significant and scientifically and technically competent human resources can be a driving force in this endeavor. All important advantages of the Greek Research and Innovation System (R&I) namely, good performance in co-financed EU Framework Programmes, considerable Greek representation in international research networks and projects of the European Roadmap for Research Infrastructures, strong Greek research community abroad, high-quality human capital and Greek presence in the field of scientific publications (GSRT, 2015) have to be considerably and fully utilized in order to integrate research activity in the production processes and improve Greece's overall performance compared to that of other EU countries. At the same time, the stable democratic political environment the country enjoys combined with its geographical position as a gateway from Asia to the EU, makes Greece a focal point for the exchange of knowledge ideas and actions.

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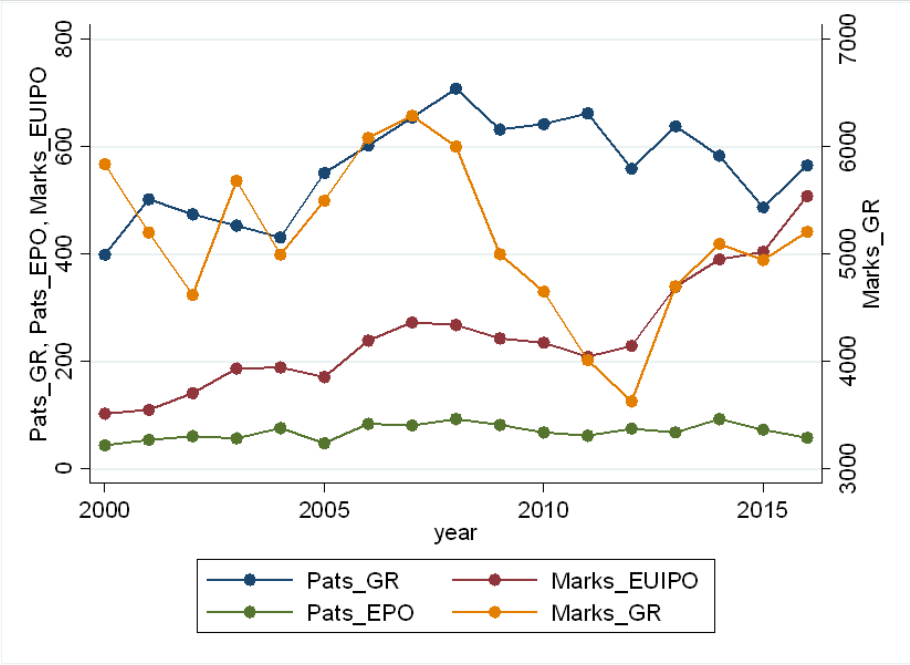
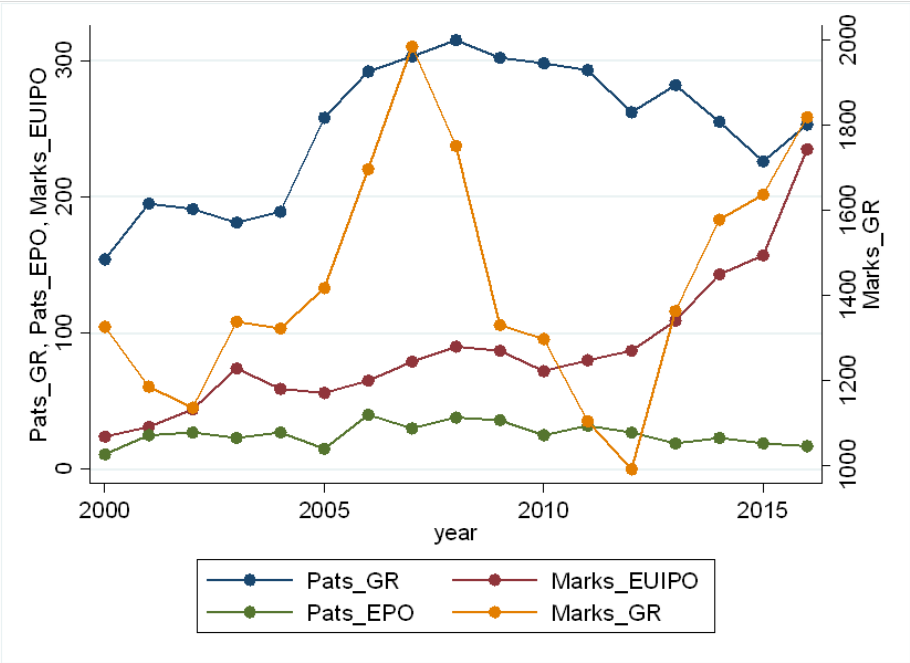
Appendix

Figure 1. The Evolution of IPRs.



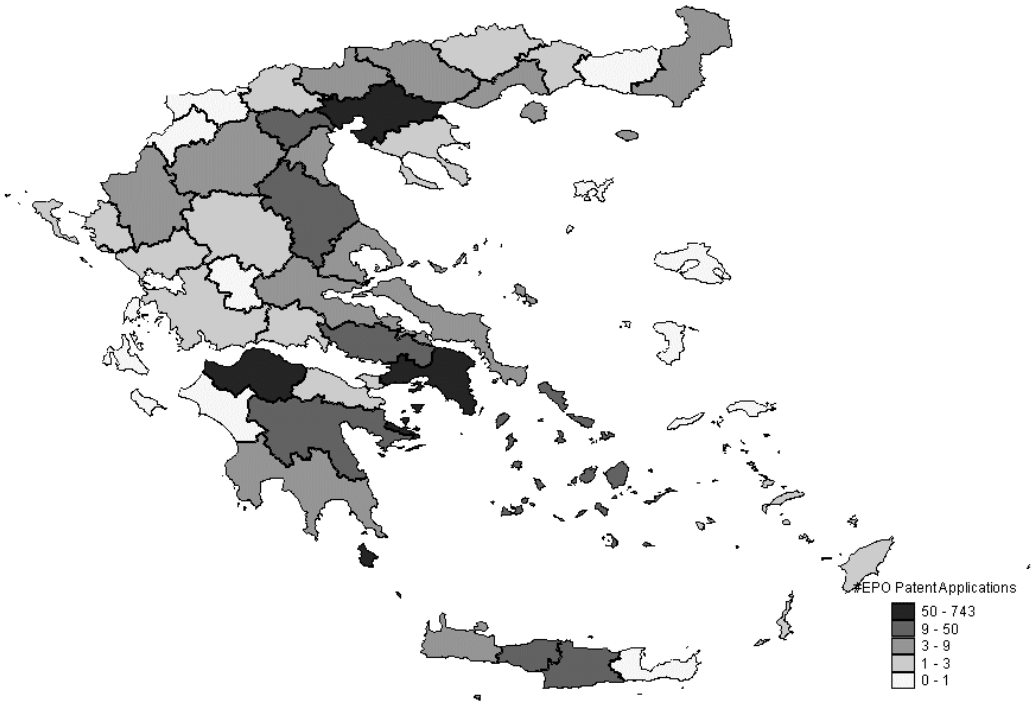
Notes: Total number of IPRs by application year filed by Greek located entities. The number of patent applications filed at HIPO (*Pats_GR*), number of patent applications filed at EPO (*Pats_EPO*) and number of trademark applications filed at EUIPO (*Marks_EUIPO*) are displayed in the left y-axis. The number of trademark applications filed at GSC (*Marks_GR*) are displayed in the right y-axis.

Figure 2. The Evolution of IPRs. Excluding Attica.



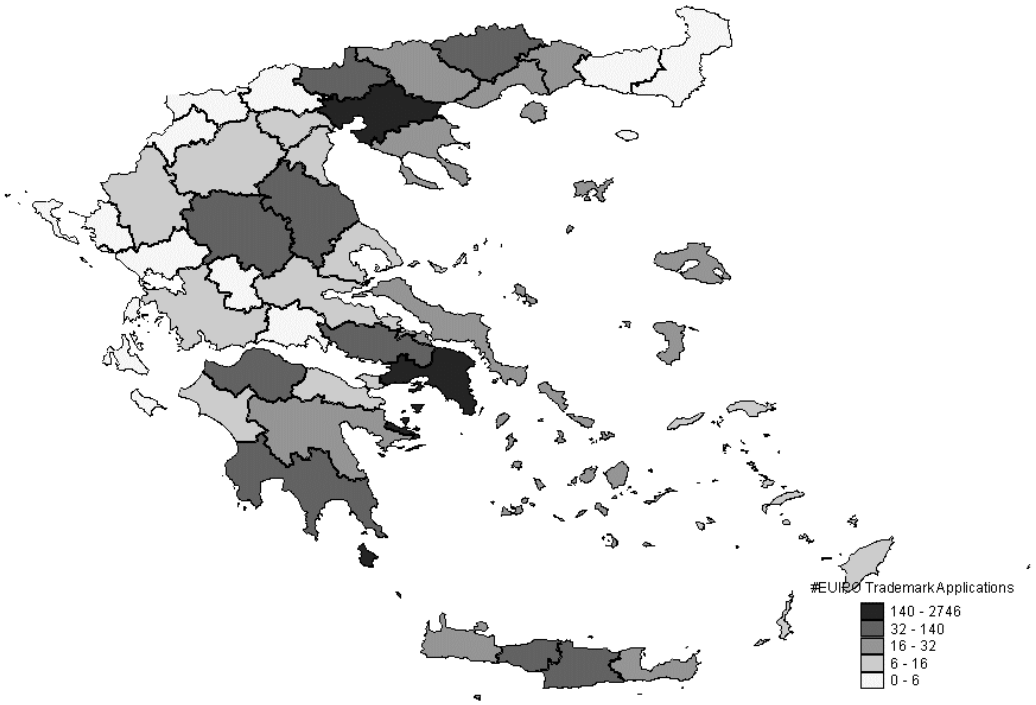
Notes: Total number of IPRs by application year filed by Greek located entities excluding the region of Attica. The number of patent applications filed at HIPO (*Pats_GR*), number of patent applications filed at EPO (*Pats_EPO*) and number of trademark applications filed at EUIPO (*Marks_EUIPO*) are displayed in the left y-axis. The number of trademark applications filed at GSC (*Marks_GR*) are displayed in the right y-axis.

Figure 3A. EPO Patent Applications (2000-2016)



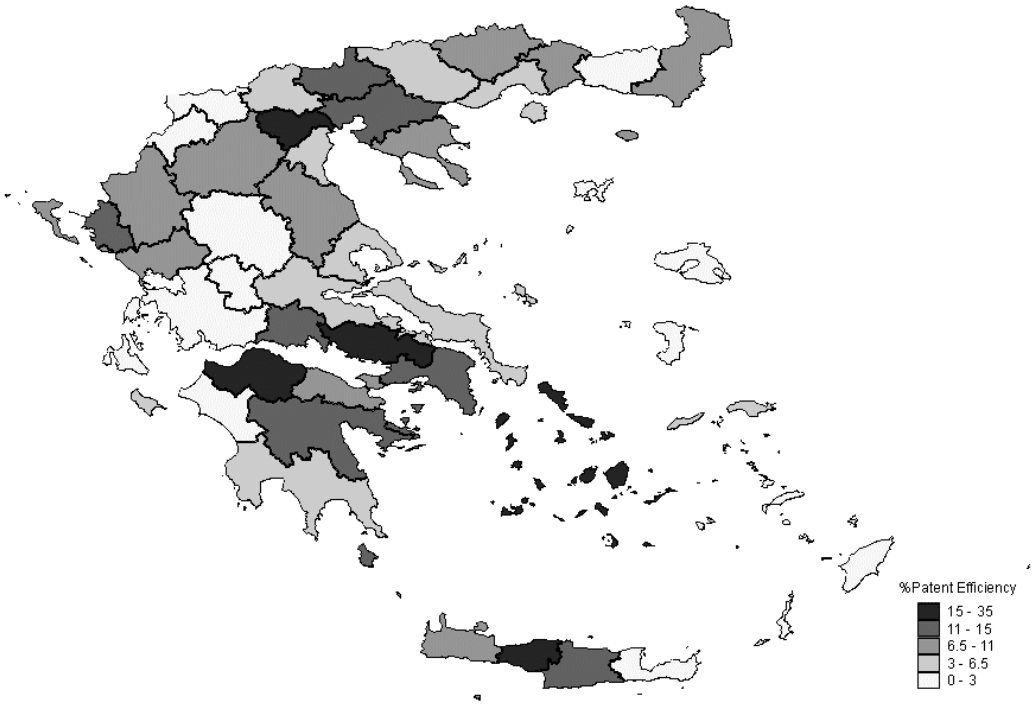
Notes: Total number of EPO patent applications filed during the period 2000-2016 by NUTS-3 regions.

Figure 3B. EUIPO Trademark Applications (2000-2016)



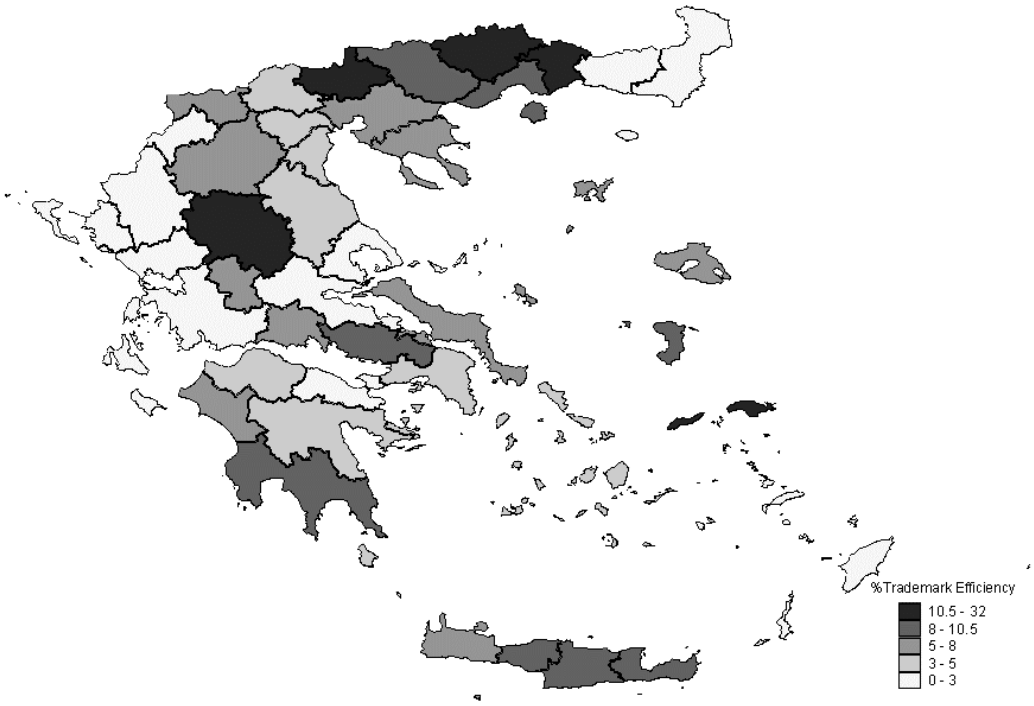
Notes: Total number of EPO patent applications filed during the period 2000-2016 by NUTS-3 regions.

Figure 4A. Patent Efficiency (2000-2016)



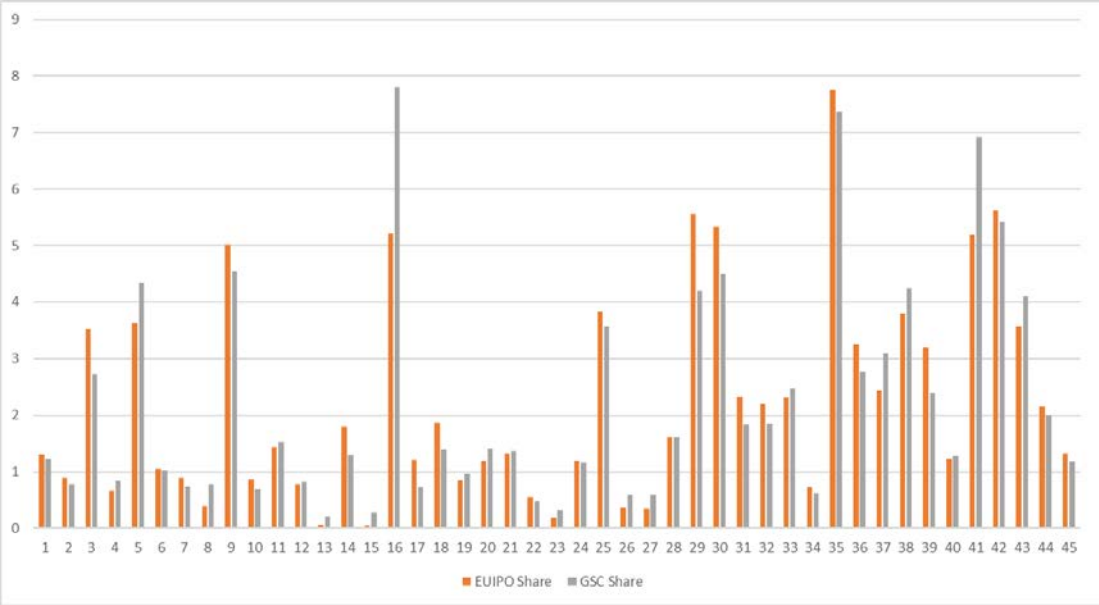
Notes: Patent efficiency is calculated as the ratio of the number of EPO patent applications over the number of HIPO patent applications. The ratio is multiplied by 100 to be translated in percentages.

Figure 4B. Trademark Efficiency (2000-2016)



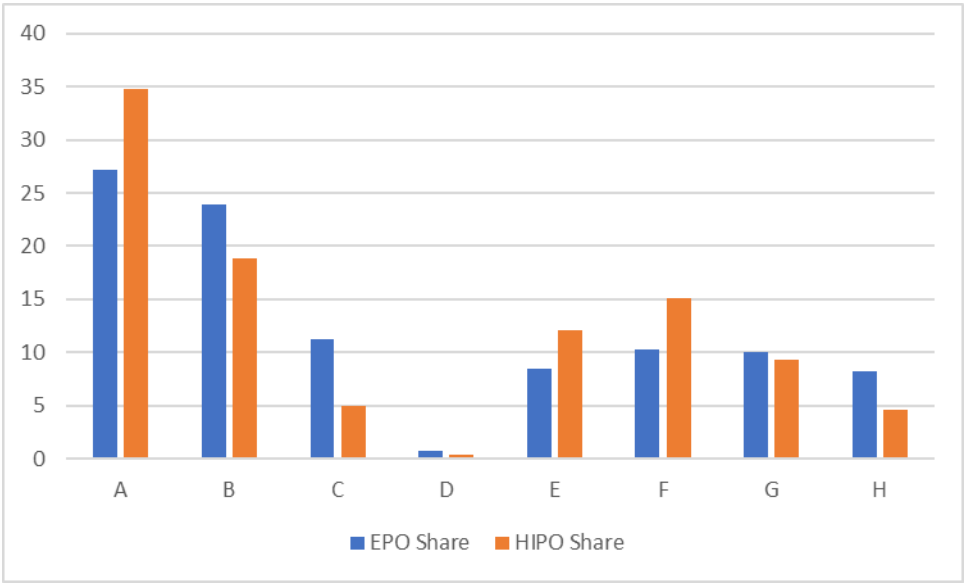
Notes: Trademark efficiency is calculated as the ratio of the number of EUIPO patent applications over the number of GSC patent applications. The ratio is multiplied by 100 to be translated in percentages.

Figure 5. Share of Nice classes



Notes: The share for each Nice class *i* is calculated by dividing the total number of that Nice class *i* has been claimed over the total number of Nice classes that have been claimed across all trademark applications.

Figure 6. Share of first-digit IPC classes



Notes: The share for each IPC class *i* is calculated by dividing the total number of patent applications that claim IPC class *i* over the total number of patent applications.