GreeSE Papers

Hellenic Observatory Discussion Papers
on Greece and Southeast Europe

Paper No. 207

On the Role of Innovation in the Generation of Value-Added Trade Opportunities

Kyriakos Drivas and Afroditi Anagnosti

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

April 2025

Hellenic Observatory Centre
for Research on Contemporary
Greece and Cyprus
Research at LSE

On the Role of Innovation in the Generation of Value-Added Trade Opportunities

Kyriakos Drivas and Afroditi Anagnosti

GreeSE Paper No. 207

Hellenic Observatory Papers on Greece and Southeast Europe

Contents

On the Role of Innovation in the Generation of Value-Added Trade Opportunities

Kyriakos Drivas[1] and Afroditi Anagnosti[2]

ABSTRACT

Innovation and exports are closely related concepts that are frequently explored in the academic literature, particularly in the fields of economics, business strategy, and intellectual property management. The purpose of this paper is to explore these concepts via two complementary approaches. First, while the relationship between innovation and exports is well established, the specific contributions of different stages of innovation remain underexplored. We therefore use the principle of relatedness and examine how different stages of innovation—namely technology, market, and design activities—are related to export specialisation. The results show that technology- and market-related capabilities serve as key drivers of new export specialisation. Second, we conducted an in-depth survey of Greek inventors with the aim to identify the motives, challenges and opportunities they face throughout the complex process of patenting and valorisation. The study reveals significant differences in the patenting motivations of Greek inventors according to their affiliation. Independent inventors and university-affiliated researchers see patents primarily as tools for commercialisation, exploiting them through licensing or sales. In contrast, large companies focus on strategic patenting to protect products and block competitors.

Keywords: Innovation, export, patents, inventors, motives to file IPRs

Acknowledgements:

The authors are grateful to the LSE's Hellenic Observatory, A.C. Laskaridis Charitable Foundation (ACLCF) and Dr. Vassili G. Apostolopoulos for financially supporting the current project in the context of a call for research project proposals in 2023-2024, entitled "On the Role of Innovation in the Generation of Value-Added Trade Opportunities". The authors are responsible for any errors and omissions.

[1] Associate Professor, Department of Economics, University of Piraeus; Project coordinator and corresponding author.

[2] PhD Candidate, Departments of Economics, University of Piraeus

Introduction

Innovation, patents, and trade are closely related concepts that are frequently explored in the academic literature, particularly in the fields of economics, business strategy, and intellectual property management. Innovation drives economic growth by introducing new or improved products, services, and processes that increase productivity and competitiveness. Innovation has been shown to contribute substantially to export and adding value to products (Vetsikas and Stamboulis, 2023).

Patents are widely recognised as indicators of innovation, providing measurable insights into inventive activity and technological progress (Griliches, 1990). Patents play a critical role in this dynamic by providing legal protection for inventions, incentivising investment in research and development (R&D), and facilitating the diffusion of technical knowledge (Hall et al., 2014; Griliches, 1990). The protection afforded by patents has an impact on international trade, as firms with patented innovations often gain a competitive advantage in export markets, leading to increased trade flows (Chalioti et al., 2020).

Trade and exports are vital to economic activity, driving growth by enhancing productivity and fostering competition. International trade plays a crucial role in promoting innovation by facilitating the diffusion of knowledge, increasing competition, and enabling firms to participate in global value chains (Grossman & Helpman, 1991). Exporting firms benefit from learning-by-exporting effects, gaining access to larger markets and advanced technologies that increase productivity and innovation capacity (Aw et al., 2011). Trade in technology-intensive goods promotes cross-border technology transfer, which further stimulates innovation in both exporting and importing economies (OECD, 2021).

These findings highlight the symbiotic relationship between innovation and trade, with advances in one often drive growth in the other, thereby fostering broader economic development. However, this relationship is not uniform and varies depending on the type of innovation undertaken (Bıçakcıoğlu-Peynirci et al., 2020). Innovation spans multiple stages, from technological breakthroughs to downstream market and design activities that add value. While its role in export activity is well documented, the specific contributions of each innovation stage remain less explored.

To this end, for Objective 1 of this paper we examine how each stage of innovation—technological, market, and design activities—relates to export activity. By unpacking innovation into these three stages, we analyze their specific contributions to related exports. Our framework is based on the principle of relatedness (Hidalgo et al., 2007), later extended to multiple activities (Pugliese et al., 2019; Catalán et al., 2020). To approximate these stages, we use global Intellectual Property Right (IPR) data for 76 countries from 2008 to 2022, complemented by export data from the BACI database (Gaulier and Zignago, 2010).

We begin by visualising the innovation and export spaces, highlighting significant interactions between innovation stages and export activity. Our econometric analysis confirms that related export activities strongly influence new export specialisations, while technological and market capabilities also contribute to the development of new export comparative advantages. We validate this relationship for the case of Greece separately with additional stylized facts.

Having examined the relationship between the different stages of innovation activity and export activity, we carried out an in-depth survey of Greek inventors for Objective 2. The aim of the survey was to identify the motives, the challenges and opportunities they face throughout the complex process of patenting and valorisation. This process encompasses the legal, financial and strategic aspects of turning innovative ideas into marketable products or services. By gathering insights directly from inventors, we sought to better understand the barriers they face and identify potential areas for improvement in leveraging their inventions for commercial success.

To do this, we conducted an online survey of Greek-located inventors who had at least one patent granted by international offices, including the EPO, WIPO and USPTO, between 2017 and 2022. The survey was completed by two hundred Greek-located inventors. The typical Greek inventor is predominantly male, mainly mid-career, highly educated, and concentrated in the Attica region. Using factor analysis, we categorised inventors' patenting motives into three interrelated factors: exchange, protection/blocking, and reputation. This framework highlights the multiple roles that patents play in commercialisation, strategic positioning, and career advancement. Our findings also suggest that financial constraints—particularly those related to legal services, fees, and patent writing—are the most significant challenges in the patenting process.

The study reveals significant differences in the patenting motivations of Greek inventors according to their affiliation. Independent inventors and university-affiliated researchers primarily view patents as tools for commercialisation, exploiting them through licensing or sales. In contrast, large companies focus on strategic patenting to protect products and block competitors, reflecting established patterns in the broader literature (Torrisi et al., 2016).

We contribute to the literature that has examined the important link between innovation and exports. We add to this literature by focusing on innovation activity and unpacking it across its stages to uncover nuances about its contribution to export activity. At the same time, we provide new evidence on the characteristics of inventors, the motives for filing a patent application and the challenges and opportunities that inventors face. By clarifying overlapping motivations, we provide a comprehensive framework for understanding the role of patents in commercialisation, strategy, and career advancement. These findings contribute to the literature by highlighting the strategic use of patents in entrepreneurship and reputation building.

From a policy perspective, our findings highlight the critical link between innovation and exports, providing a framework that integrates technology, design, and market activities. The results support smart specialisation strategies in line with EU policies to promote export growth. Greece needs a comprehensive innovation strategy that promotes both technological inventions and market activities. A successful strategy should focus on entrepreneurial discovery, moving from low- to high-value sectors thereby driving economic growth.

To support innovation, policymakers should increase financial support, simplify patenting procedures, and promote mentorship, especially for early-stage inventors. Reducing gender disparities and supporting regional patenting will promote inclusiveness. Aligning Greek patent laws with European systems and reducing costs for SMEs and researchers can increase patenting participation and boost economic growth.

The remainder of the article is organized as follows: Section 2 reviews the literature on innovation and exports and presents the data, methodology, and results for the first objective. Section 3 follows the same structure for the second objective. Finally, Section 4 concludes the report.

Innovation and Exports: Country-Level Analysis

This section examines the first objective of the study, which is to investigate the relationship between different stages of innovation - technological, market and design activities - and export activity. To provide a comprehensive understanding, we begin with a review of the existing literature on the interplay between innovation and exports. This is followed by a detailed discussion of the data sources and methodological approach used in the analysis. Finally, we present the empirical results.

Literature review

Our empirical framework extends the study by Hidalgo et al. (2007) which adopted a computational methodology to demonstrate how existing export capabilities can facilitate the development of new export specializations. Their framework and results supported important theoretical concepts in trade literature, emphasizing the spillover effects that occur at the national level. These effects are driven by mechanisms such as knowledge dissemination, shared inputs, and human capital, ultimately promoting export diversification.

The extension of the empirical framework is based on the established theoretical and empirical result that technological innovation can help countries become more competitive internationally and therefore able to export (Soete, 1987). Indeed, Pugliese et al., (2019) and Hausmann et al., (2024) employed the Hidalgo et al., framework and showed that related technological capabilities can contribute to new export specializations. This takes place as export activities benefit from recombining technological inventions in new product offerings.

We add to this literature to make a distinction between innovation and invention. An invention represents the initial emergence of an idea or the creation of a prototype (Asheim and Coenen, 2005), but innovation goes beyond this. Innovation involves transforming the invention or a new product or process into a commercially viable outcome (Fagerberg, 2005). Achieving this requires technological progress coupled with design and market efforts that enhance the value of the final product. Therefore, in addition to examining own export and technology capabilities, we aim to observe a nation's capabilities in market and design capabilities. On the one side, design activities play a crucial role in enhancing the appeal of products, boosting their value, and elevating their presence in global markets (Verganti, 2006; Windrum et al., 2017). On the other side, much like design, market-driven efforts can bolster export performance by distinguishing products and emphasizing attributes that support competitiveness on an international scale (Mendonça et al., 2004).

Relatedness and Exports

The above discussion shows the strong relationship between innovation and exports. Furthermore, it shows that export activity reinforces new export activity as firms within an economy may learn from own experience or experience of their peers (Clerides et al., 1998). Therefore, we need a framework where we can identify and quantify how each activity contributes to exporting. The principle of relatedness (Hidalgo et al., 2018) originally applied to trade is a natural candidate as we can observe how established export specializations in a country can contribute to new export specializations.

When considering the relationship between the principle of relatedness and trade or exports, it is important to examine how regional economies tend to expand their export portfolios based on existing capabilities. The principle suggests that regions are more likely to develop exports in industries that are related to their existing industries, as these areas share complementary knowledge, inputs and infrastructure. This allows for smoother transitions and sustainable economic growth. In addition, Hernández-Rodríguez et al., (2025) have recently shown that regions that follow this path of related diversifying, they are more likely to upgrade to export activities of higher value.[3]

However, this framework needs to encompass the activities that, as the previous discussion showed, can play an important role in trade. Pugliese et al., (2019) expanded on the principle of relatedness and showed that one can account for cross-relatedness, i.e. the relatedness of a type of activity (technology) to another (exports). This framework has been expanded to better understand the relationship between science and technology (Catalán et al., 2020; Balland and Boschma, 2022) and the different stages of innovation activity (Castaldi and Drivas, 2023; Drivas et al., 2023). We adopt this framework to comprehensively account for the contribution of export and innovation related capabilities to new export specializations.

Approximating Innovation Stages

To capture the three innovation stages, i.e., technological inventions, design, and market activities, we turn our attention to utility patents, industrial designs, and trademarks respectively.

The literature shows that patents have a positive impact on trade by enhancing the ability of firms to negotiate, license and sell technologies across borders (Palangkaraya et al., 2017). This is particularly evident in markets with strong IPR enforcement, where patents serve as a tool to secure market entry and establish competitive advantage. By fostering these dynamics, patents not only promote technology diffusion, but also support export growth and international market integration.

Trademarks are the most frequently used type of IPR with a growing literature examining their economic implications (Block et al., 2015). Trademarks play a vital role in facilitating trade by fostering trust, differentiation, and partnerships in the marketplace. Trademarks serve as a strategic tool for SMEs by protecting brand identity, which is crucial for marketing efforts that expand market reach both domestically and internationally. They also enhance a firm's reputation and reliability, which is vital in international trade, where trust-building is critical. Additionally, trademarks support collaboration with external partners, including suppliers and distributors, by formalizing intellectual property assets. This strengthens trade relationships and promotes innovation exchange across borders, ultimately boosting the competitiveness of SMEs in global markets.

Industrial designs also play a key role in trade by elevating product appeal, stimulating innovation, and supporting economic growth. By blending functionality with aesthetics, they distinguish products in

[3] This methodology cannot unfortunately distinguish between inter-industry and intra-industry trade. To the extent that inter-industry trade relates to labor-intensive and resource-intensive activities as opposed to intra-industry trade that relates to capital- and knowledge-intensive activities, the methodology could be extended to capture relatedness between the two types. For intra-industry measures and theoretical underpinnings see Grubel and Lloyd (1971).

competitive markets, enhance value, and boost consumer demand globally and locally. Strategically they tailor products to regional preferences, reinforce brand identity, and drive export success. Schartinger (2023) discusses factors such as the costs associated with obtaining design rights, the strategic value of these protections, and the competitive dynamics in industries where design is crucial. Spulber (2008) highlights how international markets now increasingly involve patents, designs, and ideas, driving global productivity and economic growth.

There are two main reasons we employed these types of IPRs to approximate the three innovation stages. First, for all three types there is sufficient data availability for country-level analysis since most offices provide detailed information to World Intellectual Property Organization (WIPO). Second, there is a large literature that employs these IPRs for each innovation stage separately (Griliches, 1990; Schmoch 2003; Mendonça et al., 2004; Flikkema et al., 2019; Castaldi, 2020; Chan et al., 2017; Corradini and Karoglou, 2023).

We should note that employing IPRs to approximating activity in these innovation stages is not without disadvantages. A major concern is that firms may file strategically for IPRs for reasons unrelated to commercialization such as blocking competitors (Greenhalgh and Rogers, 2012). Further, as with any metric, they will not capture the entire activity related to each innovation stage. However, to the extent that the unobserved activity is distributed randomly across countries and fields, then any findings should be unbiased.

Data and Methods

Data Construction and Summary Statistics

We collect the entire patent, trademark and design activity globally for each country from WIPO. Each IPR activity is distinguished according to its respective classes. Trademarks are counted by the Nice classification system which consists of forty-five classes; 1-34 correspond to goods while classes 35-45 correspond to services. Designs are counted by the thirty-two Locarno classes. Finally, WIPO groups patent counts in thirty-five broad technology fields (Table A1 of the Appendix). We collect export data from BACI (Gaulier and Zignago, 2010). We use the Harmonized System (HS) of Codes and bundle exports at the two-digit level. Therefore, for each country we can observe exports for ninety-six broad product categories.

Overall, we were able to extract data for seventy-six countries for the years 2008-2022. We bundle years in three five-year periods. Specifically, denote each period with the letter t where: t=1 for 2008-2012, t=2 for 2013-2017 and for and t= for 2018-2022. This is a standard procedure in the diversification literature to avoid counting specializations due to random short-term shocks (Neffke et al., 2011).

Table 1 shows the summary statistics for the four focal variables at the country-class-period level. Interestingly, the innovation metric with the highest frequency is trademarks, a fact that corroborates its reputations as the most widely used IPR. Specifically, trademarks are used widely by large firms and SMEs alike to protect their differentiating attributes (Mendonça et al., 2004). Table A2 of the Appendix displays in descending order the countries by each activity separately. Unsurprisingly, China holds first place across all four activities while US and Germany are among the top innovators and exporters

Table 1. Summary statistics.

	Number of Observations	Mean (Standard Deviation)
Exports	21,888	10.81 (69.29)
Patents	7,980	2,203.77 (10,735.47)
Trademarks	10,260	9,633.55 (68,213.49)
Designs	7,296	905.23 (6,974.96)

Note: Exports are displayed in USD millions.

The correlations of these four activities are displayed in Table 2. While they are highly correlated, these activities are not co-linear. This is also evident from Table A2 of the Appendix as countries may rank higher in certain innovation activities than in export activities (e.g. Austria, Switzerland and Sweden) and vice versa (e.g. Netherlands, Mexico and Singapore). Finally, note that export activity is the least correlated with design activity.[4]

Table 2. Correlations

	Exports	Patents	Trademarks	Designs
Exports	1			
Patents	0.80	1		
Trademarks	0.73	0.71	1	
Designs	0.65	0.68	0.94	1

Note: All correlations are significant at the 1% level.

Construction and Description of Variables

To construct the independent and dependent variables, the first step is to construct the Relative Comparative Advantage (RCA) for each activity. We adopt Balassa (1965) where the RCA of country c for exporting product class i in period t is denoted as:

$$RCA_{c,i,t} = \frac{exports_{c,i,t} / \sum_c exports_{c,i,t}}{\sum_r exports_{r,i,t} / \sum_r \sum_c exports_{r,i,t}}$$

We construct similar RCAs for patents, trademarks and design activities according to their associated classes. According to Hidalgo et al., (2007) a country specializes in class i when RCA is above one:

$$x_{c,i,t} = \begin{cases} 1 \; if \; RCA_{c,i,t} > 1 \\ 0 \quad otherwise \end{cases}$$

[4] Table A3 displays each activity per capita. The order is significantly changed; however, developed countries still rank high across all four activities.

For the next step towards generating the relatedness measures, we calculate the probability that a country specializes in class i given that it also specializes in class j. For the seventy-six countries we count the frequency where class i has an RCA>1 given that class j, where $i \neq j$, has RCA>1. Then, we divide this frequency number with the instances where class j has an RCA>1 thereby obtaining the probability $P(x_{i,t} | x_{j,t})$. Since the probability $P(x_{i,t} | x_{j,t})$ need not be equal to the opposite conditional probability $P(x_{j,t} | x_{i,t})$, Hausmann and Klinger (2007) calculate the minimum of each pair of probabilities. That is:

$$\varphi_{i,j} = \min\{P(x_{i,t} | x_{j,t}), P(x_{j,t} | x_{i,t})\}$$

Overall, we have 208 classes spanning the four activities (35 patent classes, 45 trademark classes, 32 design classes and 96 export classes). Therefore the $\varphi_{i,j}$ populates a 208x208 symmetric matrix which captures the overall innovation-export space. Figures 1A-1C display this space for the periods for 2008-2012, 2013-2017 and 2018-2022 respectively. As can be seen throughout the entire time span there are several clusters where export classes and innovation classes of all three stages are strongly linked. This highlights the importance of studying comprehensively innovation and its relationship to trade.

Figure 1A. The innovation-export space. 2008-2012.

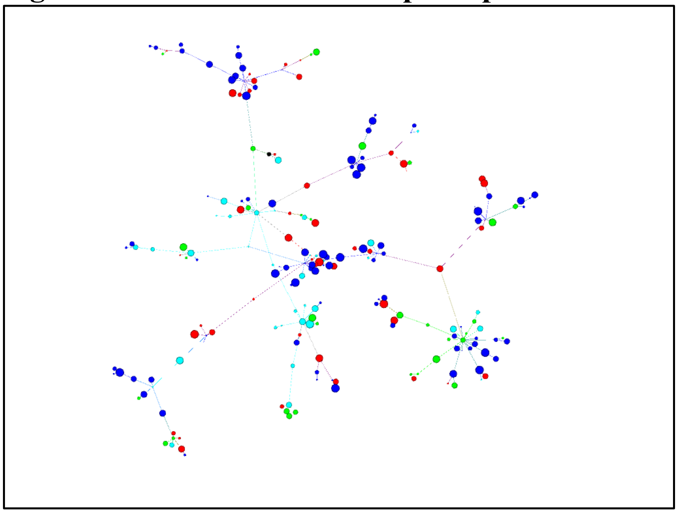
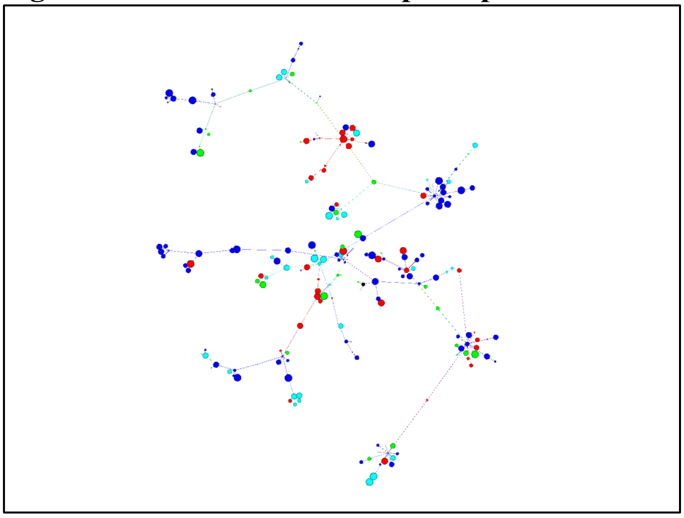


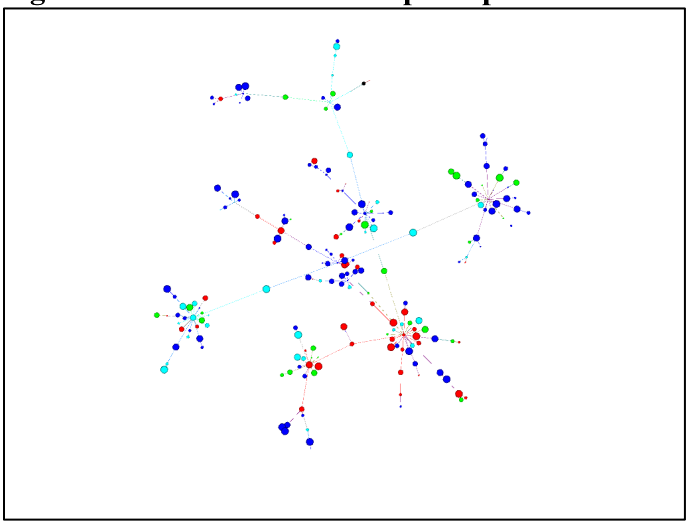
Figure 1B. The innovation-export space. 2013-2017.



Note:

Exports	
Trademarks	
Patents	
Designs	

Figure 1C. The innovation-export space. 2018-2022.



Moving forward with the construction of variables, a key interim step is to generate the main dependent variable that capture the entry of country c in export specialization in class i. This is depicted as $Entry_{c,i,t}$. It takes the value of 1 if country c exhibits RCA in class i in period t given it had not in period t-1 and 0 otherwise. Formally:

$$Entry_{c,i,t} = \begin{cases} 1 \; if \; x_{c,i,t} = 1 \;\; and \; x_{c,i,t-1} = 0 \\ \quad 0 \quad\;\; otherwise \end{cases}$$

We should note that, as we will discuss below in Section 2.2.3 we are interested only in the cases where $x_{c,i,t-1} = 0$. In other words, we are interested in regions where export class i has not exhibited a comparative advantage in period t-1. If the region has entered an export specialization in period t-1 then it is not included in the sample as it is no longer of interest. Overall, we interested in uncovering the generation of new specializations and not the maintenance of existing ones.

Note that for only 3% of observations during the latter two periods in the sample (2013-2017 and 2018-2022) we observe an entry by a country in a given export class. The low frequency of diversification is the main motivation for this study as we aim to capture the role of export and innovation relatedness in the generation of new specializations.

To this end, we construct the four main independent variables of interest that measure relatedness of export activity. For tractability, let i taking the values of i=1-96 which corresponds to a different export class. The relatedness with respect to export activity is calculated as (t subscript is suppressed for the sake of brevity):

$$Export\_RELATEDNESS_{i,r} = \frac{\sum_{j=1, j\in r, j\neq i}^{96} \varphi_{ij}}{\sum_{j=1, j\neq i}^{96} \varphi_{ij}}$$

The numerator is the sum of φ_{ij} in the export classes j that country c is specializes in. The denominator is the overall sum of φ_{ij} for export class i. This measure captures how embedded export class i is in the rest of the country's export activities. The rest of the three variables are the cross-relatedness measures that capture the relatedness of export activity to each of the IPR activities. Cross-relatedness measures are calculated as in Castaldi and Drivas (2023). For patent classes let j taking the values 97-131; for trademark classes j=132-176 and for design classes j=177-208. To this end, the cross-relatedness measures, are calculated as:

$$PatExport\_RELATEDNESS_{i,c} = \frac{\sum_{j=97, j\in c, j\neq i}^{131} \varphi_{ij}}{\sum_{j=97, j\neq i}^{131} \varphi_{ij}}$$

$$TMExport\_RELATEDNESS_{i,c} = \frac{\sum_{j=132, j\in c, j\neq i}^{176} \varphi_{ij}}{\sum_{j=132, j\neq i}^{176} \varphi_{ij}}$$

$$DesignExport\_RELATEDNESS_{i,c} = \frac{\sum_{j=177, j\in c, j\neq i}^{208} \varphi_{ij}}{\sum_{j=177, j\neq i}^{208} \varphi_{ij}}$$

$PatentExport\_RELATEDNESS_{i,c}$ for export class i for country c shows how related are patent classes j=97-131 of country c to the country's export class i. A similar description holds for $TMExport\_RELATEDNESS_{i,c}$ and $DesignExport\_RELATEDNESS_{i,c}$ respectively. Note that all the relatedness measures are standardized.

Econometric Specification and Estimation

The basic specification takes the following form:

$$Entry_{c,i,t} = \beta_0 + \beta_1 Export\_RELATEDNESS_{c,i,t-1} + \beta_2 PatentExport\_RELATEDNESS_{c,i,t-1} + \beta_3 TMExport\_RELATEDNESS_{c,i,t-1} + \beta_4 DesignExport\_RELATEDNESS_{c,i,t-1} + Region_c + Class_i + Period_t + \varepsilon_{c,i,t} \qquad (1)$$

We expect own relatedness to be positively related to new specializations and hence $\beta_1 > 0$. As for the cross-relatedness measures we expect to contribute positively to new export specializations, i.e., $\beta_2, \beta_3, \beta_4 > 0$. We include region, class and period fixed effects. Also, we focus only on observations where the country did not display an RCA above 1 in period *t-1* (i.e.$x_{c,i,t-1} = 0$). While the dependent variable is a dummy, due to the large amount of fixed effect we employ OLS estimator instead of a probit or logit estimator as research has shown that the latter can produce biased estimates (Gomila 2020). Standard errors are clustered at the region level to avoid serial correlation (Bertrand et al., 2004).

Results

Table 3 displays the results. Given that the cross-relatedness measures may be correlated, we include them sequentially and then altogether. In any event, note that correlations are not worryingly high with the highest correlation being between $Export_RELATEDNESS_{c,i,t-1}$and $PatentExport\_RELATEDNESS_{c,i,t-1}$ (ρ=0.39). Overall, we do not observe any changes when including them separately or altogether indicative that multicollinearity is not likely to cause an issue. Consistent with the literature (Hidalgo et al., 2007; Nomaler and Verspagen, 2024) we find that export relatedness contributes positively to new export specializations (Columns 1-4).

Innovation, measured by patents and trademarks, also appears to be related strongly to new export specializations (Column 4). Related design activity however seems to have no contribution to export diversification. This is partially consistent with the Castaldi and Drivas (2023) where they showed that related design activity has the smallest contribution to new patent and trademark specializations.

Table 3. Regression results of Equation (1)

VARIABLES	(1)	(2)	(3)	(4)
$Export\_RELATEDNESS_{i,r,t-1}$	0.035***	0.034***	0.038***	0.031***
	(0.009)	(0.009)	(0.009)	(0.009)
$PatExport\_RELATEDNESS_{i,c,t-1}$	0.010**			0.011**
	(0.004)			(0.005)
$TMExport\_RELATEDNESS_{i,c,,t-1}$		0.009**		0.011**
		(0.005)		(0.005)
$DesignExport\_RELATEDNESS_{i,c,,t-1}$			-0.001	-0.006
			(0.006)	(0.006)
Constant	0.053***	0.053***	0.052***	0.053***
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	10,460	10,460	10,460	10,460
R-squared	0.041	0.041	0.041	0.042

Note: The dependent variable in all regressions is $Entry_{c,i,t}$. All regressions are estimated via OLS. All columns include region, class and period dummies. Standard errors are clustered at the region-class level and are displayed in parentheses. ***p < 0.01; **p < 0.05; *p< 0.1.

The Case of Greece

We examine how the relatedness measures for Greece contribute to specializations. Table 4 compares the cases of new export specializations given that there was no specialization the period before. As can be seen all relatedness measures are higher for the case of new export specializations signifying both the positive role of related export and innovation (including design) capabilities.

Table 4. Relatedness measures by new export specializations.

VARIABLES	$x_{c,i,t} = 1\ \&\ given\ x_{c,i,t-1} = 0$	$x_{c,i,t} = 1\ \&\ given\ x_{c,i,t-1} = 0$
$Export\_RELATEDNESS_{i,r,t-1}$	0.37	0.34
	(0.03)	(0.04)
$PatExport\_RELATEDNESS_{i,c,t-1}$	0.46	0.42
	(0.04)	(0.07)
$TMExport\_RELATEDNESS_{i,c,,t-1}$	0.45	0.43
	(0.06)	(0.06)
$DesignExport\_RELATEDNESS_{i,c,,t-1}$	0.41	0.36
	(0.04)	(0.05)
	n=6	n=117

Given that the sample is quite small, we expand the analysis by examining the instances of export specializations in Table 5. The picture that emerges is quite similar with all relatedness being larger for the case of specialization as opposed to lack of. Overall, these findings show that related export and innovation capabilities are positively related to new export specializations for the case of Greece.

Table 5. Relatedness measures by export specializations.

VARIABLES	$x_{c,i,t} = 1$	$x_{c,i,t} = 0$
$Export\_RELATEDNESS_{i,r,t-1}$	0.38	0.34
	(0.03)	(0.04)
$PatExport\_RELATEDNESS_{i,c,t-1}$	0.47	0.41
	(0.05)	(0.07)
$TMExport\_RELATEDNESS_{i,c,,t-1}$	0.49	0.42
	(0.05)	(0.06)
$DesignExport\_RELATEDNESS_{i,c,,t-1}$	0.39	0.36
	(0.04)	(0.05)
	n=84	n=108

Motivations and challenges of Greek inventors

In this section, we address the second objective of this paper. Specifically, we conducted an in-depth survey of inventors based in Greece to identify their key characteristics, motivations, challenges, and opportunities throughout the complex processes of patenting and commercialisation. We begin with a review of the relevant literature, followed by data compilation, descriptive statistics, an empirical analysis of the motives for filing a patent application, and finally, the conclusion section.

Literature review

Invention plays a crucial role in technological progress and economic development, representing the creation of new products, processes, or methods. Academic research distinguishes invention from innovation, where the latter involves commercialization and diffusion (Schumpeter, 1934). Studies highlight that invention stems from both individual creativity and systematic R&D efforts, with firms, universities, and independent inventors as significant contributors (Griliches, 1990). The characteristics of inventors have been widely examined, with findings indicating that education, particularly in STEM fields, plays a vital role in inventive activity (Acs & Audretsch, 1988). Experience, collaboration, and exposure to diverse knowledge networks further enhance an inventor's productivity (Lazear, 2004), while geographic location and institutional support influence the success of their inventions (Jaffe et al., 1993).

Patents serve as a legal mechanism to protect inventions, granting exclusive rights to inventors for a fixed period and incentivising innovation by ensuring a return on investment. Patent applicants typically include firms seeking to protect their market position (Hall & Harhoff, 2012), universities aiming to facilitate technology transfer (Mowery et al., 2001), and independent inventors who, despite lower patenting rates, contribute to technological progress. The motives for filing patents vary, ranging from market protection and competitive advantage (Cohen et al., 2000) to revenue generation through licensing and commercialization. Additionally, patents serve as a strategic tool for signaling technological strength to investors and competitors (Hall & Ziedonis, 2001), while for academic inventors, they offer reputational benefits and career advancement (Azoulay et al., 2009).

Despite their benefits, patents come with several challenges. High filing, prosecution, and maintenance costs pose significant financial burdens, particularly for small firms and individual inventors (Lanjouw & Schankerman, 2004). The complexity of the patenting process requires legal expertise, making it difficult for many applicants to navigate without professional assistance (Harhoff et al., 2003). Even after obtaining a patent, enforcement remains a major issue, as infringement litigation is costly and uncertain (Bessen & Meurer, 2008). Moreover, many patents fail to generate substantial economic value, making patenting a risky investment (Pakes, 1986). These challenges highlight the need for continuous improvements in the patent system to better support inventors and foster innovation.

Empirical studies have delved into the demographic characteristics, motivations, and challenges faced by inventors, providing a nuanced understanding of the inventive landscape (Giuri et al., 2007; Cohen et al., 2000, Blind et al., 2006; Veer et al., 2006; Bell et al., 2019). Previous studies have extensively examined the characteristics of inventors, identifying key factors that influence their inventive productivity. Education plays a crucial role, with many inventors holding advanced degrees, particularly in science, technology, engineering, and mathematics (STEM) fields, which provide the technical expertise necessary for innovation (Acs & Audretsch, 1988). Prior experience in research and development (R&D) and exposure to diverse knowledge networks significantly enhance an inventor's ability to generate patents and novel technologies (Lazear, 2004). Collaboration is also a vital factor, as teamwork and cross-disciplinary partnerships foster knowledge spillovers and improve the quality of inventions (Singh & Fleming, 2010). Additionally, geographic location influences inventive output, with innovation clusters such as Silicon Valley benefiting from strong institutional support, access to venture capital, and high levels of knowledge exchange (Jaffe et al., 1993).

The role of mobility and career trajectory is also significant, as inventors who transition between firms or academia and industry tend to produce higher-impact patents due to their exposure to diverse technological domains (Hoisl, 2007). Furthermore, demographic factors such as age and experience impact innovation, with mid-career professionals often being the most prolific inventors, as they combine creative thinking with practical expertise (Jones, 2010). Gender disparities in patenting have also been documented, with women being underrepresented in patent filings, often due to structural barriers in STEM fields and differences in collaboration networks (Ding et al., 2006). These findings underscore the complex interplay of education, collaboration, location, career trajectory, and demographic factors in shaping the productivity and impact of inventors.

The motives behind patenting can be multifaceted, reflecting both the traditional purpose of protecting innovation and broader strategic objectives. A study by Lam (2011) found that scientists engage in patenting activities not only for financial gains but also due to a desire for their research to have practical applications and societal impact. Giuri et al. (2007) found that inventors prioritized personal satisfaction, prestige, reputation, and contributing to their organization's performance over monetary rewards or career advancement.

Patents are essential for protecting R&D investments by preventing competitors from replicating innovations and providing exclusivity, particularly in high-R&D industries like pharmaceuticals (Hall & Harhoff, 2012). Firms use patents to create barriers, generate revenue through licensing, and build patent portfolios for strategic purposes (Arora & Ceccagnoli, 2006; Somaya, 2012). Patents signal technological competence, enhancing reputation and attracting investment (Hsu & Ziedonis, 2013). They also help firms avoid intellectual property infringement and can be used to meet conditions for subsidies (Shapiro, 2001; Guellec & van Pottelsberghe, 2007).

Studies show that patenting motives vary by firm size, with large firms focusing on strategic uses like blocking competitors, while SMEs prioritize protection (Blind et al., 2006). Start-ups patent to attract funding, and academics patent for prestige and research stimuli (Giuri et al., 2007). Commercialization is increasingly tied to university spin-offs, reflecting the growing role of patents in entrepreneurship (Blind et al., 2018).

Data Compilation

We conducted an online survey of Greek-located inventors who held at least one patent granted by international patent offices, such as the EPO, WIPO, and USPTO. The survey questionnaire is presented in Appendix II and comprises of eighteen questions. Please note that the survey questionnaire was originally disseminated in the Greek language. Hence, the questionnaire in the Appendix II is a translation from the original. The data collection process involved several steps. First, we extracted information on Greek inventors with at least one international patent granted between 2017 and 2022 from Espacenet. Using the inventors' names and any available location information associated with their patent applications, we conducted a thorough search across on various platforms, including Google, LinkedIn, to collect the contact details needed to send out the survey questionnaire.

This step proved to be particularly time-consuming, as although patents and inventor names are publicly available, contact details (such as email addresses) are not. In the end, we obtained the contact details of approximately one thousand Greek inventors who had received at least one patent from international offices during this period. The survey was sent electronically, either to the inventors' email addresses or directly via LinkedIn messages. The survey was conducted in the spring and early summer of 2024 and was completed by 200 Greek-located inventors.

We should highlight Greece as a special case due to its low patenting activity. According to EPO's Statistics & Trends Centre, Greece ranks 33rd in applications per capita. Interestingly while EPO members' applications per million inhabitants are 141.63, Greece ranks below that with 14.70. This latter figure is approximately ten times less than the overall rate of patenting of all EPO member countries. To this end, Greece's overall low rate of patenting is a major motivation of this research project as we aim to uncover the challenges and opportunities of Greek innovators.

Descriptive statistics

This subsection provides a detailed analysis of the descriptive statistics on Greek-located inventors, examining their characteristics, motivations for patenting, and the challenges they face, such as legal complexity, financial costs, and administrative hurdles. This review aims to improve understanding of the factors that shape patenting activity in Greece.

The characteristics of inventors

Table 6 provides a comprehensive overview of the demographic characteristics of the inventor sample used in this study, focusing on key characteristics such as gender distribution, age group representation, regional residence, and levels of educational attainment. The dataset includes a total of 200 Greek-located inventors, providing a robust basis for examining patterns and trends in inventive activity within the specified population.

Table 6: Descriptive statistics of Greek-located inventor: gender, age group, education and region

		N	Percent
Gender	1. Female	32	16.00
	2. Male	168	84.00
Age	1. 18-40	47	23.50
	2. 41-50	83	41.50
	3. 51-60	44	22.00
	4. ≥61	26	13.00
Education	1. Prof	2	1.00
	2. BSc	12	6.00
	3. MSc	41	20.50
	4. PhD	145	72.50
Region	01. Attica	111	55.50
	02.Central Macedonia	23	11.50
	03. Abroad	20	10.00
	04. Crete	16	8.00
	05. Epirus	9	4.50
	06. Other	21	10.50

Note: Total number of inventors: Obs 200. Region: referring to the 13 regions of Greece

The sample of inventors shows a pronounced gender imbalance, with male inventors significantly outnumbering their female counterparts. Specifically, 84% of the respondents identified themselves as male, highlighting the strong male dominance in the field of innovation. In contrast, female inventors constitute a minority, accounting for only 16% of the sample. This marked gender disparity is consistent with wider empirical findings in patenting and invention research (e.g., Giuri et al., 2007), which often point to a systemic under-representation of women in technological innovation and the creation of intellectual property.

The age profile of the inventors shows a concentration on the mid-career stage. The largest age group consists of inventors aged between 41 and 50 years old, representing 41.5% of the total sample. This is followed by the 18-40 age group with 23.5% and the 51-60 age group with 22%. Inventors aged 61 and over make up 13% of the sample, reflecting the continued involvement of older professionals in inventive activity. This age distribution underlines the predominant participation of experienced, mid-career professionals in the innovation process, which is in line with the existing literature linking increased patenting productivity with career maturity.

The educational background of the inventor sample indicates a highly skilled and academically advanced population. The overwhelming majority, 72.5%, holds a doctoral degree (PhD), demonstrating the crucial role of advanced research training in fostering inventive capacity. Inventors with a Master's degree (MSc) make up 20.5% of the sample, while those with a Bachelor's degree (BSc) account for 6%. A marginal 1% of inventors reported having a professional qualification without a university degree. This distribution highlights the strong link between formal education, especially at the postgraduate level, and innovative activity, which is consistent with findings in knowledge-based economies where advanced technical expertise is a key driver of patenting.

Geographically, the inventors are highly concentrated in certain regions, with a notable clustering in Attica, the main economic and innovation centre of Greece. More than half of the sample (55.5%) resides in the Attica region, demonstrating its key role in driving national patenting activity. Central Macedonia ranks second with 11.5% of the inventors, while a significant proportion (10%) are currently based internationally, reflecting the global mobility and cross-border engagement of some inventors. Other regions, including Crete (8%), Epirus (4.5%) and various smaller regions together accounting for 10.5%. This geographical concentration highlights the importance of regional innovation systems and the uneven spatial distribution of inventive output within national economies.

In summary, the sample of inventors analysed in this study has a distinct demographic composition characterised by a significant male majority, a preponderance of mid-career professionals, a high level of education attainment, and a marked regional concentration in Attica. These demographic trends reflect broader patterns observed in innovation-driven economies, where regional centres of economic activity, high levels of educational attainment, and persistent gender disparities shape the landscape of patent activity. Understanding these characteristics provides valuable insights into the human capital dynamics underlying inventive processes and provides a basic for policy discussions aimed at fostering more inclusive and geographically dispersed innovation ecosystems.

Motives of patent filing

Table 7 presents the descriptive statistics for the different motives considered by patent applicants in this study. Inventors were asked to rate the importance of nine different motives on a 5-point Likert scale, ranging from "not at all important" (1) to "very important" (5).

Table 7: Reasons for filing a patent application

Variable	Mean (Std. dev.)
prestige	3,21 (1,50)
commercial_exploitation	4,17 (1,04)
licensing	3,31 (1,45)
selling	3,14 (1,42)
spinoff/startup	2,66 (1,54)
company_image	3,69 1,37)
protection	3,86 (1,42)
blocking	4,01 (1.29)
central_decision	2,79 (1,54)

Note: Total number of inventors: Obs 200. 5-point Likert scale: 1: Not at all Important, 2: Slightly Important, 3: Moderately Important, 4: Important, 5: Very Important

The mean value for the prestige motive was 3.21, indicating that, on average, respondents considered prestige to be a somewhat important motive for filing patents. Commercial exploitation emerged as one of the more important motives, with a mean of 4.17. This indicates that respondents generally consider commercial exploitation to be an important factor in their decision to file a patent. The mean score for licensing was 3.31, suggesting that while it is an important motive, it is not as strongly emphasised as commercial exploitation or protection. Respondents rated selling as a less important motive for filing patents, with a mean of 3.14. This value suggests a neutral attitude towards on its importance.

Creating a spin-off or start-up received the lowest mean score of 2.66, suggesting that respondents generally consider this motive to be a less important reason for filing a patent. With a mean of 3.69, the motive of enhancing company image was considered important by respondents, though not as strongly as commercial exploitation or blocking. Protection was also considered a significant motive for filing a patent, with a mean of 3.86. This suggests that many respondents agree that securing legal protection for intellectual property is an important reason for patenting. Blocking emerged as one of the more important motives, with a mean of 4.01. The central decision-making process of the organisation they work for was the least emphasised motive, with a mean of 2.79.

Moreover, in this subsection, we conduct our empirical analysis using factor analysis on patent motives of Greek-located inventors with a framework based on Blind et al. (2006) and Block et al. (2015)5.

[5] Block et al. use this framework for trademarks.

Our empirical analysis uses factor analysis to investigate the underlying structure of inventors' motives for filing patents. To quantify the importance of these motives, we designed a survey with nine different items, each rated on a 5-point Likert scale (ranging from 1 = "not at all important" to 5 = "very important"). Table 9 provides detailed descriptions of the survey items and their measurement framework.

To uncover latent dimensions within the motives for patenting, we conducted an exploratory factor analysis (EFA). Factor analysis assumes intercorrelation between observed variables, a condition we assessed using Bartlett's sphericity test ($\chi^2 = 471.76$, $p < 0.01$) and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (KMO = 0.64). According to Kaiser and Rice (1974), a KMO value above 0.60 is considered acceptable, indicating that our data are suitable for factor analysis. In addition, Bartlett's test rejects the null hypothesis of variable independence, further confirming the appropriateness of applying factor analysis (Dziuban & Shirkey, 1974).

We used principal component factor analysis (PCFA) with varimax rotation to improve interpretability by maximising the variance of the squared loadings. A factor loading threshold of 0.50 was used to determine item-factor assignments. The analysis yielded a three-factor solution based on the latent root criterion, with three factors having eigenvalues greater than 1 (Thomä & Bizer, 2013). The rotated factor loadings and extracted variances are presented in Table 8. Each item loads uniquely on a single factor, ensuring a clear and unambiguous classification. Together, the three factors explain 63.73% of the total variance, indicating a robust factor structure.

Table 8: Factor analysis of motives for filing a patent application

Variable	**Factor1**	**Factor2**	**Factor3**
Interpretation	*Exchange*	*Protection-Blocking*	*Reputation/Marketing*
Prestige/Reputation			0.7258
Licensing	0.8449		
Selling	0.8372		
Spin-off/ Start-up	0.6361		
Company_image			0.6946
Protection		0.8723	
Blocking		0.8098	
Variance	26,96%	22,15%	13,83%

Note: Obs=200, Principal component analysis, varimax-rotated factor loadings. Kaiser–Meyer–Olkin Measure: 0.6373, Bartlett's test of sphericity: 471.76, $p < 0.01$. The blank in the table represents factor loadings with an absolute value less than 0.5.

The factor structure derived from our analysis closely corresponds to the motive clusters identified in previous research (Blind et al., 2006; Block et al., 2015) with only minor variations. Factor 1 represents exchange motives and includes the motives of licensing of the invention, selling the patent and starting a new business (Spin off/start up). More specifically, this factor reflects strategic objectives such as increasing attractiveness to potential licensees to secure higher royalty fees and generating future cash flows by selling the patent. Notably, our findings extend existing classifications by incorporating the formation of starting a new business (Spin off/start up) within this exchange-oriented factor. This inclusion suggests that beyond facilitating direct financial transactions, patents also strengthen inventors' bargaining power with potential investors, facilitating capital acquisition for business development.

Factor 2 includes the motives of protecting products from competition (Protection) and prevent third parties from patenting similar inventions (Blocking). While prior research has often treated these as distinct factors, our findings indicate that they coalesce into a single dimension. This convergence suggests that both motives stem from a common strategic objective: asserting technological capabilities and maintaining control over proprietary knowledge. The protective motive ensures exclusivity in the market, while the blocking motive preempts competitors from securing patents in related technological domains.

Factor 3 includes the motives of reputation/creating opportunities for me as an inventor and enhancing the profile of the company/organization. Specifically, it includes the inventor's aim to enhance personal recognition and career opportunities, as well as the company's goal of strengthening its public profile. This factor reflects the motive of reputation or in other words the marketing motive. From an individual perspective, securing patents can enhance an inventor's reputation, increasing professional visibility and future career prospects. At the organizational level, patents contribute to brand positioning by signaling innovation capabilities, attracting potential customers or partners, and even justifying premium pricing. By integrating personal and corporate reputation-building motives, this factor underscores the role of patents beyond legal protection and commercialization—highlighting their strategic function in **branding, differentiation, and competitive positioning**.

The results suggest that commercial exploitation, blocking, and protection are seen as the most important motives for filing a patent, with respondents generally agreeing on their importance. In contrast, creating a spin-off or start-up, and central decision-making by the organisation they work for were considered less important, with greater variability in responses. The consistency of our factor analysis results with previous studies reinforces the robustness of our approach while also allowing us to refine existing classifications. In particular, our research introduces a nuanced perspective by including spin-off/start-up formation within the exchange-oriented factor, suggesting a broader interpretation of patents as tools not only for immediate financial returns but also for facilitating entrepreneurial endeavours. Moreover, our identification of protection and blocking as a single strategic dimension highlights the intertwined nature of defensive and competitive motives for patenting and emphasises the role of patents in asserting technological leadership. These findings provide insight into the different factors that influence the decision to file a patent, highlighting the importance of both strategic business motives and legal considerations.

Challenges of patent filing

The process of patent application involves several challenges that influence decision-making regarding final registration. Table 9 presents the descriptive statistics for various obstacles faced by applicants, providing insight into the relative importance of each challenge. Respondents rated these challenges on a five-point Likert scale, with higher values indicating greater difficulty (" not at all important " (1) to " very important " (5)).

Table 9: Challenges in the pre-application process and during the application process that influenced the decisions inventor had to make regarding the final registration

Variable	Mean (Std. dev.)
fees	3,09 (1,50)
process_cost	3,04 (1.46)
translation_cost	2,48 (1,44)
attorney	3,29 (1,52)
writing	3,08 (1,56)
mentor	2,65 (1,49)
registration_difficulties	2,52 (1,39)
central decision_applicant	2,54 (1,72)

Note: Total number of inventors: Obs 200. 5-point Likert scale: 1: Not at all Important, 2: Slightly Important, 3: Moderately Important, 4: Important, 5: Very Important

Among the most significant challenges reported were financial and legal costs. The cost of finding good legal services had the highest mean score (3.29), indicating that securing experienced legal support was a major concern for many respondents. Similarly, the cost of fees at each patent office (mean = 3.09) and the cost associated with writing the patent and subsequent monitoring (mean = 3.04) were perceived as considerable barriers. The cost of translation for filing with local offices, however, was rated lower (mean = 2.48), suggesting that while translation expenses were a concern for some applicants, they were not as universally significant as other financial burdens.

In addition to financial constraints, respondents highlighted difficulties in securing expert support. Finding experienced patent writers had a mean score of 3.08, reflecting that access to skilled professionals was an important but somewhat variable challenge. Similarly, the lack of mentorship in patenting was rated at 2.65, suggesting that while some applicants benefitted from experienced colleagues, others faced obstacles due to limited guidance.

Administrative and procedural challenges were rated somewhat lower compared to financial and legal barriers. The difficulty of obtaining a patent from local offices had a mean of 2.52, indicating that while this was a challenge for some, it was not a predominant concern. Additionally, the involvement of centralized decision-making by the organization (mean = 2.54) suggests that for some applicants, the process was managed at a corporate level, reducing their direct involvement in decision-making.

Overall, the results suggest that financial constraints, particularly those related to legal services, official fees, and patent writing, represent the most pressing challenges in the patent application process. Challenges related to procedural difficulties, mentorship, and central decision-making appear to be less critical but still relevant for certain applicants. These findings highlight the importance of financial and legal support mechanisms in facilitating patent applications and ensuring a smoother registration process.

Inventors by type of applicant and motives for filing at different patent offices

With another view of analysis, among the 200 inventors who responded to the survey, the distribution of patent assignees was relatively balanced. In the Appendix III, we present the results across the four different types of applicants. Specifically, 14.5% of inventors reported holding patents as independent inventors, 28% were affiliated with a university or research center, 27,5 % were employed by a small or medium-sized enterprise (SME), and 30% were employed by a large firm (i.e., an organization with more than 250 employees). The findings (Table C1 of the Appendix III) indicate distinct differences in the motivations for patenting across these groups. Inventors who personally own their patents, as well as those affiliated with universities, predominantly perceive patenting as a mechanism for commercialization, either through licensing or selling their inventions. Conversely, large firms primarily utilize patents for strategic purposes such as protecting their products and blocking competitors, a practice that has been well-documented in the literature (Torrisi et al., 2016). The prevalence of blocking as a key motivation for patent filings aligns with broader empirical evidence and suggests that Greek large firms follow similar strategic behaviors observed in other contexts.

Table C2 of the Appendix III presents the challenges in the pre-application process and during the application process that influenced the decisions inventors had to make. The results show that individual inventors, universities, and SMEs face similar challenges when it comes to patent costs, including fees, writing, and monitoring, while large companies find these costs less of a burden. Translation costs are a concern for all groups but less so for large firms. SMEs and universities struggle the most with finding good legal services and experienced patent writers, whereas large firms seem to have easier access to these resources. Having a mentor or colleague with patenting experience is more important for SMEs and universities than for individual inventors or large companies. A key difference is that large companies are far more likely to have the entire patenting process handled internally, whereas individuals and smaller organizations are more directly involved. Overall, smaller entities face greater financial and procedural challenges, while large firms benefit from established resources and centralized processes.

Examining patent filing motives across different jurisdictions yields two key observations. First, when filing patents at international offices such as the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), and the World Intellectual Property Organization (WIPO), market-driven motives and commercialization prospects emerge as the most significant factors. This highlights the strategic importance of international patenting for Greek inventors and their affiliated organizations, reflecting broader efforts to integrate innovation within a globalized framework of exports, investments, and commercialization of high-value technologies.

Discussion and conclusions

In this report we had two main objectives. For the first objective, we examined the relationship between each stage of innovation—technological, market, and design activities—and export performance. By decomposing innovation into these three stages, we analysed their different contributions to related export activities, based on the principle of relatedness (Hidalgo et al., 2007). Our results revealed significant interactions between innovation stages and export activity. Furthermore, our econometric analysis showed that related export activities play a crucial role in fostering new export specialisations, while technological and market capabilities contribute to the development of new comparative advantages in exports.

For the second objective, we conducted a comprehensive survey of Greek-based inventors to explore their motivations, challenges, and opportunities throughout the complex processes of patenting and commercialisation. The typical Greek inventor is predominantly male, mainly mid-career, highly educated, and concentrated in the Attica region. Using factor analysis, we categorised inventors' patenting motives into three interrelated factors: exchange, protection/blocking, and reputation. This framework highlighted the multiple roles that patents play in commercialisation, strategic positioning, and career advancement. Our findings also suggested that financial constraints—especially those related to legal services, fees, and patent writing—represent the most significant challenges in the patenting process. Greek inventors showed different patenting motives based on affiliation. Independent inventors and university researchers focus on commercialisation, while large firms use patents strategically to protect products and block competitors (Torrisi et al., 2016).

Our contribution to the literature is twofold. First, we contribute to the link between innovation and exports, by examining innovation activity across its stages, revealing its nuanced impact on export performance. In addition, we provide new insights into the characteristics of inventors, their motivations for patenting and the challenges they face. By clarifying overlapping motivations, our study provides a comprehensive framework for understanding the role of patents in commercialisation, strategy and career advancement. These findings extend existing research by highlighting the strategic use of patents in entrepreneurship and reputation building.

The policy implications of our findings with respect to the first objective highlight the critical link between innovation and exports, providing a holistic framework that integrates technology, design, and market activities. This approach helps policymakers design targeted innovation strategies, recognising the different roles each dimension plays in driving exports, including green products and emerging sectors such as digital services (Stojkoski et al., 2024). The findings support the adoption of smart specialisation strategies that emphasise the link between innovation and export growth, as promoted by EU policies. Greece could benefit from a national innovation strategy that promotes not only technological inventions, but also promotes market and design activities. A successful strategy should integrate entrepreneurial discovery and focus on the transition from declining to high-value activities. This integrated approach can drive structural development and economic growth.

For the second objective, improving financial support through subsidies or tax incentives can reduce barriers related to legal fees and patenting costs. We should highlight that such actions are already in place in European Union.6 Simplifying procedures and promoting mentorship programmes would improve accessibility, especially for early-stage inventors and those outside major innovation centres. Addressing gender disparities and promoting regional patenting can foster a more inclusive innovation landscape. Finally, examining the alignment of Greek patent laws with European frameworks, such as the Unitary Patent, and improving legal support for SMEs and researchers is critical in the coming years.

In conclusion, Greece ranks quite low in innovation activity. In a recent study, Balland and Boschma (2022) showed that no Greek region was a technological leader; however, four were scientific leaders pointing to the significant human capital that is located in Greece. The inability of Greece to translate this human capital to leading technological innovations can have many culprits (institutional, cultural etc.). While these are beyond the scope of the current report, we propose policies that could help Greece enter high-value added activities.

[6] See for instance intellectual property vouchers from the European Union Intellectual Property Office: https://www.euipo.europa.eu/en/about-us/the-office/procurement-and-grants/grants

References

Acs, Z. J., & Audretsch, D. B. (1988). Innovation in large and small firms: An empirical analysis. *American Economic Review, 78*(4), 678–690.

Arora, A., & Ceccagnoli, M. (2006). Patent protection, complementary assets, and firms' incentives for technology licensing. *Management Science, 52*(2), 293–308.

Asheim, B. T., and Coenen, L. 2005. Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy* 34 (8): 1173–90.

Aw, B. Y., Roberts, M. J., & Xu, D. Y. (2011). R&D investment, exporting, and productivity dynamics. *American Economic Review*, *101*(4), 1312-1344.

Azoulay, P., Ding, W., & Stuart, T. (2009). The impact of academic patenting on the rate, quality, and direction of (public) research output. *Journal of Industrial Economics, 57*(4), 637–676.

Balland, P. A., & Boschma, R. (2022). Do scientific capabilities in specific domains matter for technological diversification in European regions?. *Research Policy*, *51*(10), 104594.

Balassa, B. (1965). "Trade liberalisation and “revealed” comparative advantage." *The manchester school* 33(2): 99-123.

Bell, A. M., Chetty, R., Jaravel, X., Petkova, N., & Van Reenen, J. (2019). Who becomes an inventor in America? The importance of exposure to innovation. *The Quarterly Journal of Economics, 134*(2), 647–713.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics*, 119(1), 249–275.

Bessen, J., & Meurer, M. J. (2008). *Patent failure: How judges, bureaucrats, and lawyers put innovators at risk.* Princeton University Press.

Bıçakcıoğlu-Peynirci, N., Hizarci-Payne, A. K., Özgen, Ö., & Madran, C. (2020). "Innovation and export performance: A meta-analytic review and theoretical integration." *European Journal of Innovation Management*, 23(5), 789-812

Blind, K., Edler, J., Frietsch, R., Schmoch, U., 2006. Motives to patent: empirical evidence from Germany. Res. Policy 35 (5), 655–672.

Blind, K., Pohlisch, J., & Zi, A. (2018). Publishing, patenting, and standardization: Motives and barriers of scientists. *Research Policy, 47*(7), 1185-1197.

Block, J. H., Fisch, C. O., Hahn, A., Sandner, P. G., 2015. Why do smes file trademarks? insights from firms in innovative industries. Research Policy 44, 1915–1930.

Castaldi, C. (2020). All the great things you can do with trademark data: Taking stock and looking ahead. *Strategic Organization*, 18(3), 472-484.

Castaldi, C., & Drivas, K. (2023). Relatedness, cross-relatedness and regional innovation specializations: An analysis of technology, design, and market activities in Europe and the US. *Economic Geography*, 99(3), 253–284.

Catalán, P., Navarrete, C., & Figueroa, F. (2020). The scientific and technological cross-space: Is technological diversification driven by scientific endogenous capacity? *Research Policy*, 104016.

Chalioti, E., Drivas, K., Kalyvitis, S., & Katsimi, M. (2020). Innovation, patents and trade: A firm-level analysis. *Canadian Journal of Economics/Revue canadienne d'économique*, *53*(3), 949-981.

Chan, T. H., Mihm, J., & Sosa, M. E. (2017). On Styles in Product Design: An Analysis of US Design Patents. *Management Science*, 64(3), 1230-1249.

Clerides, S. K., Lach, S., & Tybout, J. R. (1998). Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *The quarterly journal of economics*, *113*(3), 903-947.

Cohen, W. M., Nelson, R. R., & Walsh, J. P. (2000). Protecting their intellectual assets: Appropriability conditions and why U.S. manufacturing firms patent (or not). *NBER Working Paper No.* 7552, National Bureau of Economic Research, Inc.

Corradini, C., & Karoglou, M. (2023). On the persistence and complementarities of design and technological change: a regional perspective. *Regional Studies*, *57*(7), 1289-1302.

Ding, W. W., Murray, F., & Stuart, T. E. (2006). Gender differences in patenting in the academic life sciences. *Science, 313*(5787), 665–667.

Drivas, K., Economidou, C., Kaplanis, I., & Tagaraki, M. T. (2023). Examination of related diversification in laggard regions. *Papers in Regional Science*, *102*(4), 851-870.

Dziuban, C.D., Shirkey, E.C., 1974. When is a correlation matrix appropriate forfactor analysis? Some decision rules. Psychol. Bull. 81 (6), 358–361.

Fagerberg, J. (2005). The Oxford handbook of innovation. Oxford University Press.

Flikkema, M., Castaldi, C., de Man, A. P., & Seip, M. (2019). Trademarks' relatedness to product and service innovation: A branding strategy approach. *Research Policy*, 48(6), 1340-1353.

Gaulier, G., & Zignago, S. (2010). Baci: International Trade Database at the Product-Level. The 1994-2007 Version Working Papers 2010-23, CEPII research center.

Giuri, P., Mariani, M., Brusoni, S., Crespi, G., Francoz, D., Gambardella, A., ... & Verspagen, B. (2007). Inventors and invention processes in Europe: Results from the PatVal-EU survey. *Research Policy, 36*(8), 1107-1127.

Gomila, R. (2020). Logistic or linear? Estimating causal effects of experimental treatments on binary outcomes using regression analysis. *Journal of Experimental Psychology*: General, (2020): 1-27.

Greenhalgh, C., & Rogers, M. (2012). Trade Marks and performance in services and manufacturing firms: Evidence of Schumpeterian competition through innovation. *Australian Economic Review*, 45(1), 50-76.

Griliches, Z. (1990). Patent statistics as economic indicators: A survey, Part II. National Bureau of Economic Research.

Grossman, G. M., & Helpman, E. (1991). *Innovation and growth in the global economy*. MIT Press.

Grossman, G. M., & Helpman, E. (2018). Growth, Trade, and Inequality. *Econometrica, 86*(1), 37–83.

Grubel, H. G., & Lloyd, P. J. (1971). The Empirical Measurement of Intra-Industry Trade. *Economic record*, *47*(120).

Guellec, D., & van Pottelsberghe de la Potterie, B. (2007). *The economics of the European patent system: IP policy for innovation and competition.* Oxford University Press.

Hall, B. H., & Harhoff, D. (2012). Recent research on the economics of patents. *Annual Review of Economics*, 4(1), 541–565.

Hall, B. H., & Harhoff, D. (2012). Recent research on the economics of patents. *NBER Working Paper No.* 17773, National Bureau of Economic Research, Inc.

Hall, B. H., & Ziedonis, R. H. (2001). The patent paradox revisited: An empirical study of patenting in the U.S. semiconductor industry, 1979–1995. *RAND Journal of Economics, 32*(1), 101–128.

Harhoff, D., Scherer, F. M., & Vopel, K. (2003). Citations, family size, opposition and the value of patent rights. *Research Policy, 32*(8), 1343–1363.

Hall, B. H., Helmers, C., Rogers, M., & Sena, V. (2014). The choice between formal and informal intellectual property: A review. *Journal of Economic Literature, 52*(2), 375–423.

Hausmann, R., Yildirim, M. A., Chacua, C., Hartog, M., & Matha, S. G. (2024). Global trends in innovation patterns: A complexity approach. *World Intellectual Property Organization (WIPO) Economic Research Working Paper Series*, (80).

Hernández-Rodríguez, E., Boschma, R., Morrison, A., & Ye, X. (2025). Functional upgrading and downgrading in global value chains: evidence from EU regions using a relatedness/complexity framework. *Papers in Regional Science*, *104*(1), 100072.

Hidalgo, C. A., Klinger, B., Barabási, A. L., & Hausmann, R. (2007). The product space conditions the development of nations. *Science*, *317*(5837), 482-487.

Hidalgo, C. A., Balland, P.-A., Boschma, R., Delgado, M., Feldman, M., Frenken, K., . . . Morrison, A. (2018). The principle of relatedness. In International conference on complex systems (pp. 451-457). Springer, Cham.

Hoisl, K. (2007). Tracing mobile inventors—The causality between inventor mobility and inventor productivity. *Research Policy, 36*(5), 619–636.

Hsu, D. H., & Ziedonis, R. H. (2013). Resources as dual sources of advantage: Implications for valuing entrepreneurial-firm patents. *Strategic Management Journal, 34*(7), 761–781.

Hunt, J., Garant, J. P., Herman, H., & Munroe, D. J. (2013). Why don't women patent? *National Bureau of Economic Research*. Working paper 17888.

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic localization of knowledge spillovers as evidenced by patent citations. *Quarterly Journal of Economics, 108*(3), 577–598.

Jones, B. F. (2010). Age and great invention. *Review of Economics and Statistics, 92*(1), 1–14.

Kaiser, H.F., Rice, J., 1974. Little Jiffy, Mark IV. Edu. Psychol. Meas. 34 (1), 111–117.

Lam, A. (2011). What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'? *Research Policy, 40*(10), 1354–1368.

Lanjouw, J. O., & Schankerman, M. (2004). Patent quality and research productivity: Measuring innovation with multiple indicators. *Economic Journal, 114*(495), 441–465.

Lazear, E. P. (2004). Balanced skills and entrepreneurship. *American Economic Review, 94*(2), 208–211.

Mendonça, S., Pereira, T. S., & Godinho, M. M. (2004). Trademarks as an indicator of innovation and industrial change. *Research policy*, *33*(9), 1385-1404.

Mowery, D. C., Nelson, R. R., Sampat, B. N., & Ziedonis, A. A. (2001). The growth of patenting and licensing by U.S. universities: An assessment of the effects of the Bayh-Dole Act of 1980. *Research Policy, 30*(1), 99–119.

Neffke, F., Henning, M., and Boschma, R. 2011. How do regions diversify over time? Industry relatedness and the development of new growth paths in regions. Economic Geography 87 (3): 237–65.

Nomaler, Ö., & Verspagen, B. (2024). Related or unrelated diversification: What is smart specialization? *Structural Change and Economic Dynamics, 70, 503-515.*

Organisation for Economic Co-operation and Development (OECD). (2021). *Trade and innovation: The role of policies for innovation-driven trade*. Paris: OECD Publishing.

Pakes, A. (1986). Patents as options: Some estimates of the value of holding European patent stocks. *Econometrica, 54*(4), 755–784.

Palangkaraya, A., P. H. Jensen, and E. Webster (2017). "The effect of patents on trade," *Journal of International Economics*, 105, 1–9

Pugliese, E., Cimini, G., Patelli, A., Zaccaria, A., Pietronero, L., & Gabrielli, A. (2019). Unfolding the innovation system for the development of countries: coevolution of Science, Technology and Production. *Scientific Reports*, 9(1), 1-12.

Schartinger, D. (2023). Why firms do (not) use design rights to protect innovation: A literature review. *World Patent Information*, *73*, 102175.

Schmoch, U. (2003). Service marks as novel innovation indicator. *Research Evaluation*, 12(2), 149–156.

Schumpeter, J. A. (1934). *The theory of economic development.* Harvard University Press.

Singh, J., & Fleming, L. (2010). Lone inventors as sources of breakthroughs: Myth or reality? *Management Science, 56*(1), 41–56.

Shapiro, C. (2001). Navigating the patent thicket: Cross licenses, patent pools, and standard setting. University of Chicago Press.

Somaya, D. (2012). Patent strategy and management: An integrative review and research agenda. *Journal of Management, 38*(4), 1084–1114.

Soete, L. (1987). The impact of technological innovation on international trade patterns: the evidence reconsidered. Research policy, 16(2-4), 101-130.

Spulber, Daniel F., 2008. "Innovation and international trade in technology," *Journal of Economic Theory*, Elsevier, vol. 138(1), pages 1-20, January

Stojkoski, V., Koch, P., Coll, E., & Hidalgo, C. A. (2024). Estimating digital product trade through corporate revenue data. *Nature Communications*, *15*(1), 5262.

Thomä, J., Bizer, K., 2013. To protect or not to protect? Modes of appropriability in the small enterprise sector. Res. Policy 42 (1), 35–49.

Torrisi, S., Gambardella, A., Giuri, P., Harhoff, D., Hoisl, K., & Mariani, M. (2016). Used, blocking and sleeping patents: Empirical evidence from a large-scale inventor survey. *Research policy*, *45*(7), 1374-1385.

Verganti, R. (2006). Innovating through design. *Harvard Business Review, 84*(12), 114.

Veer, T., & Jell, F. (2012). Contributing to markets for technology? A comparison of patent filing motives of individual inventors, small companies, and universities. *Technovation, 32*(9-10), 513–522.

Vetsikas, A., & Stamboulis, Y. (2023). Does innovation activity affect trade openness? An ARDL bounds testing approach for 10 European countries. *The Journal of International Trade & Economic Development, 32*(1), 34–55.

Windrum, P., Frenken, K., & Green, L. (2017). The importance of ergonomic design in product innovation. Lessons from the development of the portable computer. *Industrial and Corporate Change*, 26(6), 953-971.

Appendix I

Table A1. Patent classifications according to WIPO.

Technology Classification
1 - Electrical machinery, apparatus, energy
2 - Audio-visual technology
3 - Telecommunications
4 - Digital communication
5 - Basic communication processes
6 - Computer technology
7 - IT methods for management
8 - Semiconductors
9 - Optics
10 - Measurement
11 - Analysis of biological materials
12 - Control
13 - Medical technology
14 - Organic fine chemistry
15 - Biotechnology
16 - Pharmaceuticals
17 - Macromolecular chemistry, polymers
18 - Food chemistry
19 - Basic materials chemistry
20 - Materials, metallurgy
21 - Surface technology, coating
22 - Micro-structural and nano-technology
23 - Chemical engineering
24 - Environmental technology
25 - Handling
26 - Machine tools
27 - Engines, pumps, turbines
28 - Textile and paper machines
29 - Other special machines
30 - Thermal processes and apparatus
31 - Mechanical elements
32 - Transport
33 - Furniture, games
34 - Other consumer goods
35 - Civil engineering

Table A2. Descending order of countries based on activity.

Rank	Exports	Patents	Trademarks	Designs
1	China	China	China	China
2	USA	Japan	USA	Germany
3	Germany	USA	Germany	USA
4	Japan	Rep. of Korea	United Kingdom	Rep. of Korea
5	Rep. of Korea	Germany	France	Spain
6	France	France	Italy	United Kingdom
7	Netherlands	Russian Federation	Türkiye	Italy
8	Italy	United Kingdom	India	France
9	United Kingdom	Switzerland	Switzerland	Switzerland
10	Canada	Netherlands	Russian Federation	Japan
11	Russian Federation	Sweden	Rep. of Korea	Türkiye
12	Mexico	Canada	Spain	India
13	Belgium	Italy	Japan	Netherlands
14	India	Finland	Australia	Poland
15	Switzerland	Austria	Brazil	Austria
16	Spain	Australia	Mexico	Australia
17	Singapore	Belgium	Netherlands	Sweden
18	Saudi Arabia	Israel	Canada	China, Hong Kong
19	Australia	Spain	Austria	Brazil
20	Malaysia	Denmark	Poland	Russian Federation
21	Thailand	India	Sweden	Denmark
22	Brazil	Poland	Argentina	Canada
23	United Arab Emirates	Singapore	Czechia	Belgium
24	Poland	Norway	China, Hong Kong	Ukraine
25	Indonesia	Ireland	Indonesia	Thailand
26	Czechia	Ukraine	Ukraine	Finland
27	Türkiye	Brazil	Portugal	Czechia
28	Austria	Luxembourg	Belgium	Indonesia
29	Sweden	China, Hong Kong SAR	Chile	Portugal
30	Ireland	Saudi Arabia	Denmark	Singapore
31	Norway	New Zealand	Singapore	Israel
32	China, Hong Kong	Czechia	Finland	New Zealand
33	Hungary	South Africa	Bulgaria	Mexico
34	South Africa	Malaysia	Romania	Greece
35	Denmark	Greece	New Zealand	Bulgaria
36	Slovakia	Türkiye	Thailand	Luxembourg
37	Philippines	Slovenia	Luxembourg	Romania
38	Finland	Romania	South Africa	Argentina
39	Chile	Mexico	Colombia	Norway
40	Romania	Hungary	Norway	South Africa
41	Argentina	Portugal	Philippines	Malaysia
42	Kazakhstan	Rep. of Moldova	Malaysia	Philippines
43	Israel	Cyprus	Morocco	Morocco
44	Portugal	Malta	Hungary	Ireland

45	Ukraine	Bulgaria	Slovakia	Hungary
46	Colombia	Belarus	Ireland	Slovakia
47	New Zealand	Latvia	Cyprus	Croatia
48	Greece	Slovakia	Belarus	Slovenia
49	Slovenia	Thailand	Israel	Saudi Arabia
50	Bulgaria	Chile	Slovenia	Estonia
51	Belarus	Croatia	United Arab Emirates	Cyprus
52	Lithuania	Lithuania	Croatia	Colombia
53	Morocco	Iceland	Serbia	Belarus
54	Pakistan	United Arab Emirates	Kazakhstan	Latvia
55	Luxembourg	Morocco	Saudi Arabia	Serbia
56	Tunisia	Argentina	Lithuania	Malta
57	Serbia	Georgia	Panama	Lithuania
58	Estonia	Estonia	Uruguay	Pakistan
59	Croatia	Serbia	Estonia	United Arab Emirates
60	Latvia	Cuba	Greece	Sri Lanka
61	Costa Rica	Bahamas	Latvia	Rep. of Moldova
62	Sri Lanka	Kazakhstan	Malta	Chile
63	Panama	Colombia	Costa Rica	Kazakhstan
64	Jordan	Mauritius	Pakistan	Iceland
65	Uruguay	Panama	Rep. of Moldova	Jordan
66	Iceland	Philippines	Armenia	Armenia
67	Malta	Uruguay	Iceland	Georgia
68	Cyprus	Jordan	Mauritius	Panama
69	Lebanon	Indonesia	Georgia	Bahamas
70	Georgia	Lebanon	Sri Lanka	Mauritius
71	Rep. of Moldova	Pakistan	Cuba	Kyrgyzstan
72	Mauritius	Costa Rica	Bahamas	Costa Rica
73	Bahamas	Sri Lanka	Jordan	Lebanon
74	Armenia	Armenia	Lebanon	Uruguay
75	Kyrgyzstan	Tunisia	Kyrgyzstan	Tunisia
76	Cuba	Kyrgyzstan	Tunisia	Cuba

Table A3. Descending order of countries based on activity by capita.

Rank	Exports	Patents	Trademarks	Designs
1	Singapore	Korea	Luxembourg	Switzerland
2	Switzerland	Japan	Switzerland	Luxembourg
3	Ireland	Luxembourg	Cyprus	Germany
4	Belgium	Switzerland	Malta	Korea
5	Netherlands	Sweden	Iceland	Austria
6	Luxembourg	Finland	Germany	Spain
7	Norway	Netherlands	Austria	Hong Kong(China)
8	United Arab Emirates	Germany	Hong Kong (China)	Denmark
9	Austria	United States	Denmark	Sweden
10	Denmark	Denmark	Singapore	Netherlands
11	Germany	Austria	Finland	Finland
12	Slovenia	France	Sweden	Malta
13	Czechia	Singapore	New Zealand	Italy
14	China, Hong Kong	Israel	Netherlands	United Kingdom
15	Iceland	Norway	Slovenia	Cyprus
16	Sweden	Ireland	Estonia	Singapore
17	Slovakia	Belgium	Czech Republic	New Zealand
18	Finland	Iceland	Bulgaria	Estonia
19	Estonia	Malta	Australia	France
20	Hungary	Canada	United Kingdom	Belgium
21	Rep. of Korea	United Kingdom	Italy	Australia
22	Lithuania	Slovenia	France	Slovenia
23	Canada	China	Portugal	Poland
24	Malta	Cyprus	Norway	Iceland
25	Australia	Bahamas	Korea	Bulgaria
26	Saudi Arabia	Australia	Belgium	China
27	Italy	Hong Kong(China)	Bahamas	Czech Republic
28	France	Italy	Latvia	Portugal
29	Latvia	Russia	Spain	Norway
30	Malaysia	New Zealand	China	Israel
31	New Zealand	Spain	Slovakia	United States
32	Israel	Rep. of Moldova	Turkey	Turkey
33	United Kingdom	Latvia	Ireland	Latvia
34	Bahamas	Poland	Lithuania	Ireland
35	Spain	Czech Republic	Croatia	Greece
36	Poland	Estonia	United States	Croatia
37	Portugal	Ukraine	Mauritius	Japan
38	Japan	Greece	Chile	Slovakia
39	Bulgaria	Lithuania	Uruguay	Ukraine
40	Cyprus	Hungary	Canada	Canada
41	USA	Croatia	Hungary	Lithuania
42	Croatia	Mauritius	Rep. of Moldova	Bahamas
43	Chile	Portugal	Poland	Hungary
44	Thailand	Saudi Arabia	Panama	Romania
45	Romania	Slovakia	Romania	Rep. of Moldova
46	Greece	Bulgaria	Serbia	Thailand

47	Kazakhstan	Georgia	Russia	Serbia
48	Belarus	Romania	Belarus	Belarus
49	Mexico	Belarus	Ukraine	Malaysia
50	Russian Federation	Malaysia	Armenia	Russia
51	Panama	Serbia	Israel	Argentina
52	Serbia	South Africa	Argentina	Morocco
53	Costa Rica	United Arab Emirates	Costa Rica	Mauritius
54	Uruguay	Panama	Japan	Brazil
55	Mauritius	Cuba	United Arab Emirates	Armenia
56	Türkiye	Chile	Mexico	South Africa
57	South Africa	Brazil	Greece	Georgia
58	Ukraine	Uruguay	Georgia	Panama
59	China	Turkey	Malaysia	United Arab Emirates
60	Tunisia	Mexico	Brazil	Saudi Arabia
61	Argentina	Kazakhstan	Morocco	Mexico
62	Rep. of Moldova	Morocco	Colombia	Philippines
63	Brazil	Armenia	Kazakhstan	Indonesia
64	Georgia	India	Thailand	India
65	Colombia	Lebanon	South Africa	Jordan
66	Jordan	Thailand	Saudi Arabia	Colombia
67	Morocco	Argentina	Philippines	Sri Lanka
68	Lebanon	Costa Rica	Indonesia	Chile
69	Armenia	Jordan	India	Uruguay
70	Philippines	Kyrgyzstan	Lebanon	Kazakhstan
71	Indonesia	Colombia	Cuba	Costa Rica
72	Sri Lanka	Tunisia	Sri Lanka	Lebanon
73	Kyrgyzstan	Sri Lanka	Jordan	Kyrgyzstan
74	India	Philippines	Kyrgyzstan	Tunisia
75	Cuba	Indonesia	Tunisia	Cuba
76	Pakistan	Pakistan	Pakistan	Pakistan

Appendix II

Survey questionnaire (Translated from the Greek Language)

1. Please note your gender:

   Male ☐ Female ☐ Other ☐ No answer ☐

2. Please note the age category to which you belong:

   18-30 years ☐
   31-40 years ☐
   41-50 years ☐
   51-60 years ☐
   61 years and over ☐

3. Please note your highest level of education:

   Compulsory education (up to middle school) ☐
   High School Graduate ☐
   Professional Specialty Graduate ☐
   Higher Education Degree ☐
   Master's degree holder ☐
   PhD holder ☐

4. Please note your place of residence **when filing your patent**:

   Eastern Macedonia and Thrace ☐
   Attica ☐
   North Aegean ☐
   Western Greece ☐
   Western Macedonia ☐
   Epirus ☐
   Thessaly ☐
   Ionian Islands ☐
   Central Macedonia ☐
   Crete ☐
   South Aegean ☐
   Peloponnese ☐
   Central Greece ☐
   Abroad ☐

5. Please indicate with which of the following organizations or companies you applied for a patent (you can choose more than one):

   The patent belongs to me and/or my team as individuals ☐
   University or Research Centre ☐
   Very small company (0 - 10 employees) ☐
   Small companies (11 - 49 employees) ☐
   Medium-sized enterprise (50 -249 employees) ☐
   Large companies (250 employees or more) ☐
   Other ☐
   ☐

6. Please note how important were the following reasons for filing a patent?
(1: not important, 2: not important, 3: important, 4: very important, 5: very important)

	1	2	3	4	5
Reputation/Creating opportunities for me as an inventor					
Commercial exploitation of the invention					
Licensing of the invention to a third party					
Sale of the patent to a third party					
Starting a new business (Spin-off/startup)					
Enhancing the profile of the business/organisation					
Protection of products from competition					
Blocking of patenting of similar inventions by third parties (Blocking)					
Central decision of the organization where I work for					

7. Please note the number of patent applications you have filed with the **European Patent Office (EPO);**

0	
1	
2	
3-5	
≥6	

8. Please note how important the following reasons were for filing a patent with the **European Patent Office (EPO):**

(1: not at all important, 2: slightly important, 3: moderately important, 4: important, 5: very important)

	1	2	3	4	5
The European market is important for my invention					
My funding agent demands it					
To receive the European Search Report					
I plan to use the unitary patent system					
I want to validate in at least 3 countries included in the EPO					
I am already in contact with interested parties for the commercial exploitation of my invention					
Prospects for commercial exploitation are increasing					
Protection of the company's products from competition because they are sold in European countries					
Blocking similar inventions being patented by others					
It is a central decision of the business/organization I work for					

(Questions in the form of 7-8 are asked for other offices as well and are omitted for the sake of brevity)

9. Please note which of the following ways you used your patent (**you can choose more than one**):

We haven't exploited it yet, but we're exploring the possibility	
Licensing of the invention to a company / organization for the generation of revenue	
Sale of the patent to a company/organisation	
Starting a new business (Spin-off/startup)	
Protecting the products of your business or the organization I work for (internal exploitation)	
I donated it	

10. In the process prior to the patent application and during the application, what were the challenges or difficulties you faced that you consider that influenced the decisions you have to make regarding the final registration:

(1: not important, 2: not important, 3: important, 4: very important, 5: very important)

	1	2	3	4	5
The cost in terms of fees in each office					
The cost in terms of the process of writing the patent and subsequent follow-up in the office					
Translation costs for submission to local offices					
Finding good legal services					
Finding experienced people in patent drafting					
The existence of a mentor or colleague who already has the experience in patenting					
The difficulty of registering in the respective local offices					
I did not deal with the application process because the business/organisation I work for was centrally involved					

Appendix III

Table C1. Reasons for filing a patent application by applicant type

Variables	Individual Inventors	Universities or Research Centers	SMEs	Large Companies
	Mean (Std. dev.)			
prestige	3,59 (1,64)	3,41 (1,41)	3,02 (1,52)	3,02 (1,47)
commercial_exploitation	4,24 1,21	3,95 (1,24)	4,44 (0,71)	4,08 (0,96)
licensing	3,52 (1,43)	3,48 (1,39)	3,53 (1,44)	2,85 (1,45)
selling	3,52 (1,45)	3,48 (1,33)	3,33 (1,40)	2,47 (1,31)
spinoff/startup	3,28 (1,51)	2,96 (1,49)	2,87 (1,63)	1,88 (1,21)
company_image	3,21 (1,66)	3,14 (1,47)	3,91 (1,25)	4,23 (0,91)
protection	4,10 (1,40)	2,96 (1,63)	4,02 (1,27)	4,43 (0,91)
blocking	4,24 (1,27)	3,63 (1,56)	3,85 (1,18)	4,38 (0,98)
central_decision	1,83 (1,51)	2,23 (1,33)	2,76 (1,55)	3,80 (1,12)
Obs	29	56	55	60

Note: Total number of inventors: Obs 200. 5-point Likert scale: 1: Not at all Important, 2: Slightly Important, 3: Moderately Important, 4: Important, 5: Very Important

Table C2. Challenges in the pre-application process and during the application process that influenced the decisions inventor had to make.

Variables	Individual Inventors	Universities or Research Centers	SME	Large Companies
		Mean (Std. dev.)		
fees	3,55 (1,55)	3,36 (1,35)	3,55 (1,33)	2,18 (1,40)
process_cost	3,45 (1,59)	3,18 (1,35)	3,49 (1,23)	2,28 (1,42)
translation_cost	2,59 (1,70)	2,66 (1,42)	2,75 (1,40)	2,00 (1,26)
attorney	3,24 (1,66)	3,61 (1,37)	3,82 (1,29)	2,53 (1,50)
writing	3,10 (1,76)	3,02 (1,48)	3,69 (1,32)	2,55 (1,57)
mentor	2,31 (1,69)	2,73 (1,36)	2,89 (1,44)	2,52 (1,53)
registration_difficulties	2,62 (1,59)	2,84 (1,46)	2,65 (1,24)	2,05 (1,24)
central_decision_applicant	1,76 (1,43)	2,18 (1,59)	2,15 (1,54)	3,60 (1,68)
Obs	29	56	55	60

Note: Total number of inventors: Obs 200. 5-point Likert scale: 1: Not at all Important, 2: Slightly Important, 3: Moderately Important, 4: Important, 5: Very Important

Previous Papers in this Series

206. **Athanasia Chalari,** Transitioning from European Citizenship towards Immigration Identities after Brexit (the case of Greek diaspora in the UK), March 2025

205. **Manussos Marangudakis, Theodore Chadjipadelis, Maria Zampoka and Christos Kouroutzas**, The Anti-vaccination Movement in Greece, February 2025

204. **Alexandros Kontonikas and Emmanouil Pyrgiotakis**, A comprehensive analysis of transactions in the Greek residential property market, January 2025

203. **Athanasia Chalari**, Cultural identities among Greek Diaspora in the UK, December 2024

202. **Revecca Pedi and Iannis Konstantinidis**, Small States Navigating Shelters and Political Shocks: The Republic of Cyprus Between EU Sanctions and Multivector Foreign Policy, November 2024

201. **Theopisti Stylianou-Lambert and Antigone Heraclidou,** Re-framing Photographic Archives: archaeology and colonial Cyprus, October 2024

200. **Konstantinos Mavrigiannakis, Stelios Sakkas,** EU Sanctions on Russia and Implications for a Small Open Economy: the case of Cyprus, September 2024

199. **Emmanuel C Mamatzakis,** High Greek Banks Net Interest Margins, Recapitalisations and Competitions, August 2024

198. **George Alogoskoufis,** Before and After the Political Transition of 1974 Institutions, Politics, and the Economy of Post-War Greece, July 2024

197. **Emmanouil Pikoulis, Ioannis Vardakastanis, EvikaKaramagioli, Evangelia Kallimani and Eleni Panagiota Stoupa**, Inclusion of People with Disabilities in Disaster Risk Management after the COVID19 Pandemic: an exploratory study in the Greek context, June 2024

196. **Katerina Sideri and Eleni Chanania,** Vaccination mandates for hesitant healthcare workers and the science advice system in Greece: a hermeneutic approach to public policy, May 2024

195. **Spyros Economides,** Konstantinos Karamanlis and Leadership in Foreign Policy, April 2024

194. **George Economides, Giota Koliousi, Natasha Miaouli, and Apostolis Philippopoulos**, From debt arithmetic to fiscal sustainability and fiscal rules: taking stock and policy lessons, March 2024

193. **Sofia Anyfantaki, Yannis Caloghirou, Konstantinos Dellis, Aikaterini Karadimitropoulou, and Filippos Petroulakis**, The Need for an Industrial Policy for long-term Growth, February 2024