EUROPE'S AMBITION FOR EXPATRIATE TAXATION

AN EMPIRICAL ANALYSIS ON EFFECTS OF EXPATRIATE INCOME TAX INCENTIVE REGIMES ON INNOVATION OF EUROPEAN STATES

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Europe's Ambition for Expatriate Taxation: An Empirical Analysis on Effects of Expatriate Income Tax Incentive Regimes on Innovation of European States

Abstract:

This thesis investigates the evolution and effectiveness of expatriate tax incentive regimes in Europe, with a focus on their impact on innovation and the migration of skilled workers. Since the Netherlands introduced the first such policy in 1964, significant amendments across European countries have aimed to better target high-skilled talent essential for innovation. Through a mixed-methods approach combining qualitative categorization and quantitative analysis of data from 2016 to 2023, this research evaluates these regimes across 38 European nations. It explores how features like after-tax salary and salary thresholds influence innovation outputs, finding that while higher after-tax salaries typically promote innovation, stringent thresholds can diminish these benefits. Further analysis indicates a negative correlation between the after-tax salaries of the top 1% of earners and innovation, suggesting that increasing the salary threshold to exclude this group or directly reducing their after-tax benefits could be advantageous. This study enriches the tax policy literature by offering insights into the design and outcomes of tax incentive regimes, proposing refined strategies to enhance Europe's competitive edge in attracting global talent.

Keywords:

Expatriate Income Tax, Tax Incentive, Innovation, International Workforce

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1. Introduction

In 1964, the Netherlands was the first country in Europe to introduce a tax incentive policy for expatriate workers. By allowing employers to offer up to 30% of an employee's gross salary tax-free, it aims to cover the extraterritorial costs[1] (ETC) that employees incur when they work outside their country of origin. This incentive, known as the 30% facility[2], was part of the Dutch government's strategic efforts to attract highly skilled expatriates from across the globe. Introduced to support the Netherlands in attracting international talent with scarce expertise essential for innovation, the scheme helps enhance the competitiveness of the Dutch business climate (Evaluatie 30%-regeling[3], 2016). Exactly 60 years later, drastic amendments[4] to the 30% facility were enacted in January 2024, marking it the second time in the past 5 years that the benefits of the tax incentive regime have been reduced. Under the new regime, the reimbursement will no longer be a maximum of 30% of gross salary over the entire validity[5] of the decision and a cap[6] of €69,900 was added to the total tax-free reimbursement. These amendments represent the most substantial change to the regime since the introduction of minimum salary requirements[7] in 2012.

In fact, the Netherlands is not the only country in Europe that has made significant amendments to its tax incentive regimes in recent years. There is a dynamic interplay between tax policy and entrepreneurial incentives, showcasing how shifts in tax regimes influence the structural conditions for high-impact entrepreneurship (Elert et al., 2023). Belgium added the minimum gross annual income requirements as a provision to its

[1] These include costs related to the move itself, higher living expenses in the host country, and expenses for maintaining connections with their home country, among others.
[2] Dutch Wage Tax Act 1964. See details of the regime in chapter 3.
[3] In 2017 the Ministry of Finance of the Netherlands had the 30% facility evaluated by an independent consultancy, original languange in Dutch: See https://open.overheid.nl/documenten/ronl-844cbaf9b3266ed4801810c4a2991605d4ac5bb1/pdf (Accessed in March, 2024)
[4] On 26 October 2023, during the discussion of the 2024 Tax Plan, the Dutch House of Representatives adopted two amendments for a further reduction in the 30%-facility. See details of the amendaments in chapter 3.
[5] The maximum of the time that one can benefit from the tax incentive regimes.
[6] Known as the Balkenende norm, which means that the ruling can only be applied to a maximum gross salary of €233,000.
[7] Minimum gross salary requirements of €35,048 in 2012 or €26,605 for people who are young than 30 and have a master's degree.

Special Expatriate Tax Regime[8] in 2022 with a transitional phase of two years. From Jan 2024 on, only those[9] earning over €75,000 gross salary per year can qualify for the special tax regime, a figure that exceeds most expatriates' income. Portugal drew the ultimate vote on the government's State budget Proposal in 2023 to discontinue its Non-Habitual Resident (NHR) regime[10] in January 2024.

The changes in tax incentive regimes in Europe illuminate the complex dynamics at play among tax policies, migration of skilled workers, and innovation (OECD Tax Policy Study, 2011). At the economic and political juxtaposition, as we are today, it is important to underscore the critical role of nuanced, well-designed tax incentives. In this research, we aim to accomplish that by comprehensively reviewing the details of tax incentive regimes in Europe, connecting the past, presence, and future of these regimes, understanding the effects of the regimes on European states' innovation capability, and framing policy suggestions on fostering an environment conducive to innovative growth and the attraction of key talents.

Many countries in Europe have a long history of active tax incentive regimes to attract immigration of highly skilled labor (OECD Tax Policy Study, 2011; Halkyard, 2013). Nevertheless, current studies fail to provide a comprehensive benchmark of tax incentive regimes in Europe, which is pivotal in understanding the effectiveness of these regimes. Existing literature highlights the impact of tax incentive regimes on economic growth and labor markets (Wolff, 2005; Jacob and Vossebürger, 2022; Zhao et al., 2024). However, in the examination of measuring the effectiveness of tax incentive regimes on innovation, existing research failed to provide empirical support. We add to the tax policy study literature that studies the design, execution, and effects of tax incentive regimes in Europe. Meanwhile, we contribute to the existing literature focused on the effects of tax incentives by investigating the relationship between tax incentive regimes and European countries' innovation capability.

[8] See https://www.politico.eu/article/brussels-belgium-parliament-tax-expats-new-regime/ (Accessed in April, 2024).
[9] The exception is people who are researchers, for whom the threshold does not apply.
[10] The Non-Habitual Residence (NHR) regime, which came into effect in Portugal in 2009, essentially provides a relieved tax rate to eligible individuals for a duration of 10 years. See details of the regime in chapter 3.

Firstly, we conduct a qualitative analysis to compare expatriate tax incentive regimes in Europe. Drawing from the OECD Tax Policy Study (2011), we summarize the regimes into three types according to the target group and entry threshold: key employee tax incentive regime, universal expatriate tax incentive regime, and occupation-specific tax incentive regime. Through an analysis of their current implementation, historical modifications, and fundamental structures, we evaluated their role in attracting highly skilled labor and discussed potential development trajectories.

Subsequently, we developed a quantitative framework to assess the effects of these regimes in enhancing innovation output. Our empirical investigation spanned 38 European nations from 2016 to 2023, utilizing a dataset categorized into three groups: innovation metrics from the European Innovation Scoreboard (EIS), demographic and structural details of expatriate tax incentives, and national income tax information.

Our comprehensive dataset enables us to conduct progressive tests. The preliminary phase of our analysis tested the basic impact of the existence of tax incentive regimes on national innovation levels, revealing that their mere presence was insufficient for a statistically significant effect. We then explored more granular aspects of these regimes by examining specific characteristics such as after-tax salary, regime validity, and salary threshold requirements. Further analysis investigates if and how the characteristics of these incentives influence innovation outputs. This regression generates a conflict that although a higher after-tax salary typically enhances a country's innovation output, imposing a salary threshold might reverse these benefits. Thus, to refine our understanding, we conducted a deep-dive analysis to break down the after-tax salary for further testing. We involve four distinct salary profiles for workers in our tax model. These groups include European median salary workers, the top 10 percent of salary workers, the top 1 percent of salary workers, and a group we refer to as executives. Our regression results suggest that the countries aiming to enhance innovation should either raise the salary threshold to match executives' income level or reduce the tax benefits for the top 1% earners. Although the after-tax salary of the 50th percentile workers may be adversely affected, our analysis confirms the importance of focusing on high-income workers.

2. Literature Review

In this literature review, we examine existing studies on the impact of Europe's diverse income tax policies on economic choices, labor markets, and innovation. We review methodologies for measuring innovation, emphasizing the role of tax policies and investments. Additionally, we highlight the European Innovation Scoreboard (EIS) as a tool for assessing innovation performance across European countries, differentiating between inputs and outputs.

2.1. Income Tax and Innovation

European countries employ diverse income tax policies, significantly impacting economic decisions and labor markets. Wolff (2005) reveals the complexity of measuring tax burdens, highlighting the variability of effective tax rates across the EU. The study underscores a stark difference between the EU-15 and the new member states (NMS), with the former generally imposing higher taxes on consumption, labor, and capital. Notably, effective tax rates on labor in the NMS are on average 10 percentage points lower, and 5 percentage points lower on capital and consumption, compared to the EU-15. This disparity suggests a difference in the attractiveness of regions for both investment and skilled labor migration. Wolff's methodology, grounded in the work of Mendoza, Razin, and Tesar (1994), shows that statutory tax rates may not fully capture the economic distortions caused by taxation. Wolff underscores the critical role of tax policy in shaping economic landscapes, with implications for labor mobility, investment decisions, and overall economic growth within the European Union. Cnossen (2001) points out that tax systems and policies pervasively influence economic activities. The EU has a significantly higher tax burden than the U.S., with the combined tax burden of the member states reaching 42.5 percent of the EU’s GDP compared with a U.S. tax burden of 29.4 percent. Moreover, the tax burden on labor and consumption is 36 percent of the EU’s GDP, compared to 20 percent in the U.S.

The intricate relationship between tax relief regimes and economic growth within Europe and beyond offers a rich tapestry for analysis. Wolff (2005) underscores the significant variation in effective tax rates within the European Union, highlighting how

such disparities could influence labor mobility and investment, both pivotal to fostering innovation. This foundational insight sets the stage for a deeper exploration of tax policy's role in driving innovation. In parallel, Xu and Zhao (2021) provide a critical examination of China's evolving expatriate tax policies. While outside the European scope, their analysis demonstrates how strategic tax planning can attract foreign expertise crucial for innovation, without compromising on tax fairness.

Tang and Liu (2024) round out the discussion by assessing the specific influence of R&D tax incentive policy and entrepreneurial activities. Their work highlights the importance of intellectual property rights (IPR) protection together with incentive policy implementation. Governments should also prioritize robust IPR protection to achieve better innovation outputs.

The empirical effects of personal income tax policies on innovation and economic growth have been extensively studied by researchers across the world. Zhao et al. (2024) explore the unintended consequences of tax incentives on firms' human capital composition in China, providing evidence that VAT credit refund policies led to an increase in R&D employee ratios within treated firms. The literature underscores the significant role that well-designed tax incentives play in shaping the human capital composition within firms and fostering an environment conducive to innovation. This suggests that alleviating internal financing constraints through tax incentives can enable firms to invest more in human capital and innovation activities, enhancing their innovation capabilities. Zhang, Huang, and Wei (2024) delve into the macro tax burden's influence on China's economic growth. Their analysis, spanning 2010 to 2022 across 31 Chinese provinces, utilizes fixed and random effect models, robust test methods, system GMM, and instrumental variables, alongside subregional heterogeneity analysis. They discover that smaller-caliber macro tax burdens positively affect economic growth, contrasting with the negative impact of larger-caliber burdens. Complementary to the research by Zhao et al. (2024), this study finds that VAT and CIT burdens have a moderate, positive influence, whereas the burdens of total non-tax income and individual income tax negatively impact growth. The paper uniquely contributes by highlighting regional heterogeneities in the effects of tax burdens on economic growth, offering nuanced policy recommendations for China's tax system optimization.

In a more European context, Jacob and Vossebürger (2022) investigate the impact of personal income taxes (PIT) on corporate investment across 27 European countries, revealing that PIT significantly diminishes investment, with effects comparable to corporate taxes. They identify increased labor costs and reduced employee consumption as key mechanisms driving this relationship. The study's rigorous empirical approach, utilizing data on private firms, provides robust evidence that the adverse effect of PIT on investment weakens at higher income levels. Obst, Onaran, and Nikolaidi (2017) investigate the combined effects of income distribution and fiscal policy on Europe's economic growth, investment, and budget balance using a novel multi-country post-Kaleckian model. Their empirical analysis across EU15 countries reveals that a mix of pro-labor wage policies, expansionary fiscal policy, and progressive taxation significantly boosts GDP. The study highlights the synergistic potential of these policies to drive equitable and sustainable growth, suggesting a comprehensive approach to fiscal and wage policy is crucial for enhancing Europe's economic performance.

The relationship between income tax policies and innovation is intricately explored through diverse methodologies. Gordon (1998) assesses how high personal tax rates potentially hinder entrepreneurship, concluding that while high taxes may deter innovation, targeted tax incentives can offset these negative effects, thereby fostering an innovative ecosystem. They employ a broad analytical framework to dissect the direct and indirect impacts of personal tax rates on various components of innovation, emphasizing the role of tax policy design in mitigating the adverse effects of high taxation on entrepreneurial activities.

In contrast, the analysis by Halkyard (2013) focuses on tax incentives designed to encourage the migration of skilled labor. Utilizing a comprehensive review of existing tax incentives across multiple jurisdictions, they examine the effectiveness, efficiency, fairness, and transparency of these incentives. Through a methodological lens that encompasses both qualitative and quantitative assessments, they reveal the nuanced outcomes of such policies in attracting and retaining the highly skilled workforce essential for innovation.

Finally, Elert et al. (2023) delves into the evolution of owner-entrepreneurs' taxation over a 160-year period, employing the King and Fullerton method to calculate the

marginal effective tax rate (METR) across different tax regimes and financing sources. This longitudinal study highlights the dynamic interplay between tax policy and entrepreneurial incentives, showcasing how shifts in tax regimes influence the structural conditions for high-impact entrepreneurship. Together, these studies illuminate the complex dynamics at play between tax policies and innovation, underscoring the critical role of nuanced, well-designed tax incentives in fostering an environment conducive to innovative growth and the attraction of key talents.

2.2. Overview of Innovation Measurement Research

There are various methodologies employed across the literature to dissect the multifaceted nature of innovation.

The mainstream to measure innovation is based on micro-data, such as firm-level patent data, design data, and companies' R&D expenditures. Pessoa (2007) and Westmore (2013) employ panel models to explore the determinants of R&D expenditures, patents, and their relationship with economic growth, underscoring the role of tax incentives and public support in nurturing innovation activities within the private sector. Comparatively, Petrariu et al. (2013), utilize panel models to underscore the vital role of R&D investment as the mainstay of innovation, portraying innovation as a catch-up process in relation to economic growth rates. Studies by Norris et al. (2010) and Czarnitzki & Toivanen (2013) adopt the number of patents granted or R&D investments at the firm level to investigate the innovation process within specific industries or firms.

Macro-data approach contributes to the exploration of innovation measurement methodologies within different countries. The study by Balsalobre-Lorente et al. (2021) dissects the influence of tax contributions on fostering innovation, with a particular focus on the role of corporate taxes alongside governance quality. This approach adeptly captures the dynamic interactions between fiscal policies, institutional quality, and innovation, addressing potential endogeneity concerns to offer robust insights into the influence of macroeconomic policies on the innovation landscape.

Compared with individual macro indicators, some integrated indexes provide a more systematic assessment of a country's level of innovation. At the international level, Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO)

co-published the Global Innovation Index (GII)[11] to help developing economies catch technology by revealing the comprehensive innovation performance of countries since 2007. While at the regional level, the European Commission also created the European Innovation Scoreboard (EIS)[12], to measure the innovation activity in the member countries. Additionally, there are even countries that study their own innovation indices, for example, China published the China Innovation Index (CII)[13] to better suit the conditions in developing countries. To better allocate and identify the policy effects within European countries, we will choose the European Innovation Scoreboard (EIS) for measurement.

2.3. European Innovation Scoreboard

In the landscape of innovation assessment, the European Innovation Scoreboard (EIS) stands as a critical instrument for gauging the innovation performance of European countries. Introduced by the European Commission, the EIS adopts a structured approach to quantify innovation by distinguishing between inputs that fuel the innovation process and outputs that emerge from it. By focusing on the categorization of innovation indicators into inputs and outputs, we draw upon the insights provided by Onea (2020) and the European Commission's EIS methodology report (2020).

(1) Innovation Inputs

Innovation inputs are foundational elements that provide the necessary resources and conditions for innovation activities to take place. These inputs are further segmented into Framework Conditions and Investments.

Framework Conditions encapsulate the broader socio-economic environment that can either foster or hinder innovation activities. This category includes factors such as the quality of research systems, the level of business-academic collaboration, and the innovation-friendly environment that supports creative endeavors. As highlighted in the EIS methodology report (2020), these conditions lay the groundwork for innovation by

[11] https://www.wipo.int/global_innovation_index/en/
[12] https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en
[13]https://baike.baidu.com/item/%E4%B8%AD%E5%9B%BD%E5%88%9B%E6%96%B0%E6%8C%87%E6%95%B0/2599693

ensuring that the necessary infrastructure, policies, and cultural attitudes towards innovation are in place.

Investments in innovation comprise financial resources allocated towards research and development (R&D) and other innovation-related activities within firms. Onea (2020) emphasizes the significance of firm investments in the innovation process, noting a positive correlation between investment levels and the Summary Innovation Index (SII). This relationship underscores the critical role of financial commitment in driving innovation outcomes.

(2) Innovation Outputs

On the other side of the innovation spectrum are outputs, which are tangible results and impacts of innovation activities. These outputs are categorized into Innovation Activities and Impacts.

Innovation Activities refer to the concrete actions undertaken by firms and institutions to develop new products, services, or processes. This category captures the direct efforts made towards innovation, ranging from R&D projects to the implementation of new business models and strategies. The European Commission's EIS methodology report (2020) details various indicators within this category, including patent applications and R&D expenditure, as measures of innovation activity.

The Impacts of innovation represent the broader effects that innovation activities have on the economy and society. These effects include employment growth in knowledge-intensive sectors, sales of innovative products, and contributions to environmental sustainability. Onea (2020) points out the employment impact as a crucial indicator, illustrating how innovation leads to job creation and economic development. The positive association between innovation activities and their subsequent impacts further validates the effectiveness of innovation inputs in yielding substantial outputs.

3. Expatriate Tax Incentive Regimes Review

This section provides a comprehensive overview of tax incentive regimes in Europe, tracing their evolution from the past through the present and into the future. Additionally, it discusses the attractiveness of incentive elements to establish a theoretical basis for assessing the effectiveness of these regimes.

3.1. A Comparative Study of Expatriate Tax Incentive Regimes in Europe

3.1.1. What are expatriate tax incentive regimes?

Many countries in Europe have a long history of active tax incentive regimes[14] to attract immigration of highly skilled labor. The regimes usually offer direct income tax relief for expatriates[15] to compensate for the costs of relocating to a new country. Moreover, Halkyard (2013) suggests that most of the incentives provide exemptions for foreign source income and, in some cases, offshore capital gains. OECD Tax Policy Study (2011) compared tax concession policies for high-skilled workers in 16 OECD countries and summarized two broad categories – a specific concession[16] but with broad targeting provisions and a generic concession with narrow targeting provisions.

Building on the research by the OECD Tax Policy Study (2011) and Halkyard (2013), this review draws focus on European tax incentive regimes. We examine all European countries' income tax regimes comprehensively and compare all existing income tax incentive policies in the EU, namely, those of Austria, Belgium, Denmark, Finland, Germany, France, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Spain, and Sweden.

[14] A "tax incentive regime" refers to a set of policies or specific provisions within a country's tax code designed to encourage the migration of workers or economic activities through tax relief, exemptions, or reimbursement.
[15] An "expatriate" (often shortened to "expat") refers to a person who lives outside their native country. Expatriates can be anyone from corporate employees on international assignments, to retirees living abroad, or individuals who have chosen to live overseas for cultural, economic, or personal reasons. In our context, expatriates are those who are currently working in a country which they have no previous economic and geographic ties to.
[16] Similar to "Tax incentive". See "tax incentive regime" above.

Differentiating from the OECD Tax Policy Study (2011), we categorize the policies into three main categories (see Figure 3-1) according to the target group and entry threshold: key employee tax incentive regime, universal expatriate tax incentive regime, and occupation-specific tax incentive regime. In this study, we mainly carry out a comparative review of the first two categories of the regimes.

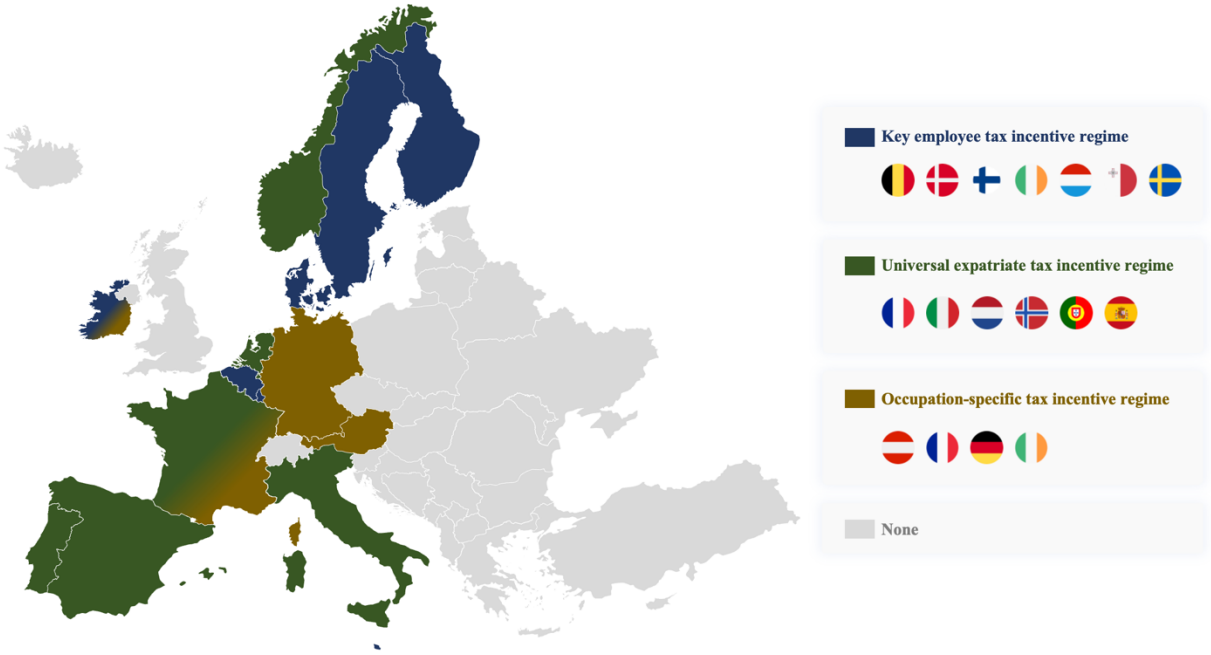


Figure 3-1: Expatriate Tax Incentive Regimes in Europe

In countries that enact the first type of policy, the key employee refers to foreign citizens carrying out particularly qualified tasks, especially those who are highly remunerated. While the exact tasks deemed qualified are often decided by relevant authorities case by case, the remuneration threshold is a much clearer qualification. However, the threshold is specifically designed to attract high-income experts, executives, and special assignees, making this category of tax incentive regime out of reach for most skilled labor. In Denmark[17], one must receive a minimum monthly salary[18] of DKK 75,100 in 2024 after the deduction of labor market supplementary pension fund (ATP) contributions. In 2023, this is equivalent to an annual salary of

[17] According to conditions for highly paid employees of Denmark's Expat Scheme for Researchers and Key Employees: see https://skat.dk/en-us/businesses/employees-and-pay/non-danish-labour/tax-scheme-for-researchers (Accessed in April, 2024).
[18] Assuming the employee is not a researcher, for whom the minimum salary requiremeny does not apply.

113,100 EUR, significantly surpassing the 99th percentile salary level[19] in the EU, which stands at 77,675 EUR.

Table 9-1 in the appendix summarizes all of the key employee tax incentive regimes in Europe. When comparing the regime details, certain qualifying requirements such as residence history, nationality, and employer establishment are omitted from the benchmark for a clearer comparison of quantifiable measurements such as salary requirements.

Universal expatriate tax incentive regimes, in contrast, target a broader pool of skilled labor. By not imposing specific remuneration requirements, or aligning them with the local median salary[20], these regimes benefit skilled workers with different salary levels who are the foundation of economic growth and innovation. (see Table 9-2 in the appendix)

In addition, some European countries introduced tax incentive regimes that are specifically designed to benefit some occupations such as scientists, researchers, and artists. While the other two categories of tax incentive regimes target a wide range of talent in efforts to attract high-skilled immigrants, occupation-specific tax incentive regimes have a more focused aim. Austria offers a tax allowance[21] designed to attract foreign scientists and researchers to its academic and research institutions, supporting its reputation as a center for academic excellence and research development. (see Table 3-1)

[19] Distribution of income by quantiles - EU-SILC and ECHP surveys [ilc_di01__custom_10921291] : see https://ec.europa.eu/eurostat/databrowser/view/ilc_di01__custom_10921291/default/table (Accessed in April, 2024)

[20] In the Netherlands, one needs to have a special expertise that is not or hardly found on the Dutch labor market. The expertise is deemed by the salary level: (1) One has that expertise if the salary, not including the tax-free allowance in the Netherlands, is more than €46,107 in 2024; (2) One is younger than 30, and has a Dutch academic master's degree and the salary, not including the tax-free allowance in the Netherlands, is more than €35,048 in 2024. See https://www.belastingdienst.nl/wps/wcm/connect/en/individuals/content/coming-to-work-in-the-netherlands-30-percent-facility (Accessed in April, 2024)

[21] A "Tax allowance" refers to the percentage of gross income that could be exempted from the taxable income when calculating income taxes.

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	Validity	Qualification requirements	
Austria[22] - Tax allowance for foreign scientists and researchers	Qualified individuals can retain the previous foreign tax burden (but at least 15%) on foreign income. An additional tax allowance of 30 percent of taxable income from scientific and research activities	5 years	-	Jan 2017: Added the additional tax allowance of 30 percent of taxable income from scientific and research activities

Table 3-1: Austria's Tax allowance for foreign scientists and researchers

France, Germany, and Ireland adopt occupation-specific tax incentive regimes that focus on artists. (See Table 3-2) Although these regimes do not specifically target foreign artists, they complement broader tax incentives and help European countries boost their capabilities not only in innovation but also in culture and art.

Country/ Regime name	Starting time	Target group	Tax incentive regime details
France[23] - Intermittent du spectacle	1985	Performing artists, technicians	Provides adjusted social charges, easier access to unemployment benefits, recognizing irregular employment patterns. Tax is assessed on an individual basis
Germany[24] -Künstler sozialkasse (KSK)	1983	Freelance artists, publicists	Subsidizes half of the health insurance and pension contributions, effectively lowering the tax burden. Requires income from artistic work.
Ireland[25] - Artists' Exemption	1969	Artists	Income from the sale of original creative works exempt from income tax

[22] See https://wts.com/at-en/publishing-article/20190207_zuzugsbeguenstigung~publishing-article?language=en (Accessed in April, 2024)
[23] See https://www.francetravail.fr/spectacle/spectacle--intermittents.html (Accessed in April, 2024)
[24] See https://www.kuenstlersozialkasse.de/ (Accessed in April, 2024)
[25] See https://www.revenue.ie/en/personal-tax-credits-reliefs-and-exemptions/income-and-employment/artists-exemption/index.aspx (Accessed in April, 2024)

			if deemed to have cultural or artistic merit. No cap on exemption until 2015.

Table 3-2: Other occupation-specific tax incentive regimes

3.1.2. Why did the regimes come into inception?

To understand the evolution and future trajectory of these tax incentive regimes, it's essential to investigate the rationale behind their establishment. The introduction of tax incentives for expatriates is generally backed by two main rationales - to remove taxation barriers for migration decisions and to attract and/or retain skilled workers.

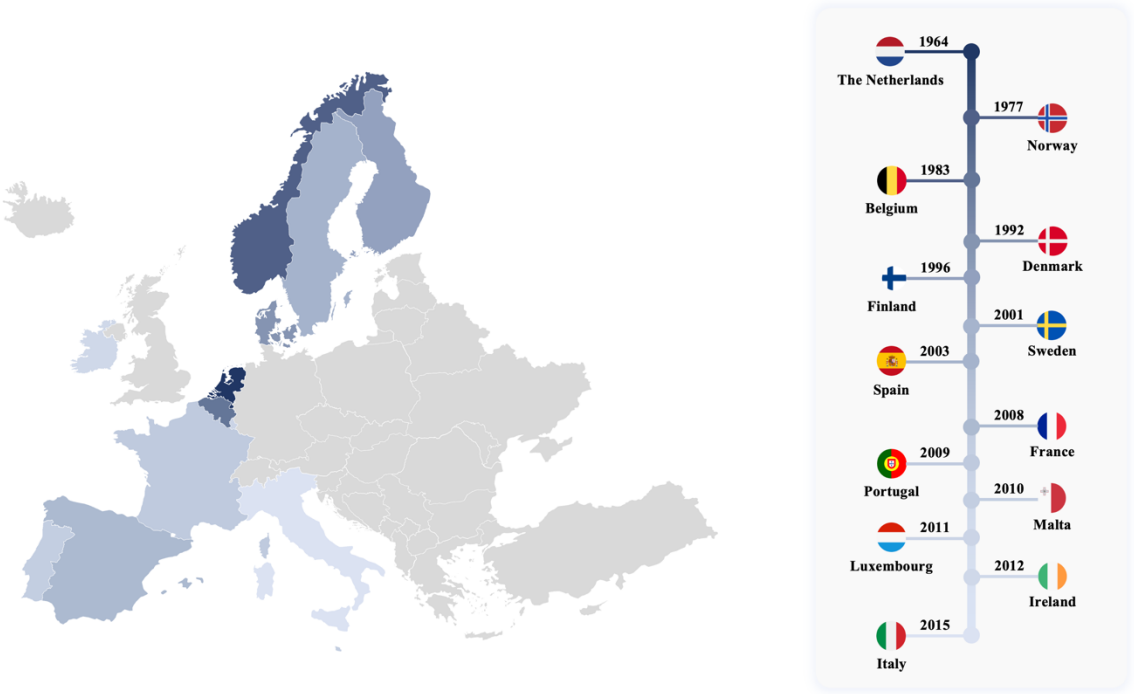


Figure 3-2: The year of inception of expatriate tax incentive regimes in Europe

Moreover, Halkyard (2013) discovered that other motives, such as equality considerations and tax competition, should not be overlooked. In 1964, the Netherlands became the first country in Europe to introduce a tax incentive regime for expatriates, the 30% facility, as part of the Dutch government's efforts to attract qualified expats from all over the world. The 30% ruling is created under the context of the Dutch Wage Tax Act 1964. The rationale of this tax facility is to reimburse certain expats for the occurred extraterritorial expenses (e.g., moving costs, travel costs, accommodation costs) when they move to the Netherlands. The tax incentive regime ensures that

expatriates aren't unfairly penalized for the additional financial burdens associated with their relocation, promoting equality compared to local employees.

In 2020, Sweden announced that it would amend its decade-long tax incentive regime by extending the validity from 3 years to 5 years, an effort[26] to compete with other Nordic countries like Denmark. As we have previously reviewed, many other countries in the Nordics and Benelux have similar tax incentive regimes targeting key employees like that of Sweden.

3.1.3. Where are the regimes going in the future?

When comparing tax incentive regimes across Europe, a trend of continuous amendments to increase the attractiveness of policy was observed in many countries. Sweden's tax incentive regime for expatriates was introduced as a strategic measure to bolster the country's economic strength and improve its research capabilities. Initially launched in the 1980s, the policy was primarily designed to attract and retain researchers[27]. This early focus was aimed at enhancing Sweden's research landscape and fostering innovation. In 2001, the scope of the policy expanded to include a broader range of careers[28], reflecting a more inclusive approach to economic growth. Despite this expansion, the policy lacked a clear threshold requirement and qualification for key employees, leading to case-by-case assessments by officers. It wasn't until 2012 that a defined threshold requirement for salary was introduced, offering an alternative to the assessment process by providing a more standardized framework for evaluating tax relief applications[29]. The tax scheme, which was first for a period of 36 months, was extended to a general regime of 60 months on 1 January 2021 and then to 84 months on 1 January 2024. According to Håkan Gustavsson, a tax lawyer at Forskarskattenämnden, authorities in Sweden are discussing lowering the salary threshold requirement at the moment to allow more foreign employees to qualify.

[26] According to Håkan Gustavsson, Tax lawyer at Forskarskattenämnden, during our interview in March 2024
[27] According to Forskarskattenämnden: see https://forskarskattenamnden.se/andra-sprak/taxation-of-research-workers-board/about-us (Accessed on April, 2024)
[28] Note 27 above, citing Forskarskattenämnden.
[29] Note 27 above, citing Forskarskattenämnden.

However, we also observe that some countries are downsizing the scale of their regimes, reducing the incentive package for existing beneficiaries or making it more difficult for expatriates to qualify. A notable example is the Netherlands' 30% facility, a tax incentive for expatriates, which has been modified to decrease its duration from eight years to five years in 2019[30]. The regime was further amended in 2024 with the introduction of a cap on tax-free reimbursement, and the fixed 30% tax-free portion of the salary was replaced by a tiered rate that would gradually decrease over the intended five years[31]. Belgium adopted a divergent approach by introducing a key provision to its tax regime in 2022, setting a minimum gross annual income requirement. This amendment shifted the category of the tax incentive regime from a universal expatriate tax incentive regime to a key employee tax incentive regime. Effective from January 2024, only those with a gross annual income exceeding €75,000 will be eligible for the special tax regime[32], a figure that's out of reach for many expatriates.

Our comparative study on European tax incentive regimes shows a great disparity in the countries' attitudes towards attracting high-skilled expatriates. While countries like France, Denmark, and Sweden seek to gain tax competitiveness by prolonging the validity of their regimes, many other countries like the Netherlands and Portugal are cutting down the tax incentives and even discontinuing the regime. That raises the question – Where are the regimes going in the future?

Despite the current political complications and a resurgence of conservatism in Europe, the primary factor driving policy decisions is whether they benefit the economy or enhance the country's capability in labor competition, innovation, and cultural status.

In the context of expatriate tax incentive regimes, the most common expectation is that these concessional policies would help a nation attract immigrant workers. Vedder (2005) considers taxation a significant motivator for migration. Examining domestic

[30] Announced by the Ministry of Finance of the Netherlands: See https://www.government.nl/topics/income-tax/shortening-30-percent-ruling (Accessed in March, 2024)
[31] According to the Dutch Tax Administration: "From 1 January 2024, you are only entitled to a maximum compensation of 30% of your salary for the first 20 months of the term of your decision. The second twenty months you are entitled to 20%. And the third twenty months to 10%."
[32] The salary requirement provision was added to the regime in January 2022. The requirement was officially made mandatory in January 2024 after phasing out existing beneficiaries. See https://finance.belgium.be/en/private-individuals/international/working-in%20belgium-or-abroad/inpatriate-taxpayers-researchers (Accessed in April, 2024)

migration trends within the U.S., he found that tax, together with opportunities for professional growth and career advancement, plays a critical role in influencing people's decisions to relocate. In contrast, Liebig and Sousa-Poza (2005) find that the effect of tax on migration is not significant using micro-data for 1999-2001 from the Swiss Household Panel. Feld (2000) also failed to find evidence to prove tax's effect on migration decisions.

While the effect of tax on migration is marginal suggested by multiple literature, further research indicates that the effect of tax is stronger for high-skilled workers. Liebig, Puhani, and Sousa-Poza (2007) further break down the sample into 27 subgroups differentiated by age, education, and residence status. They discover that tax rate has a significant impact on migration decisions, especially for younger, highly educated workers and college graduates. Wagner (2000) also finds that the effect of gross income and tax difference was more significant for highly educated workers. In a survey by Dialogic[33] as part of an evaluation of the Dutch 30% facility, approximately 90% of the scheme users appear to be highly educated[34]. However, Halkyard (2013) raises major pitfalls of the current tax incentive regimes, pointing out that a tax exemption for expatriates discriminates against domestic workers having the same skills.

Given the extensive track record of the tax incentive regimes in some European countries, several studies and analyses have been conducted to assess its efficacy. Kleven, Landais, Saez, and Schultz (2013) examine the number of foreigners paid above the eligibility threshold in Denmark. They find that the Danish regime had a very large effect on increasing the number of high-income expatriates in the country. Ulrich (2010) analyzes application data from the Danish regime spanning 1992 to 2009 and finds that the number of applicants increased more than twelvefold. To complement Ulrich's intuition, we analyzed the application data from both the Danish and Swedish regimes between 2001 and 2022 (see Figure 3-3) and observed a growing trend of applicants. Meanwhile, we discovered an accelerated increase in the number of applications around 2011 and 2018 in Denmark, which are two pivotal years of regime

[33] Evaluatie 30%-regling (2016). Original file in Dutch, see https://open.overheid.nl/documenten/ronl-844cbaf9b3266ed4801810c4a2991605d4ac5bb1/pdf (Accessed in March, 2024)
[34] Including Bachelor, Master, and Ph.D.

amendments where the validity was extended[35]. This provides evidence that highly skilled workers are not only responsive to lower tax rates but also sensitive to the duration of the incentive in effect.

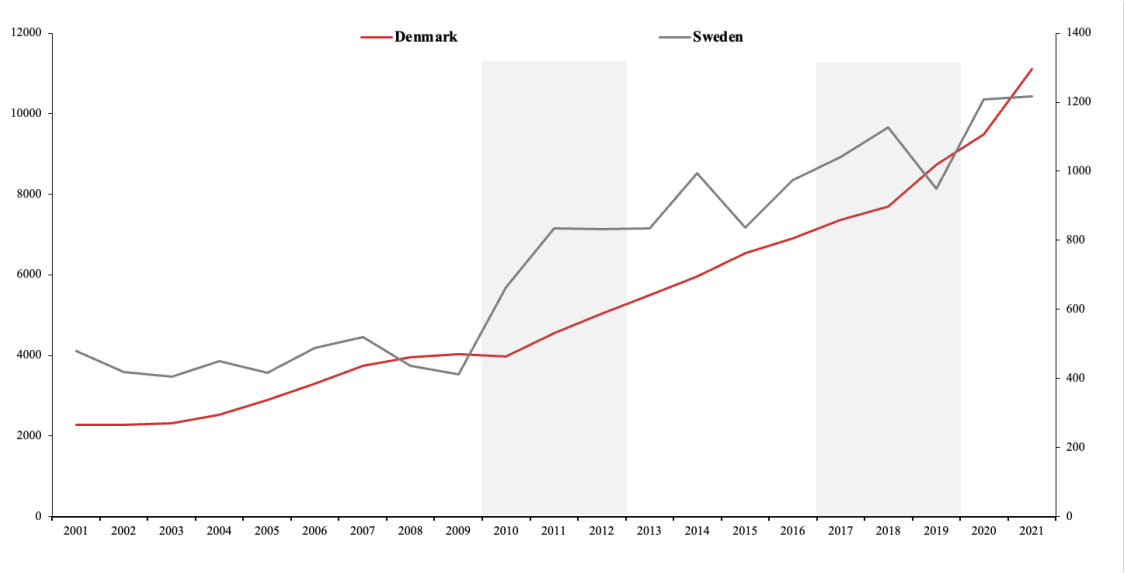


Figure 3-3: Number of applications for tax regimes in Denmark (Left axis) and Sweden (Right axis), 2001-2022

The conclusion that tax incentives pose a strong drive for high-skilled workers for relocation decisions has three implications for the future of expatriate tax incentive regimes. Firstly, governments should introduce tax incentives to adjust for the differential tax rates among countries to attract high-skilled workers. Secondly, countries should center the design of the regimes around high-skilled, generally high-income, workers to increase labor mobility. Lastly, it places pressure on countries to balance the tax relief for expatriates and the distortion effects[36] of these regimes.

3.2. Attractiveness and Effectiveness of Expatriate Tax Incentive Regimes

As presented in the previous analysis, tax incentive regimes are vital in attracting high-skilled expatriates to relocate to a country. In this section, we aim to examine which

[35] The tax scheme, which was first for a period of 36 months, was extended to a general regime of 60 months on 1 January 2011 and then to 84 months on 1 January 2018.
[36] Tax incentive regimes can create wage inequalities between expatriates and local employees, represent a significant fiscal cost to tax revenue, encourage short-term assignments over long-term integration, create dependency on a tax-advantaged workforce which may overshadow local talent development.

elements should be included as incentives to achieve the highest level of attractiveness, ultimately enhancing the effectiveness of these regimes.

The OECD Tax Policy Study (2011) discussed four key design features for tax concessions for high-skilled workers: the type of concession, whether it has a time restriction, the type of worker targeted, and the type of skill required. While the time limit and the worker type are generally straightforward, the other two features—the type of concession and the required skills—are more complex and differ significantly among various tax regimes.

The type of concession primarily concerns monetary incentives. It includes reduced rates on labor income, tax allowances or exemptions from personal income tax, specific deductions for costs related to work and relocation, and tax exemptions from foreign-sourced income. In Denmark and Finland[37], eligible expatriates can opt to pay income taxes at a flat rate of 27%[38] and 32%, respectively, as an alternative to the progressive tax system. In more generous cases, qualified individuals are subject to a flat tax rate on gross income of 15% in Malta[39] and 20% in Portugal[40]. Halkyard (2013) examines tax holidays and reduced tax rates in tax incentive regimes, criticizing their lack of effectiveness in retaining skilled workers over the long term. According to the Evaluatie 30%-regeling (2016)[41], only a limited number of participants utilized the scheme for its full duration. Around 70% of users use the scheme for four years or less, despite a maximum allowable term of eight years. Additionally, these incentives often result in a tradeoff, where the potential tax revenue loss could outweigh the benefits gained from attracting skilled workers.

An alternative type of tax concession is personal income tax exemption, which allows a portion of gross income to be excluded from the tax base when calculating the total tax

[37] According to Vero Skatt. See https://www.vero.fi/en/individuals/tax-cards-and-tax-returns/arriving_in_finland/work_in_finland/specific-instructions-for-different-occupations/key_employees_from_other_countrie/ (Accessed in April, 2024)
[38] If it is taken into account that labor market contributions must also be paid from the income, the rates correspond to 32.84 percent in 2024.
[39] According to The Commissioner For Revenue in Malta. See https://cfr.gov.mt/en/inlandrevenue/legal-technical/Pages/Tax-Guidelines-on-Highly-Qualified-Persons-Rules.aspx (Accessed in April, 2024)
[40] See https://immigrantinvest.com/blog/beneficial-tax-regime-nhr-in-portugal-en/ (Accessed in April, 2024)
[41] See note 33.

liability. The Netherlands's 30 percent facility is a namely example with its tax-free reimbursement of 30% of the gross salary.

Meanwhile, the skill requirements in tax incentive regimes help countries target specific talent. The OECD Tax Policy Study discussed four broad targeting approaches concerning qualifying requirements – industry-specific targeting, skill-specific targeting, income-based targeting, and targeting through immigration rules. Among them, qualifying requirements for specific skills and income levels are the most common practices according to our comparative review of the regimes. For occupation-specific tax incentive regimes, namely Austria's Tax allowance for foreign scientists and researchers, the eligibility criteria for skills tend to be very narrow. However, more universal regimes offer broader and more ambitious approaches, aiming to attract a larger and more diverse talent pool. Sweden's Tax Relief for Key Foreign Employees was only designed to attract and retain researchers when introduced in the 1980s, but evolved over time to include expatriates carrying out particularly qualified tasks, or "Key foreign employees".

When asked about potential improvements in the Swedish tax incentive regime, Håkan Gustavsson, a tax lawyer at Forskarskattenämnden, pointed to the ambiguity in determining qualifications. This uncertainty is further compounded by the difficulty in assessing eligibility for special tasks. While it's relatively straightforward to define qualifications in traditional industries such as technical development and engineering, the tax relief is primarily aimed at very narrow expertise within these conventional fields. Conversely, it adopts a more conservative approach towards software and IT, potentially complicating matters for unicorns and IT companies. The regime's rigidity in evaluating newer industries suggests a need for greater clarity and flexibility in the future.

In contrast, qualifying requirements for income levels offer a simpler alternative[42] to the assessment process by providing a more standardized framework for evaluating tax relief applications. All the regimes categorized as key employee tax incentive regimes have a requirement for a minimum gross salary, offering an easily quantifiable view of

[42] Sweden's introduction of threshold requirement for salary in 2012 is a notable example of providing an easier assessment process for applicants. See note 6 above.

comparing the salary requirement threshold across countries. By targeting high-income rather than specific skills, these regimes aim to support high-value-added activities regardless of their source.

4. Hypothesis

Previous research has laid a robust foundation for the examination of the complex relationship between income tax incentive regimes and their impact on innovation and entrepreneurship.

Gordon (1998) posits that while elevated tax rates may potentially deter innovation, targeted tax incentives have the capacity to counteract these deterrent effects, thereby fostering an environment conducive to innovation. Echoing this sentiment, Elert et al. (2023) elucidate how tax regimes wield influence over the structural conditions essential for nurturing high-impact entrepreneurship. Such scholarly insights have found resonance in practical policy formulations. For instance, the United Kingdom's adoption of a Patent Box regime exemplifies a proactive stance in this regard. Under this regime, enterprises are afforded a reduced corporate tax rate on profits derived from patented innovations, thereby incentivizing investment in innovative endeavors. This aligns with the broader empirical understanding that tax incentive regimes tend to engender a positive correlation with innovation.

Halkyard's (2013) examination of tax incentives tailored to attract skilled labor underscores the essential role such measures play in fostering innovation. It is observed that policies aimed at incentivizing the migration of highly skilled individuals contribute significantly to bolstering the innovation landscape. Practically, many nations have calibrated their immigration policies to attract individuals capable of making substantive contributions to societal progress. Notably, certain European countries have instituted tax incentive regimes specifically catering to professions pivotal to innovation, such as scientists, researchers, and artists – exemplified by Austria's policy landscape (see Table 3-1). Such professionals constitute the vanguard driving innovation within a nation. In light of these observations, our first hypothesis emerges:

> **H1:** The implementation of expatriate tax incentive regimes has a positive impact on a country's level of innovation.

The intricate nuances inherent in the design of various expatriate tax incentive regimes warrant careful examination. A retrospective analysis of Figure 3-3 reveals notable

trends, particularly in Denmark, where two distinct spikes in the volume of applications are discernible around 2011 and 2018. These temporal junctures coincide with pivotal years marked by amendments to the regulatory framework, wherein the validity period of the incentive schemes was extended. Such observations underscore the profound impact of policy adjustments on the allure of these regimes, directly influencing the influx of expatriates. Considering these empirical insights, our second hypothesis develops:

> **H2:** The more attractive the expatriate tax incentive regime is to expatriates, the more it can improve the country's innovation level.

Here, we primarily define the strong attractiveness of a policy as follows: low threshold, long validity period, and large scale of tax reduction. In this way, we allocate the overall impact of the policy to its components.

Additionally, extant literature underscores the heightened sensitivity of tax effects on high-skilled cohorts within the labor force. Liebig, Puhani, and Sousa-Poza (2007) elucidate the substantial influence of tax rates on migration determinations, particularly among younger cohorts, highly educated individuals, and college graduates.

In our further analysis, we observed that high-skilled workers generally correspond to high-income earners. Figure 4-1 presents a comparison involving the European median salary, top 10% salary, and top 1% salary, as well as executive salaries (colored lines), against the median salary of workers with tertiary education in each country (grey

lines). The analysis reveals that the top 1% salary in European countries surpasses the median salary of workers who have attained tertiary education across all countries.

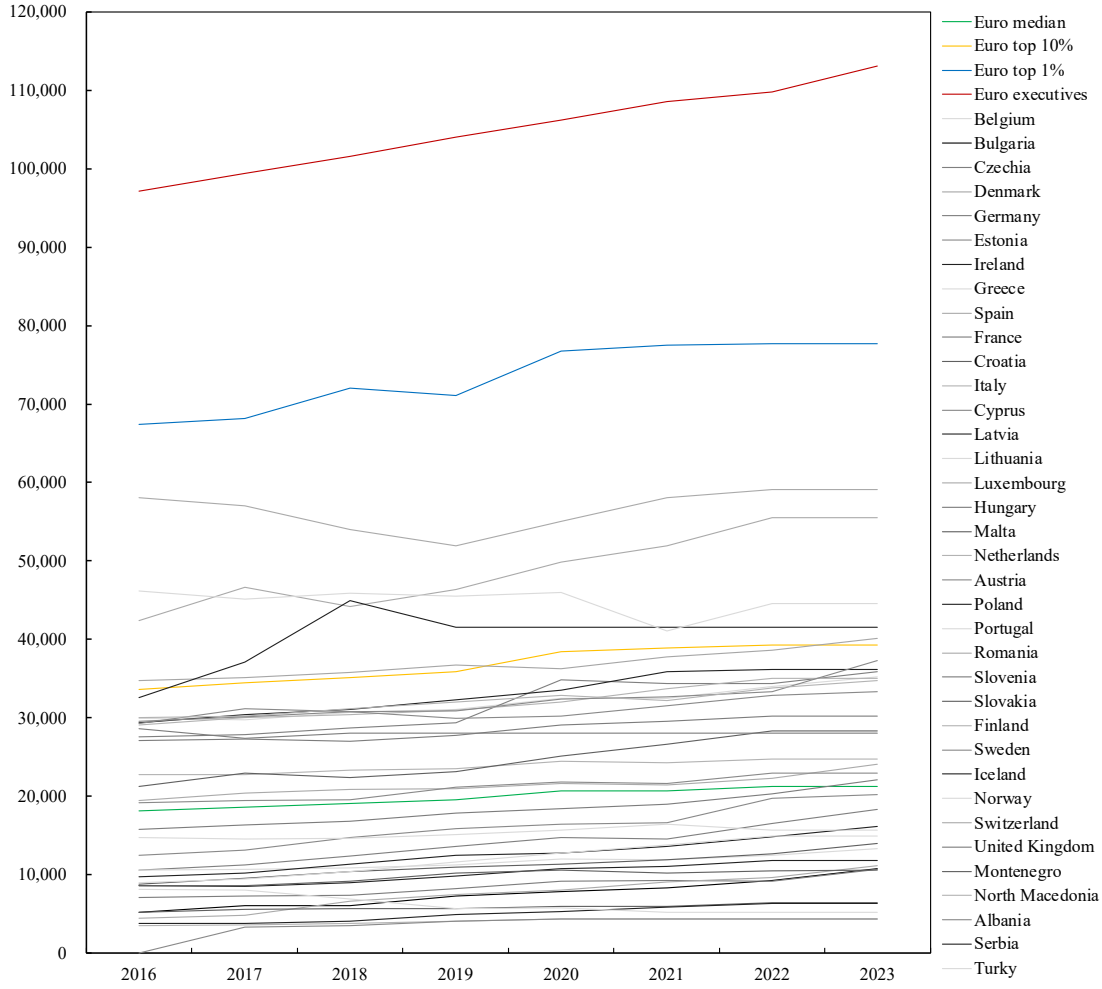


Figure 4-1: Four salary profiles among highly educated worker median salary level, 2016-2023

Building upon this premise, Kleven, Landais, Saez, and Schultz (2013) ascertain the pronounced impact of the Danish tax regime on augmenting the influx of high-income expatriates into the nation. These findings prompt us to contemplate how policy adjustments result in the attraction of varied groups of expatriates, and which demographic cohorts of expatriates should be the focal point of tax incentive regimes to enhance their efficacy in stimulating innovation output. Consequently, we posit our final hypothesis:

> **H3:** High-income workers contribute more significantly to national innovation levels compared to their low- and median-income counterparts.

5. Methodology and Data

This section outlines the methodology employed in the empirical analysis and provides an overview of the data used.

5.1. Methodology

5.1.1. Effectiveness of Policies on Innovation

Building on the quantitative methodology used by Ioana (2020) and the classification system established by Murat (2023), we categorized the indicators from the European Innovation Scoreboard (EIS) into two distinct groups based on their roles within the innovation process. The first category, termed "innovation input," encompasses the resources allocated to and the conditions conducive to innovation. This category includes the "Framework Conditions" and "Investments" sections. The second category, "innovation output," encompasses the economic, social, and cultural outcomes of innovation, incorporating the "Innovation Activities" and "Impacts" sections. Each section comprises 3 dimensions, and each dimension includes 2-3 indicators, resulting in a total of 32 indicators. With this structure, both categories contain 16 indicators, facilitating a comprehensive evaluation of innovation.

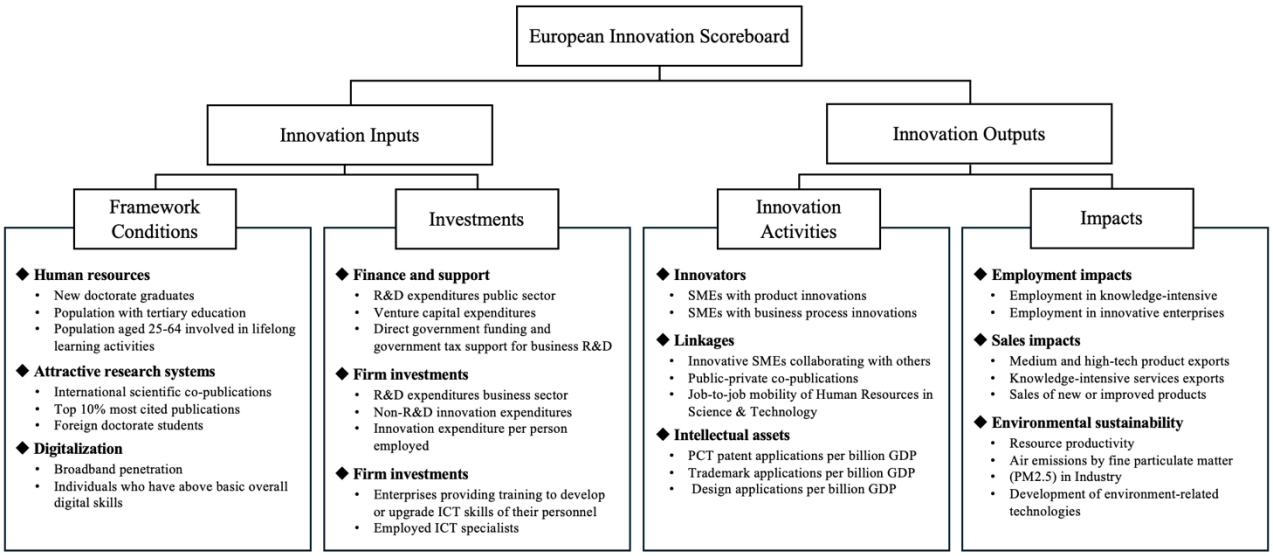


Figure 5-1: Framework of EIS

Under the EIS framework, equal weights are assigned to the 16 indicators within the innovation outputs category, which are summed to create a composite score that serves

as the dependent variable for assessing a country's overall innovation level. The indicators from the innovation inputs category, on the other hand, are used independently as independent variables in analyses. This approach provides a balanced and thorough assessment of innovation inputs and outputs, contributing to a robust understanding of national innovation metrics.

5.1.2. Measurement of Regime Attractiveness

Previous literature has highlighted various design features of tax incentive regimes. The OECD Tax Policy Study (2011) discussed four essential design elements for tax concessions for high-skilled workers: the type of concession, whether it includes a time restriction, the type of worker targeted, and the required skills. Halkyard (2013) explored tax holidays and reduced tax rates within these regimes. However, some features, such as worker type, are not amenable to quantitative analysis. To construct an empirical model that captures the attractiveness of these regimes, we identified three key components during our comprehensive policy review: the salary threshold requirement, validity period, and tax reduction. We developed three measurements to create a consistent framework for assessing the attractiveness of expatriate tax incentive regimes: Threshold multiple, validity, and after-tax salary.

The first two measurements are relatively straightforward. The salary threshold requirement is quantified as a threshold multiple which is the ratio of the salary threshold to the median salary of a respective European country. The higher the ratio, the greater the threshold. Validity refers to the time restriction on eligibility for the tax incentive, providing an assessment of the policy's attractiveness over the long term. A higher validity value indicates a longer period for eligibility.

However, the last component, tax reduction, is more challenging to quantify due to the unavailability of data on the actual tax relief for each employee under the regimes. As outlined by the targeting strategies in the OECD Tax Policy Study (2011), applicants for expatriate tax incentive regimes can be segmented into four types based on their qualifying criteria: industry-specific, skill-specific, income-based, and immigration rule-based targeting. However, industry-specific and skill-specific expatriate workers, such as experts and researchers, are not evaluated based on income and are thus exempt from the salary threshold requirement. Adding to the complexity, there are no explicit

approval standards for awarding tax incentives to these workers, with qualifications typically relying on case-by-case evaluations (The OECD Tax Policy Study, 2011; Gustavsson[43], 2024). Meanwhile, income-based targeted workers, including general applicants, must meet standardized conditions such as a minimum annual gross salary. The qualifying requirements for these individuals are concrete and comparable, providing a solid basis for calculating their after-tax salary and determining the accessibility of the threshold requirement.

Therefore, to measure the attractiveness of tax incentive regimes in Europe comparably, we exclude industry-specific and skill-specific expatriate workers from our calculations of tax reduction and threshold multiple, focusing solely on the presence of income-based targeted workers. Additionally, we employ after-tax salary as a proxy for tax reduction under these assumptions: In nations lacking a salary threshold, the median salary is used to estimate gross income; in those with a salary threshold, the threshold salary[44] is utilized to gauge gross income.

Drawing upon the methodological framework developed by Liebig, Puhani, and Sousa-Poza (2007), this research aims to delineate the specific demographic segments of expatriates that should be targeted by tax incentive regimes to optimize their impact on innovation output. A notable limitation of employing median and threshold salaries as proxies is their insufficient capacity to accurately reflect the actual tax relief provided by such regimes. To mitigate this, we have constructed multiple salary profiles to approximate the earnings of expatriate workers across different income levels.

In order to assess the efficacy of these policies across disparate income brackets, we initially formulated three distinct salary profiles. For methodological consistency, each profile has been standardized to correspond to a specific income level, enabling a comparative analysis of how after-tax incomes might influence the attractiveness of such regimes to expatriates with comparable gross earnings. These profiles are based on

[43] Referencing an interview that we had with Håkan Gustavsson, a tax lawyer at Forskarskattenämnden, in March 2024

[44] The reasoning behind using the threshold salary as a proxy for representative income in countries with a salary threshold is to assess the impact of policy. This approach is adopted because the policy does not apply to an employee earning a median salary in these countries.

the 50th, 90th, and 99th percentile[45] salaries throughout Europe, providing a uniform representation across all participating countries. Furthermore, acknowledging the existence of salary thresholds in certain countries, such as Denmark and Sweden, which surpass the 99th percentile median salary in Europe, a fourth category—termed 'executives'—has been introduced. This category is predicated on the threshold salary observed in Denmark, ensuring that there is at least one salary profile that is subject to tax incentive regimes with salary thresholds.

5.1.3. Model Specification

5.1.3.1 Description of Variables

Variables	Description	Variable types
	Baseline model	
OUTPUT	The innovation level of a country	Dependent variables
NDGS	New doctorate graduates (STEM) (% share)	Innovation inputs variables
PTE	Population with tertiary education (% share)	
PLLA	Population aged 25-64 involved in lifelong learning activities (% shares)	
ISCP	International scientific co-publications per million population	
TMC	Top 10% most cited publications (% share)	
FDS	Foreign doctorate students (% share)	
BP	Broadband penetration (% share)	
ABD	Individuals who have above basic overall digital skills (% share)	
RDPS	R&D expenditures public sector (% of GDP)	
VCE	Venture capital expenditures (% of GDP)	
DGFR	Direct government funding and government tax support for business R&D	
RDBS	R&D expenditures business sector (% of GDP)	
NRIE	Non-R&D innovation expenditures (% of turnover)	
IEPE	Innovation expenditure per person employed	
EICT	Enterprises providing training to develop or upgrade ICT skills of their personnel (% share)	
EICS	Employed ICT specialists (% of total employment)	
GDP	Gross domestic products	Control variables
Tax Burden	Personal income tax amount divided by countries' GDP, Wolff, Guntram B. (2005)	
	Tax model	
YES/NO Policy	Whether a country has the expatriate tax incentives regimes	Dummy variables
YES/NO Threshold	Whether the expatriate tax incentives regime have threshold to apply	
Threshold Multiples	The salary threshold of a country's regime divided by corresponding national median salary	Other tax elements variables
Validity	The maximum of the time that the expats can be benefit from the tax incentive regimes	
Aftertax Salary	The salary after deducting taxes according to regime details based on the median salary of each country	
Aftertax Salary 50	The salary after deducting taxes according to regime details based on the median salary of Europe region	Expat profiles variables
Aftertax Salary 10	The salary after deducting taxes according to regime details based on the top 10% salary of Europe region	
Aftertax Salary 1	The salary after deducting taxes according to regime details based on the top 1% salary of Europe region	
Aftertax Salary Executives	The salary after deducting taxes according to regime details based on the salary threshold to qualify for Denmark's regime	

Table 5-1: Description of variables

5.1.3.2 Model Construction

Firstly, based on the model exploited by Balsalobre-Lorente et al. (2021), we developed a baseline model to discover the relationship between innovation inputs and outputs.

$$\text{Innovationinputs} = \lambda_1 \text{NDGS} + \lambda_2 \text{PTE} + \cdots + \lambda_{16} \text{EICS}$$

[45] Also referred to as “top 50% salary”, “top 10% salary”, and “top 1% salary” in later chapters for simplicity.

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden$$

Equation 5-1: Baseline Model

To determine whether expatriate tax incentive regimes have a positive impact, we incorporated a policy dummy variable into the baseline model.

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 \text{GDP} + \beta_2 \text{Tax Burden} + \beta_3 \text{YES/NO Policy}$$

Equation 5-2: Tax Model 1

Subsequently, we replaced the YES/NO policy dummy variable with four alternative variables: the threshold-to-median salary ratio, after-tax salary, policy validity, and a threshold dummy variable along with its interaction term. This approach was designed to investigate the components of the policy to ascertain their significance. It is worth noting that we incorporated an interaction variable between the dichotomous YES/NO Threshold and After-Tax Salary. This methodological choice was informed by the observation that several countries initially did not design a salary threshold when implementing the policy. Consequently, this absence of a predefined threshold means that observed increases in after-tax salary may not solely be attributable to the potency of the tax reductions but could also stem from increments in gross income. This approach allows for a more nuanced analysis of the factors influencing after-tax salary enhancements.

Additionally, we analyzed these four variables individually to evaluate their separate effects to compare with their combinational contributions.

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 \text{GDP} + \beta_2 \text{Tax Burden} + \beta_3 \text{Threshold Multiples} + \beta_4 \text{Validity} + \beta_5 \text{Aftertax Salary} + \beta_6 \text{YES/NO Threshold} + \beta_7 \text{YES/NO Threshold} * A\text{ftertax Salary}$$

Equation 5-3: Tax Model 2

Finally, we conducted an in-depth analysis involving four distinct salary profiles for workers. Four representative groups of workers are selected for this analysis. These groups include European median salary workers, the top 10 percent salary workers, the top 1 percent salary workers, and a group we refer to as executives. The latter group is defined by salary levels that meet or exceed the salary threshold[46] for Denmark's tax incentive regime, which is the highest in Europe.

$$OUTPUT = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden + \beta_8 Aftertaxsalary50 + \beta_9 AftertaxSalary10 + \beta_{10} AftertaxSalary1 + \beta_{11} AftertaxSalaryExecutives$$

Equation 5-4: Tax Model_ Deep Dive

Following the Data Analysis Methods of Balsalobre-Lorente et al. (2021), we will employ both Ordinary Least Squares (OLS) and Fixed Effects approaches to analyze these models. In applying the Fixed Effects model, we will control for time effects, country effects, and both simultaneously to account for potential confounding factors related to these dimensions.

5.2. Data

5.2.1. Data Collection and Preprocessing

Data on innovation inputs and outputs was sourced from the database designed for the European Innovation Scoreboard (EIS). The dataset spans the years 2016 to 2023 and

[46] To qualify, an employee must receive a minimum monthly salary of DKK 75,100 in 2024 after deduction of labour market supplementary pension fund (ATP) contributions.

includes information from 38 European countries. The identification and replacement of outliers were conducted in accordance with the EIS methodology. Outliers on the positive end were defined as those values exceeding the mean across all countries by more than twice the standard deviation. These positive outliers were replaced with the maximum value after excluding them from the dataset. The same procedure was applied in reverse for identifying and handling negative outliers.

$$\text{PositiveOutliers}: \ Score > Mean(all\ countries' scores) + 2 * STD(allcountries' scores)$$

Due to the heterogeneity in measurement units across variables and the substantial variance observed in certain data values, it was imperative to standardize the scales to ensure uniform contributions from each variable to the analytical process. This standardization facilitates the model's ability to discern the genuine patterns inherent in the data more effectively. Consequently, we adopted a rescaling approach wherein all data were normalized to a 0-1 scale, employing the methodology outlined by the European Innovation Scoreboard (EIS). We calculated re-scaled scores by first subtracting the Minimum score and then dividing by the difference between the Maximum and Minimum scores.

$$\text{Rescaled scores} = \frac{Originalscore - Minimum\left(allcountries'\ scores\right)}{Maximum\left(all\ countries'\ scores\right) - Minimum\left(all\ countries'\ scores\right)}$$

The data used to assess the attractiveness of the policies were collected from the official websites of the tax authorities in the respective countries. The thresholds and validities for the expatriate tax incentive regimes were obtained directly from the relevant policy documents. The after-tax salary was calculated using each country's tax tables, with the

exception of Sweden[47], Denmark[48], Switzerland[49], and Finland[50], where tax calculations are more complex and differentiated. For these countries, we used the Tax Calculator provided by Talent to estimate the after-tax salary.

It is noteworthy that we established specific assumptions about the characteristics of the workers. We assumed these individuals could freely choose their workplace within the European Union, unrestricted by work permits, and that they would be employed in the capital cities of their respective countries.

The median salary for each European country, along with the median, top 10%, and top 1% salaries for Europe as a whole, were sourced from the Eurostat database. The scale of personal income and the total GDP for each country, used to calculate the tax burden index, were derived from the OECD database. Governance data for the control variable was taken from the World Bank's rule of law index.

[47] Sweden Tax calculator: https://se.talent.com/en/tax-calculator
[48] Denmark Tax calculator: https://dk.talent.com/en/tax-calculator
[49] Switzerland Tax calculator: https://ch.talent.com/en/tax-calculator
[50] Finland: https://fi.talent.com/en/tax-calculator

5.2.2. Descriptive Statistics

Table 5-2 below shows the descriptive statistics for the variables incorporated. The data set is panel data with 304 samples for each variable. All the data has been rescaled to ensure that each variable contributed equitably to the analysis (see Section 5.1.3), so the minimum values are 0, and the maximum values are 1.

Variables	N	Mean	St.Dev	Min	Max
OUTPUT	304	0.468	0.179	0	1
NDGS	304	0.443	0.289	0	1
PTE	304	0.456	0.274	0	1
PLLA	304	0.388	0.307	0	1
ISCP	304	0.389	0.303	0	1
TMC	304	0.473	0.274	0	1
FDS	304	0.394	0.301	0	1
BP	304	0.442	0.287	0	1
ABD	304	0.45	0.298	0	1
RDPS	304	0.461	0.278	0	1
VCE	304	0.405	0.297	0	1
DGFR	304	0.346	0.326	0	1
RDBS	304	0.391	0.31	0	1
NRIE	304	0.458	0.258	0	1
IEPE	304	0.295	0.296	0	1
EICT	304	0.458	0.279	0	1
EICS	304	0.447	0.279	0	1
GDP	304	0.12	0.194	0	1
Tax Burden	304	0.164	0.371	0	1
YES/NO Policy	304	0.342	0.475	0	1
YES/NO Threshold	304	0.141	0.254	0	1
Threshold Multiples	304	0.122	0.287	0	1
Validity	304	0.645	0.183	0	1
Aftertax Salary	304	0.555	0.221	0	1
Aftertax Salary 50	304	0.545	0.213	0	1
Aftertax Salary 10	304	0.09	0.217	0	1
Aftertax Salary 1	304	0.284	0.184	0	1
Aftertax Salary Executives	304	0.197	0.217	0	1

Table 5-2: Descriptive Statistics

It is found that the standard deviation of PLLA, ISCP, FDS, DGFR, and Tax Burden is extensive, which means that Population aged 25-64 involved in lifelong learning activities, International scientific co-publications, Foreign doctorate students, Direct government funding, Government tax support for business R&D, and Personal income tax amount have a bigger difference among countries. Mean results reveal that 161 samples surpass the average in terms of output, suggesting that these countries exhibit a higher innovation output.

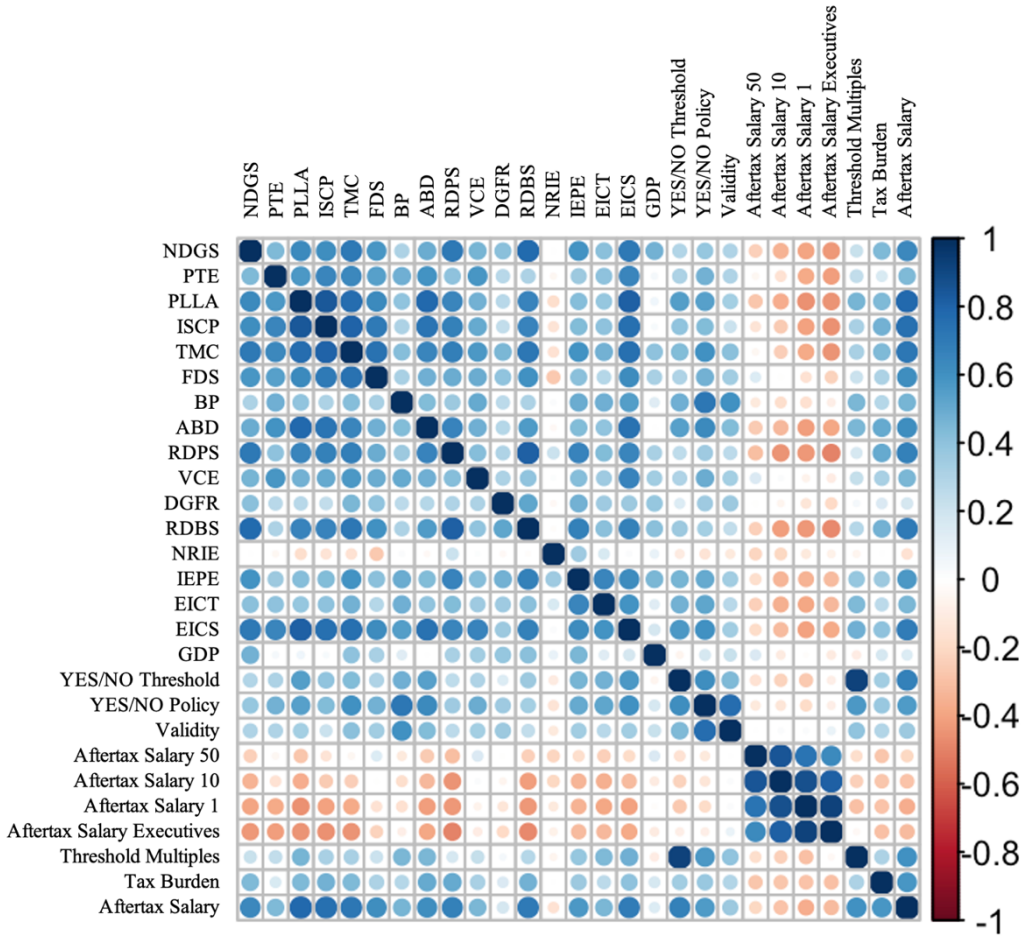


Figure 5-2: Correlations of Variables

Figure 5-2 shows the interconnected matrix between the indicators of innovation inputs and policy components. The correlation within each of 2 groups is relatively high, indicating that the indicators within the same group are relatively linked. The high correlation among policy components indicates the linkage of policy content changes, which does not mean multicollinearity. Similarly, the correlation of Innovation inputs

means that there is some interaction between innovation variables, but the EIS sets these indicators based on the differences of their representatives which does not bring multicollinearity.

Figure 5-3 depicts the innovation output of 38 European countries over the 2016-2023 period. The colored lines represent countries with expatriate tax incentive regimes, while the grey lines represent countries without such regimes. The data reveals that five countries—Portugal, Slovenia, Finland, Malta, and Italy—experienced a significant surge in innovation output in 2018. Similarly, five countries—Denmark, Finland, Sweden, Malta, and Italy—showed notable growth in innovation output in 2020. The figure also indicates that, except for Denmark, Finland, and Ireland, most countries with expatriate tax incentive regimes experienced a decline in innovation output in 2021.

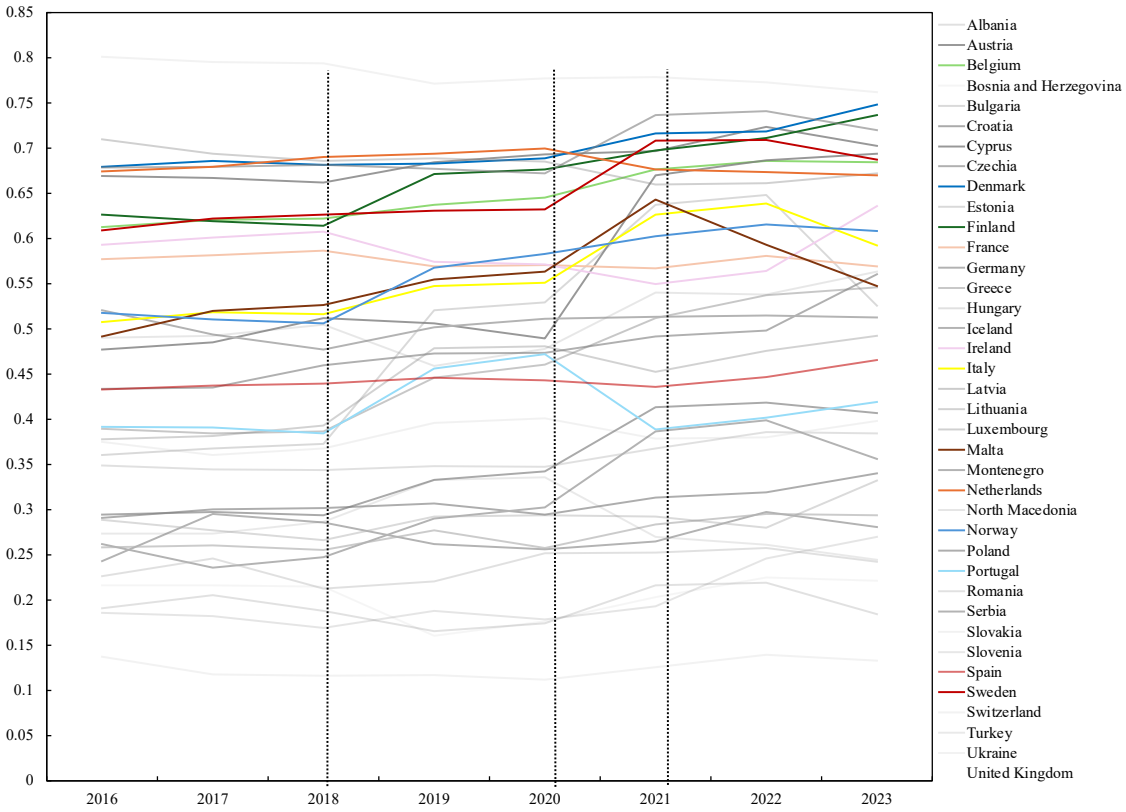


Figure 5-3:Innovation Output of European Countries, 2016-2023

The observed statistical variations in innovation output appear to align with changes in expatriate tax incentive regimes, suggesting a possible connection between these regimes and a country's innovation levels. To investigate this relationship further, we will conduct an empirical study to analyze the impact of expatriate tax incentive regimes on innovation output.

Figure 5-4 consists of four subfigures, each illustrating the after-tax salary of workers across various salary levels in countries that implement expatriate tax incentive regimes.

Subfigure (a) focuses on the median salary workers in Europe, comparing the after-tax incomes in different nations. Within this context, the Netherlands offers the highest after-tax salary for expatriates with the same median gross incomes, whereas Finland provides the lowest. In 2021, Belgium experienced a notable decrease in after-tax salaries, primarily due to changes in tax policy. Before 2021, Belgium's tax policy did not stipulate a threshold requirement, allowing median salary workers to benefit from the foreign talent tax reduction policy. However, post-2021, the introduction of a higher threshold excluded median salary workers from these tax reductions, resulting in a significant decline in their after-tax salaries as they no longer qualified for the tax reduction.

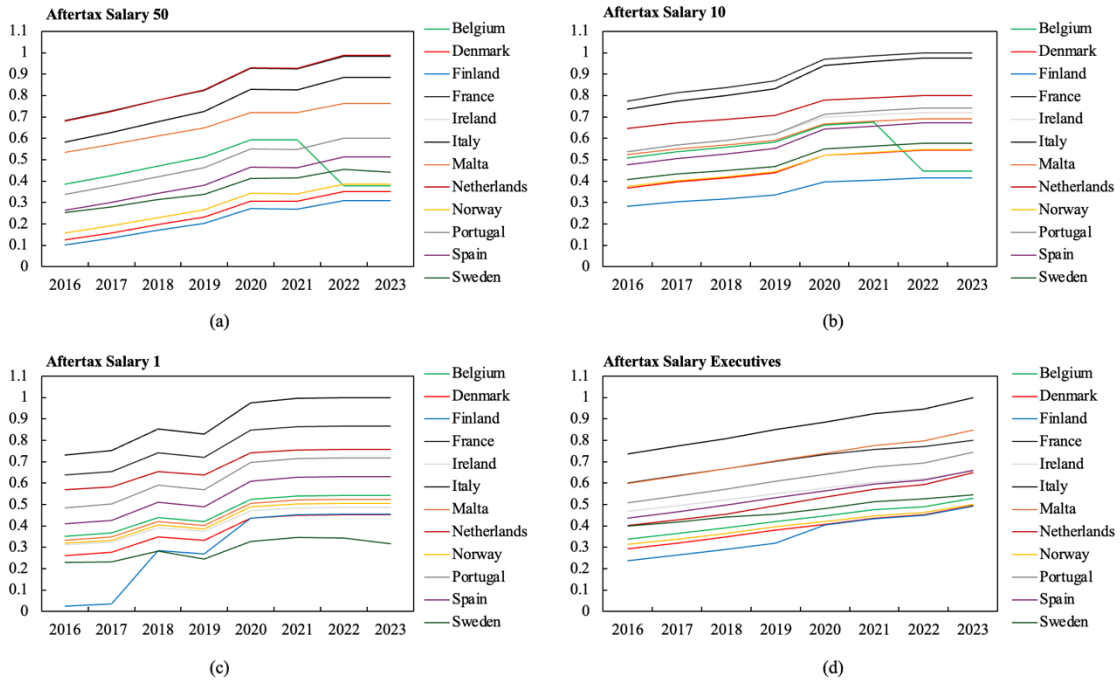


Figure 5-4: After-tax Salary Distribution Based on Salary Profiles, 2016-2023

Subfigure (b) analyzes the after-tax salaries of the top 10% of salary workers in Europe, highlighting France as the country with the highest and Finland with the lowest. The substantial decrease observed in Belgium is attributed to the same policy adjustments mentioned previously.

Subfigures (c) and (d) depict the after-tax earnings for the top 1% of salary workers and executives, respectively. In both categories, the highest salaries are in Italy, while the

lowest are in Finland. In Subfigure (d), the observed increase in after-tax salaries in Malta results from a particularly high threshold requirement that limits tax incentives exclusively to executives.

6. Empirical Findings and Discussion

This section presents the empirical findings from hypothesis tests and robustness checks. It also discusses the economic implications of the results and offers policy recommendations based on these findings. Additionally, it addresses the limitations of the thesis, which aids in interpreting the analysis and guiding future research.

6.1. Empirical Findings

We used a step-by-step procedure to test our 3 hypotheses. For each hypothesis, an OLS regression was conducted to identify a primary relationship. Subsequently, we utilized fixed effects regression to control for time and country-specific fixed effects, thereby enhancing the robustness of our findings.

6.1.1. Test of Hypothesis 1

> **H1:** The implementation of expatriate tax incentive regimes has a positive impact on a country's level of innovation.

Initially, we executed the baseline model using both OLS and fixed effects methodologies. Table 6-1 provided robust estimates concerning the impact of various innovation inputs on outputs. In both the OLS and fixed effects models, the variables[51] ISCP, TMC, RDBS, and NRIE demonstrated significant and positive contributions to innovation output. Conversely, the variables[52] ABD, RDPS, and EICS showed significant negative impacts on innovation output within the fixed effects model, contrasting with the OLS results. This suggests that these factors may adversely influence innovation output after accounting for time-specific and individual-specific fixed effects.

[51] ISCP: International scientific co-publications; TMC: Top 10% most cited publications; RDBS: R&D expenditures in the business sector; NRIE: Non-R&D innovation expenditures

[52] ABD: Individuals with above basic overall digital skills; RDPS: R&D expenditures in the public sector; EICS: Employed ICT specialists.

	Baseline Model			
	OLS	FE (time)	FE (individual)	FE (twoways)
(Intercept)	0.16 ***			
NDGS	-0.02	-0.01	-0.07 **	-0.06 *
PTE	0.07 **	0.08 **	0.02	-0.01
PLLA	-0.11 ***	-0.11 ***	-0.05	-0.07
ISCP	0.17 ***	0.15 ***	0.22 ***	0.17 ***
TMC	0.20 ***	0.22 ***	0.10 **	0.09 **
FDS	0.01	0.01	0.03	0.03
BP	-0.03	-0.03 .	0.06 *	0.07 .
ABD	0.08 ***	0.09 ***	NA	NA
RDPS	-0.05 .	-0.06 .	0.07 *	0.07 *
VCE	0.04 *	0.04 .	0.01	0.01
DGFR	-0.06 ***	-0.07 ***	0.01	0.01
RDBS	0.20 ***	0.20 ***	0.17 ***	0.14 **
NRIE	0.05 *	0.05 **	0.10 ***	0.11 ***
IEPE	-0.01	-0.01	0.07 *	0.06 .
EICT	0.03	0.03 .	-0.05 *	-0.04 .
EICS	0.11 **	0.11 **	-0.14	-0.17 .
GDP	0.15 ***	0.14 ***	-0.20 *	-0.29 **
Taxburden	-0.05 *	-0.05 .	-0.04	-0.04
R-squared	0.904	0.904	0.578	0.410
Adjusted R-squared	0.898	0.895	0.486	0.261

*Note: This table reports the regression estimates of Equation 5-1. From the variable NDGS to the variable EICS are innovation inputs' indicators. GDP and Tax Burden are another 2 control variables. Column (1, OLS) is the coefficients of the variables in OLS regression. The other columns are the coefficients estimated by fixed-effects regression. P-value in parentheses. '***' $p < 0.001$ '**' $p < 0.01$ '*' $p < 0.05$ '.' $p < 0.1$*

Table 6-1: Regression Estimates of Baseline Model

The correlation between innovation inputs and outputs provides empirical support for us to further measure the effect of other inputs, notably tax incentive regimes, on innovation outputs. Therefore, we incorporated a policy dummy variable to differentiate between countries with or without expatriate tax incentive regimes, in efforts to test the intuition that the existence of a regime promotes innovation outputs of a country. Table 6-2 aggregates both OLS and time-fixed effects results.

	Baseline Model		Tax Model 1	
	OLS	FE	OLS	FE
(Intercept)	0.16 ***		0.17 ***	
NDGS	-0.02	-0.01	-0.02	-0.01
PTE	0.07 **	0.08 **	0.08 **	0.08 **
PLLA	-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***
ISCP	0.17 ***	0.15 ***	0.17 ***	0.16 ***
TMC	0.20 ***	0.22 ***	0.20 ***	0.21 ***
FDS	0.01	0.01	0.00	0.00
BP	-0.03	-0.03 .	-0.03	-0.03
ABD	0.08 ***	0.09 ***	0.08 **	0.08 **
RDPS	-0.05 .	-0.06 .	-0.05 .	-0.05 .
VCE	0.04 *	0.04 .	0.04 *	0.03 .
DGFR	-0.06 ***	-0.07 ***	-0.06 ***	-0.07 ***
RDBS	0.20 ***	0.20 ***	0.20 ***	0.21 ***
NRIE	0.05 *	0.05 **	0.05 *	0.05 **
IEPE	-0.01	-0.01	-0.01	-0.01
EICT	0.03	0.03 .	0.03	0.03 .
EICS	0.11 **	0.11 **	0.11 **	0.11 **
Yes/No Policy			0.01	0.01
R-squared	0.904	0.904	0.904	0.904
Adjusted R-squared	0.898	0.895	0.898	0.895

*Note: This table reports the regression estimates of Equations 5-1 and 5-2. We controlled GDP and tax burden effects. Column (3, OLS) and Column (4, FE) are the coefficients estimated by the OLS and time-fixed effects regression respectively. The results of the individual-fixed effects and twoways-fixed effects are presented in Table 9-3 in the appendix. P-value in parentheses. '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '. ' p < 0.1*

Table 6-2: Regression Estimates of Tax Model 1

The results from Tax Model 1 indicate that the "Yes/No Policy" dummy variable is not statistically significant, suggesting that expatriate tax incentive regimes generally do not significantly influence innovation output.

Additionally, we conducted analyses using individual-fixed effects and two-way fixed effects. Due to a methodological conflict between the policy dummy variable and the controls for individual characteristics, we will primarily focus on the time-fixed effects estimates. Detailed results for other fixed effects models are provided in the Appendix.

This finding is relatively aligned with the previous literature. Even though there hasn't been any research directly examining the effects of tax incentives on innovation, existing literature suggests that the empirical evidence available does not support the conclusion that the migration decisions of workers are highly responsive to tax incentives (Feld, 2000; Vedder, 2005; Liebig and Sousa-Poza, 2005).

6.1.2. Test of Hypothesis 2

> **H2:** The more attractive the expatriate tax incentive regime is to expatriates, the more it can improve the country's innovation level.

While the effect of tax on migration is marginal suggested by multiple literature, further research indicates that the effect of tax is stronger for high-skilled workers (Liebig, Puhani, and Sousa-Poza, 2007). Wagner (2000) also suggests that the effect of gross income and tax difference was more significant for some conditional groups. This inspires us to further investigate the components of the expatriate tax incentive regimes. We included 4 key components as new variables to measure the attractiveness of regimes in our tax model: Validity, Threshold Multiples, Yes/No Threshold, and After-tax Salary. The detailed quantifying methodology of those variables is discussed in Section 5.1.2.

Regression estimates from Tax Model 1 and Tax Model 2 are displayed in Table 6-3. The higher adjusted R-squared for Tax Model 2 compared to Tax Model 1 indicates enhanced explanatory power through the inclusion of regime-specific components, thereby suggesting that Tax Model 2 more accurately captures the effects of expatriate tax incentive regimes.

In the time-fixed effects estimates, Threshold Multiples and Aftertax Salary are significantly and positively correlated with the innovation output, suggesting that a higher salary threshold and higher after-tax salaries could increase a country's innovation level. However, the interaction of Aftertax Salary and Yes/No Threshold is significant with a negative coefficient. This implies that when a salary threshold is in place, the higher the after-tax salary, the greater the negative impact on the level of innovation.

The coefficient of the interaction term contradicts previous findings and complicates the validation or rejection of Hypothesis 2 under the current model. Since the threshold is empirically significantly correlated to the innovation output, we thought it is worth investigating the effects of Aftertax Salary. Thus, in conjunction with hypothesis 3, we conducted a deep-dive analysis to break down the after-tax salary for further testing.

	Tax Model 1		Tax Model 2	
	OLS	FE	OLS	FE
(Intercept)	0.17 ***		0.16 ***	
NDGS	-0.02	-0.01	-0.02	-0.02
PTE	0.08 **	0.08 **	0.08 ***	0.08 ***
PLLA	-0.11 ***	-0.11 ***	-0.07 *	-0.07 *
ISCP	0.17 ***	0.16 ***	0.15 ***	0.12 **
TMC	0.20 ***	0.21 ***	0.18 ***	0.19 ***
FDS	0.00	0.00	-0.01	-0.01
BP	-0.03	-0.03	-0.03	-0.03 .
ABD	0.08 **	0.08 **	-0.02	-0.02
RDPS	-0.05 .	-0.05 .	0.05	0.04
VCE	0.04 *	0.03 .	0.04 *	0.04 *
DGFR	-0.06 ***	-0.07 ***	-0.06 ***	-0.06 ***
RDBS	0.20 ***	0.21 ***	0.18 ***	0.18 ***
NRIE	0.05 *	0.05 **	0.03 .	0.04 .
IEPE	-0.01	-0.01	0.02	0.01
EICT	0.03	0.03 .	0.01	0.01
EICS	0.11 **	0.11 **	0.11	0.11 **
Yes/No Policy	0.01	0.01		
Validity			0.02	0.02
Threshold Multiples			0.14 **	0.14 **
Aftertax Salary			0.15 .	0.18 *
Yes/No Threshold			0.06	0.06
Aftertax Salary*Yes/No Threshold			-0.33 ***	-0.35 ***
R-squared	0.904	0.904	0.920	0.920
Adjusted R-squared	0.898	0.895	0.913	0.911

*Note: This table reports the regression estimates of Equations 5-2 and 5-3. We controlled GDP and tax burden. Column (3, OLS) and Column (4, FE) are the coefficients estimated by OLS and time-fixed effects regression respectively. The results of the individual-fixed effects and twoways-fixed effects are presented in Table 9-3 in the appendix. P-value in parentheses. '***' $p < 0.001$ '**' $p < 0.01$ '*' $p < 0.05$ '.' $p < 0.1$*

Table 6-3: Regression Estimates of Tax Model 1 and 2

Additionally, to thoroughly examine the independent effect of each component, we conducted separate regressions for each. The results indicate that none of the components individually exhibit statistical significance. This suggests that the individual elements of the tax incentive regimes do not significantly influence innovation when considered in isolation; rather, it is their collective effect that is impactful. Detailed regression estimates are available in the appendix.

6.1.3. Test of Hypothesis 3

> **H3:** High-income workers contribute more significantly to national innovation levels compared to their low- and median-income counterparts.

Reflect on the contradictory outcomes observed in testing Hypothesis 2: although a higher after-tax salary typically enhances a country's innovation output, imposing a

salary threshold might reverse these benefits. This paradox may result from changes in the demographic profiles that qualify for expatriate tax regimes following the implementation of these thresholds. As illustrated by the amendments in Belgium's regime in 2022, where a €75,000 salary threshold was introduced[53], it now excludes median and higher-salary workers from the benefits of these regimes.

In earlier analyses, we employed the median salary or the threshold requirement of a country as a proxy for a typical expatriate worker's salary. However, this approach proves inadequate for accurately capturing the tax reductions applicable to expatriates with varying salary profiles. Historically, studies using general data have not shown a significant effect of tax policies on migration patterns. In contrast, more nuanced results emerge when the data is segmented into subgroups differentiated by factors such as age, education, and residence status (Liebig and Sousa-Poza, 2005; Liebig, Puhani, and Sousa-Poza, 2007).

Drawing on the analytical framework established by Liebig, Puhani, and Sousa-Poza (2007), this study identifies four distinct salary profiles to represent expatriate subgroups: median salary workers, the top 10% salary workers, the top 1% salary workers, and executives. The methodologies used to calculate their after-tax salaries are thoroughly described in Section 5.1.2. This approach allows for an in-depth analysis of how tax incentive regimes affect these varied expatriate profiles differently.

Table 6-4 presents the regression estimates from the Tax Model: Deep Dive analysis. The OLS and time-fixed effects regressions results indicate that Aftertax Salary 50 and Aftertax Salary Executives significantly positively correlated with innovation output. Conversely, Aftertax Salary 1 is found to have a significant and negative impact on innovation output. These findings suggest that the effects of after-tax salaries on innovation output vary significantly across different income levels.

[53] The regime was previously accessible to qualified expatriates with all salary levels.

	Tax Model: Deep Dive	
	OLS	FE
(Intercept)	0.12 ***	
NDGS	0.03	0.03
PTE	0.05 *	0.05 *
PLLA	-0.06 *	-0.06 *
ISCP	0.16 ***	0.16 ***
TMC	0.17 ***	0.16 ***
FDS	-0.02	-0.02
BP	-0.01	-0.01
ABD	0.07 **	0.07 **
RDPS	0.00	-0.01
VCE	0.02	0.02
DGFR	-0.04 **	-0.04 *
RDBS	0.16 ***	0.16 ***
NRIE	0.06 ***	0.07 ***
IEPE	-0.02	-0.02
EICT	0.03 .	0.03 .
EICS	0.09 **	0.08 *
Aftertax Salary 50	0.26 ***	0.28 ***
Aftertax Salary 10	-0.07	-0.08
Aftertax Salary 1	-0.20 ***	-0.21 ***
Aftertax Salary Executives	0.09 .	0.10 .
R-squared	0.924	0.925
Adjusted R-squared	0.918	0.917

*Note: This table reports the regression estimates of Equation 5-4. We controlled GDP and tax burden. Column (1, OLS) and Column (2, FE) are the coefficients estimated by OLS and time-fixed effects regression respectively. The results of the individual-fixed effects and twoways-fixed effects are presented in Table 9-5 in the appendix. P-value in parentheses. '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '.' p < 0.1*

Table 6-4: Regression Estimates of Tax Model: Deep Dive

This finding resolves the apparent contradiction observed in testing Hypothesis 2, which relates to after-tax salary and the threshold multiple. Although both the after-tax salary and the threshold multiple have positive coefficients, the negative coefficient for the interaction term can be explained by the varying impacts of different salary profiles within the After-tax Salary variable. Specifically, there is a positive correlation between innovation output and the salaries of workers in the 50% bracket and executives, but a negative correlation with the top 1% earners. We conclude that while After-tax Salary generally shows a positive correlation with innovation output, increasing the after-tax salary for all expatriates does not necessarily enhance a country's innovation capability. In fact, significant drawbacks from increasing the after-tax salary of the top 1% earners could undermine overall innovation. However, the significant positive correlation between the after-tax salary of executives and innovation outputs suggests that making

policies more attractive to highly skilled executives could propel a country's innovation capability.

A potential explanation for this discovery could be the distortion effects of tax incentive regimes (Halkyard, 2013; Evaluatie 30%-regling, 2016). When applied inappropriately, these regimes can create wage disparities between expatriates and local employees, incur substantial fiscal costs to tax revenue, favor short-term assignments over long-term integration, and foster reliance on a tax-advantaged workforce, which may hinder the development of local talent and innovation.

6.2. Robustness

6.2.1. Governance Control

Balsalobre-Lorente et al. (2021) explored how the governance of a country might influence the efficacy of government expenditures and tax incentives aimed at fostering innovation, utilizing the Rule of Law index as a proxy to assess governance levels.

Primarily, the Rule of Law[54] is a sociological concept describing a political ideal that all members and institutions of society, including its leaders and lawmakers, are equally subject to publicly disclosed legal codes and processes. Based on this, the World Justice Project (WJP) produces the Rule of Law Index[55] as a quantitative tool measuring the extent to which nations conform to the rule of law in actual practice.

To account for governance influences, we incorporated the Rule of Law Index as a control variable in all our regression models. The following analytical models were employed to assess the impact of governance on the effectiveness of innovation-related fiscal measures:

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden + \beta_{12}\text{GOV}$$

Equation 6-1: Robustness Test for Baseline Model

[54] https://en.wikipedia.org/wiki/Rule_of_law
[55] https://en.wikipedia.org/wiki/World_Justice_Project

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden + \beta_{12}\text{GOV} + \beta_3 \text{YES/NO Policy}$$

Equation 6-2:Robustness Test for Tax Model 1

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden + \beta_{12}\text{GOV} + \beta_3 \text{Threshold Multiples} + \beta_4 \text{Validity} + \beta_5 \text{Aftertax Salary} + \beta_6 \text{YES/NO Threshold} + \beta_7 \text{YES/NO Threshold} * A\text{ftertax Salary}$$

Equation 6-3: Robustness Test for Tax Model 2

$$\text{OUTPUT} = \sum_{i=1}^{16} \lambda_i Innovation\ Inputs + \beta_1 GDP + \beta_2 Tax\ Burden + \beta_{12}\text{GOV} + \beta_8 \text{Aftertaxsalary50} + \beta_9 \text{AftertaxSalary10} + \beta_{10} \text{AftertaxSalary1} + \beta_{11} \text{AftertaxSalaryExecutives}$$

Equation 6-4: Robustness Test for Deep Dive

The results, as detailed in Table 9-6 in the appendix, indicate that the Rule of Law index does not have a statistically significant impact, nor does it enhance the adjusted R-squared of our model as might be anticipated. Despite the inclusion of this new variable, the coefficients of the key variables remain statistically significant and largely unchanged, thereby affirming the robustness of our analytical model.

6.2.2. Alternative innovation output measure

As described above, our methodology follows the framework established by Murat (2023) for categorizing the European Innovation Scoreboard (EIS) indicators into innovation inputs and outputs, with each country's level of innovation assessed based on these outputs. A notable limitation of our approach is that the EIS does not encompass all countries globally, rendering our assessments potentially less applicable to non-European nations. To address this, we incorporated the Global Innovation Index (GII) as an alternative measure of innovation output.

The GII[56], which is published annually by the World Intellectual Property Organization (WIPO)[57], calculates its overall index by averaging the scores from two sub-indices: the Innovation Input Index and the Innovation Output Index. For our analysis, we utilized the latter sub-index to represent the level of innovation, substituting it as the dependent variable across all our regression models.

Before conducting regression analyses, we performed a descriptive statistical comparison between the Innovation Output Index of the GII and the innovation output

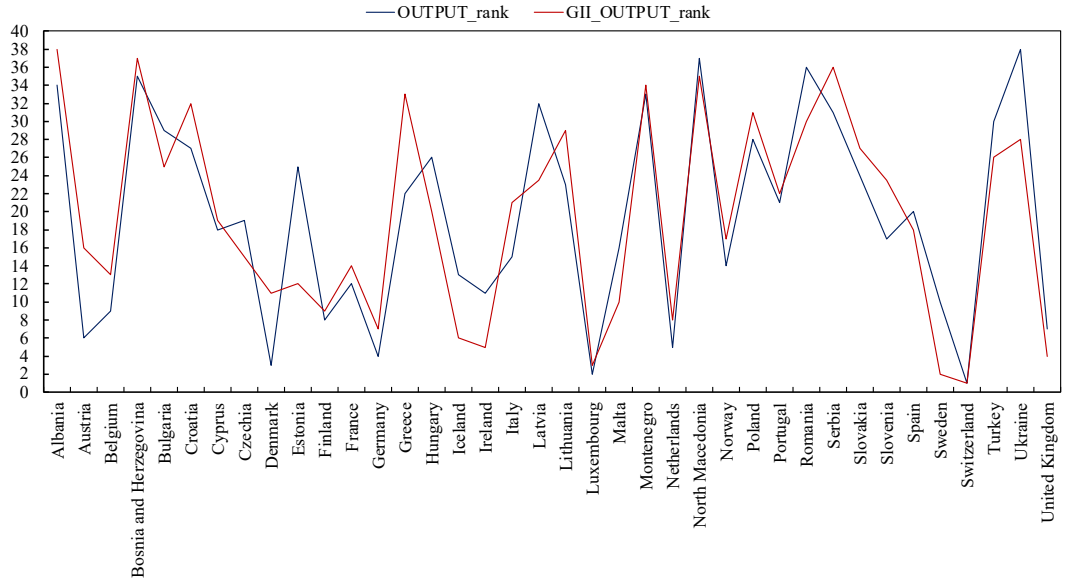


Figure 6-1: European Countries' EIS and GII Rankings in 2016

from the EIS. The correlation between these two indices stands at 0.797. Further examination involved contrasting the rankings of individual countries within these two indices. Notably, countries positioned at the upper and lower extremes of the innovation rankings show little variance between the two measures. However, significant differences emerge among countries in the middle to lower tiers of the innovation rankings, such as Latvia, Estonia, and Slovenia. These discrepancies could potentially affect the outcomes of subsequent regression analyses.

As we expected, the regression results are partially consistent with our previous findings (See Table 9-7 in Appendix). In Tax Model 2, the variable Threshold Multiples maintains a significant positive relationship with innovation output. Concurrently, in the

[56] https://en.wikipedia.org/wiki/Global_Innovation_Index
[57] https://www.wipo.int/global_innovation_index/en/

Tax Model: Deep Dive, the coefficients for Aftertax Salary 1 and Aftertax Salary Executives are consistent with our principal findings. However, discrepancies arise concerning the after-tax salaries of median-salary workers. In Tax Model 2, the interaction variable Aftertax Salary*Yes/No Threshold shows a positive correlation with innovation output, which contradicts our previous results. Furthermore, in the Tax Model: Deep Dive, the variable Aftertax 50 is found to be insignificant. These inconsistencies highlight the varied impacts of median salary workers' after-tax salaries under different innovation assessment criteria, as previously suggested by variations in countries' rankings.

6.3. Discussion

This research investigates the effects of expatriate tax incentive regimes on innovation, focusing on three progressive hypotheses. By employing a combination of OLS and fixed effects regression models, we scrutinize the relationship between tax incentives and innovation outputs across different national and temporal contexts. The integration of these hypotheses, supported by robustness checks involving governance controls and alternative innovation metrics, enables a comprehensive understanding of how tax incentives influence innovation. Table 6-5 shows the aggregated results of three hypothesis tests.

H1	The implementation of expatriate tax incentive regimes has a positive impact on a country's level of innovation	Not supported
H2	The more attractive the expatriate tax incentive regime is to expatriates, the more it can improve the country's innovation level	Partially supported
H3	High-income workers contribute more significantly to national innovation levels compared to their low- and median-income counterparts	Partially supported

Table 6-5: Results of Hypothesis Tests

Hypothesis 1 posits that expatriate tax incentive regimes enhance a country's innovation level. Our initial findings, however, show that these regimes do not have a statistically significant direct effect on innovation output when using broad categorizations of countries with and without such policies (Feld, 2000; Vedder, 2005; Liebig and Sousa-

Poza, 2005). This lack of direct correlation suggests that merely the presence of tax incentives is insufficient to drive innovation, prompting a need to explore more granular aspects of these regimes.

This leads directly to Hypothesis 2, which examines whether the attractiveness of these tax regimes, defined by specific, tailored features such as after-tax salaries and threshold multiples, has a more pronounced effect on innovation. The progression here is logical: since the mere presence of tax incentives does not suffice, the next step is to investigate if and how the specific characteristics of these incentives influence outcomes (Halkyard, 2013). The findings indicate that certain features do indeed correlate with innovation outputs, particularly among high-skilled expatriates, suggesting that the effectiveness of tax incentives depends significantly on their design and the target demographic. The insights from Hypothesis 2 reveal a complex interaction where attractive components of tax regimes impact innovation positively, but also that negative effects arise when these incentives are paired with restrictions like salary thresholds. This complexity suggests that the impact of tax incentives is not uniform across all income levels.

Hypothesis 3 explores the differential impacts of tax incentives on innovation across varying income levels among expatriates (Liebig, Puhani, and Sousa-Poza, 2007). The hypothesis discovers that high after-tax salaries boost innovation significantly when targeted at top earners but might inhibit it when applied universally, especially in the presence of a salary threshold.

The empirical findings from all three hypothesis tests indicate the need for a strategic adjustment to the tax regime: the prioritization of the after-tax salary of executives by setting the salary threshold specifically for this group. This approach also aims to mitigate the adverse impacts observed among the top 1% of salary earners, whose substantial after-tax earnings may not correspondingly enhance innovation outputs. Although this prioritization may inadvertently reduce the relative after-tax benefits for median-salary workers, potentially yielding negative effects on overall innovation outputs, it is deemed a necessary trade-off since tax incentive regimes are more effective to highly educated individuals whose average salaries significantly exceed the median (Wagner, 2000; Schmidheiny, 2006). By focusing fiscal incentives on

executives, who are likely to have a more substantial direct impact on innovation, the policy aims to optimize the overall benefits of tax incentives within the economy.

Alternatively, if not increasing or aligning the salary threshold exclusively to executives' levels, countries could consider reducing the annual after-tax salary received by the top 1% salary workers. As discussed in the "Evaluatie 30%-regeling" (2016), this proposal is underpinned by the observation that while users of the 30% scheme can receive a significant portion of their wages tax-free, the actual Extra Territorial Cost (ETK) benefits only marginally increase with higher wages, leading to substantial discrepancies at very high income levels. Reducing the lump sum for these high incomes would ensure a compensation that is more aligned with the actual benefits derived.

The evaluation also considers various strategies for reducing this lump sum, including capping[58] and restriction to fixed salary[59]. Although these measures may lead to a reduction in the after-tax salary of executives, potentially yielding negative implications for innovation, they represent a trade-off that European countries might need to consider, depending on their specific labor market demands. Importantly, this approach does not necessitate reducing the overall benefits package of the tax incentive regimes (Jenssen, 2010). Drawing from Denmark's tax practices[60], countries can establish progressive tax relief systems that maintain or even increase overall tax relief while strategically reducing annual benefits in the long run. This approach is prudent for enhancing the retention of high-skilled labor.

In order to enhance the impact of tax incentives on innovation, it is imperative for nations to thoroughly assess their economic characteristics, labor market dynamics, and prevailing taxation standards. However, there have not been many European countries that have evaluated the effectiveness and efficiency of their tax incentive regimes. One notable exception is the Netherlands, which commissioned an independent consultancy,

[58] This can be accomplished by setting an absolute maximum of the absolute maximum lump sum compensation to be paid. Another option is to only apply the flat-rate scheme to a certain part of the salary.
[59] This can be accomplished by limiting the 'basis' for calculating the maximum allowable tax-free compensation to fixed wages and excluding variable wages such as options and bonuses.
[60] From 2008 to 2011, a qualified person could choose to be taxed at the standard incentive rate of 25% for 36 months or a higher rate of 33% for 60 months.

Dialogic, in 2017 to review its 30% facility for expatriates. The report, 'Evaluatie 30%-regeling' (2016), revealed that approximately 80% of expatriate employees utilize the incentive for five years or less. Additionally, it was noted that a significant portion of the remaining 20% do not stay in the Netherlands temporarily but extend their stay. Comparable facilities in other nations typically offer a tax break for a similar duration of five years. The evaluation also highlighted that the costs intended to be mitigated by the 30% facility decline over time, suggesting that a shorter duration of the facility is not only cost-effective but maintains substantial efficacy.

Subsequent research into tax incentive schemes includes several studies examining the Expat Scheme for Researchers and Key Employees (Ulrich, 2010; Jessen, 2010; Kleven et al., 2011). These studies collectively suggest that while lower taxes significantly motivate the migration of highly skilled workers, the long-term effectiveness of special tax schemes is debatable due to the observed migration of domestically skilled individuals and the low retention rates of expatriate professionals. Currently, Tillväxtanalys[61] is assessing the effectiveness of Sweden's Tax Relief for Key Foreign Employees, which may provide further insights into the optimization of such schemes.

Our research offers a critical framework and a novel perspective for understanding the implications of expatriate tax incentive regimes on the innovative capabilities of European states. As Europe aspires to refine its ambition in expatriate taxation, it is essential for member countries to identify their specific challenges, adopt appropriate solutions, and incorporate best practices from successful implementations.

6.4. Limitations

This chapter discusses the limitations encountered during this study, which are essential for interpreting the findings and guiding future research efforts in expatriate tax incentive regimes.

First, we acknowledge certain biases inherent in the data used for estimating tax reductions. Ideally, the evaluation of tax incentive regimes should utilize direct data such as the income distribution of the regimes' beneficiaries. For instance, the report

[61] Swedish Agency for Growth Policy Analysis, see https://www.tillvaxtanalys.se/inenglish

"Evaluatie 30%-regeling" (2016) highlights that approximately 1,765 to 5,575 additional expatriates were employed in the Netherlands during the study period. Within this group, it is estimated that 1,000 to 4,000 belonged to the income bracket of less than €100,000, 750 to 1,500 fell within the €100,000 to €500,000 range, and 15 to 75 earned above €500,000. Unfortunately, such specific income data were not accessible for further analysis, preventing an accurate assessment of the actual salary levels of applicants and, consequently, the precise magnitude of the tax deductions applicable.

To compensate for this lack of direct data, our approach involved using the median salary figures from the respective countries as proxies within our Tax Models 1 and 2. This methodological choice introduces a potential bias: it likely leads to an underestimation of the tax reduction for applicants whose earnings exceed the median salary and an overestimation for those below it. This limitation underscores the need for more transparent and detailed data to enhance the accuracy of evaluations about tax incentive regimes.

The second limitation of our study pertains to the specificity of our sample selection. In the quantitative analysis segment, we deliberately omitted two distinct categories of expatriates from our evaluation. The first category includes expatriates who qualify as researchers or experts under the key employee tax incentive regime. The second category encompasses those expatriates who are eligible for occupation-specific tax incentives. Notably, individuals within these categories are exempt from meeting standardized salary thresholds, and their qualification for tax incentives is assessed on a case-by-case basis. Consequently, by excluding these two groups, our analysis may not fully capture the comprehensive appeal of the tax incentive regimes. This exclusion potentially leads to an underestimation of the regimes' overall attractiveness, as it omits significant segments of the expatriate population who benefit differently from these regimes.

The final limitation concerns the econometric model used in our study. Our analysis primarily relies on time-fixed effects because we introduced a dummy variable to differentiate between countries with and without expatriate tax incentive regimes. This approach conflicts with the potential application of individual-fixed effects, which were not employed due to the characteristics of our data. Notably, in some countries, the

policy variables are constant over time, which prevents the use of individual-fixed effects in our analysis. As a result, our methodology limits our ability to control for potential country-specific fixed effects in our regression models, potentially compromising the robustness and generalizability of our findings.

7. Conclusion

This study investigates the impact of expatriate tax incentive regimes on innovation, utilizing Ordinary Least Squares (OLS) and fixed effects regression models across diverse national and temporal contexts. The research was structured around three hypotheses, enhanced by robustness checks including governance controls and alternative innovation metrics. Empirical results indicate that the mere existence of expatriate tax incentives does not automatically enhance innovation, challenging the efficacy of broad policy applications and underscoring the need for more detailed analysis. Further examination reveals that the specific features of tax regimes—such as after-tax salaries and threshold multiples—significantly influence innovation, particularly among highly skilled expatriates. This suggests that the effectiveness of tax incentives largely depends on their design and the specific demographic targeted.

The study also demonstrates that while high-income workers significantly contribute to innovation when incentives are well-targeted, universal application of these measures, especially with salary thresholds, can be ineffective or counterproductive. This insight directs toward a strategic reorientation of tax policies to prioritize high-earning executives, maximizing their potential impact on innovation. Our study discusses the possibility of reducing the annual after-tax salary for top earners to better align compensation with actual benefits derived. Such adjustments, including the implementation of caps and fixed salary restrictions, might pose trade-offs that necessitate careful consideration based on specific labor market demands. Furthermore, the research highlights a significant gap in policy evaluation across Europe, with few countries conducting thorough assessments of their tax incentive regimes.

In summary, this thesis provides a nuanced understanding of how expatriate tax incentives influence innovation. It emphasizes the need for strategically tailored and continuously evaluated tax policies that align more effectively with national innovation goals. This research not only informs policy-making but also sets the groundwork for future studies to explore these dynamics further, advocating for the use of richer datasets and broader socioeconomic settings to enhance the generalizability and applicability of the findings.

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9. Appendix

9.1. Expatriate Tax Incentive Regimes

Table 9-1: Key Employee Tax Incentive Regimes in Europe

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
Belgium[62] - Special expatriate tax regime	Exemption from income tax of 30% of the annual gross salary, up to a maximum of €90,000 per year	5 years (with the possibility of a further 3-year extension)	For non-researchers, one must have a gross annual income of at least €75,000. For researchers, one must have a master's degree in a certain expertise area[63] or have at least 10 years of relevant experience in these areas	(1) Jan 2022: Provisions were added to the regime. Key amendments include the minimum gross annual income requirements and Belgian tax resident status; (2) Jan 2024: Only those earning over €75,000 gross (the exception is people who are researchers, for whom the threshold does not apply) per year can benefit from the special tax regime
Denmark[64] - Expat Scheme for Researchers and Key Employees	The scheme allows for a gross tax of 27% + AM contributions, totaling 32.84% of the total salary	7 years	The employee must receive a minimum monthly salary of DKK 75,100 in 2024 after deduction of labour market supplementary pension fund (ATP) contributions	(1) Jan 2011: Until 2011, foreign researchers and key employees could choose to pay either a 25 per cent personal wage tax for three years or a 33 per cent personal wage tax for five years. From 2011, the dual system was abolished, and the scheme was simplified - the gross tax rate became 26 per cent for up to five years; (2) Jan 2018: The validity was further extended to 7 years; The scheme now imposes a gross tax rate of 27% instead of the previous 26%, resulting in a total

[62] See https://www.politico.eu/article/brussels-belgium-parliament-tax-expats-new-regime/ (Accessed in April, 2024).
[63] The areas include agricultural sciences, applied sciences, industrial sciences, medical sciences, natural science pharmaceutical sciences, veterinary sciences and engineering.
[64] See https://skat.dk/en-us/businesses/employees-and-pay/non-danish-labour/tax-scheme-for-researchers (Accessed in April, 2024).

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
				tax burden of 32.84% on the total salary, including AM contributions, compared to 31.92% before the amendments
Finland[65] - Special Tax Rate for Foreign Key Employees	Qualified foreign key employees pay a flat income tax rate of 32%	7 years	For non-researchers, the employee must receive a minimum monthly salary of €5,800. For teachers or researchers in an institute of higher education, there is no minimum salary requirement	(1) Jan 2020: The tax rate for key employees was lowered from 35 percent to 32 percent; (2) Jan 2024: The maximum duration of the applicability of the Special Expatriate Tax-at-Source Regime is increased from 4 years to 7 years
Ireland[66] - Special Assignee Relief Programme (SARP)	Employment earnings over €100,000 are exempt from income tax of 30% of the annual gross salary, up to a maximum of €1,000,000 per year. Qualified employees still have to pay Universal Social Charge (USC)	5 years	The employee must receive a minimum annual salary of €100,000	Jan 2023: The minimum annual salary requirement was raised from €75,000 to €100,000

[65] Sourced from Vero Skatt. See https://www.vero.fi/en/individuals/tax-cards-and-tax-returns/arriving_in_finland/work_in_finland/specific-instructions-for-different-occupations/key_employees_from_other_countrie/ (Accessed in April, 2024)
[66] Sourced from Irish Tax and Customs. See https://www.revenue.ie/en/personal-tax-credits-reliefs-and-exemptions/income-and-employment/special-assignee-relief-programme/how-do-you-calculate-how-much-relief-is-due.aspx (Accessed in April, 2024)

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
	on the full amount of your salary			
Luxembourg[67] - Special Expatriate Tax Regime	There is no difrect tax relief. However, the regime offers partial or total tax exemptions for expenses, whether in kind or cash, directly associated with the expatriation process.	8 years	Earn a fixed annual salary in Luxembourg of at least EUR 100,000	-
Malta[68] - The Highly Qualified Persons Rules	Qualified employees with up to a maximum annual income of €5,000,000 pay a flat income tax rate of 15%	5 years	The minimum income must exceed €98,436 for the basis year 2024	-

[67] See https://guichet.public.lu/en/citoyens/immigration/plus-3-mois/ressortissant-tiers/hautement-qualifie/exoneration-hautement-qualifie.html (Accessed in April, 2024)
[68] Sourced from The Commissioner For Revenue in Malta. See https://cfr.gov.mt/en/inlandrevenue/legal-technical/Pages/Tax-Guidelines-on-Highly-Qualified-Persons-Rules.aspx (Accessed in April, 2024)

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	Validity	Qualification requirements	
Sweden[69] - Tax Relief For Key Foreign Employees	Exemption from income tax of 25% of the annual gross salary	7 years	The gross monthly remuneration should exceed twice the price base amount, which is SEK 114,601 in 2024. If an employee's remuneration rate does not reach the required level, the other way leading to tax relief is if they are an "expert", "researcher" or "other key person", in the eyes of the law.	(1) Jan 2021: The validity, which was first for a period of 3 years, was extended to 5 years; (2) Jan 2024: The validity of the policy was further extended to 7 years

Table 9-2: Universal Expatriate Tax Incentive Regimes in Europe

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	Validity	Qualification requirements	
France[70] - Tax regime for expatriate employees	Exemption from income tax of 30% of the annual gross salary	8 years	-	July 2016: The validity, which was first for a period of 5 years, was extended to 8 years

[69] Sourced from Forskarskattenämnden. See https://forskarskattenamnden.se/andrasprak/taxationofresearchworkersboard/abouttaxrelief.4.14dfc9b0163796ee3e7743e4.html (Accessed in April, 2024)

[70] See https://www.impots.gouv.fr/sites/default/files/media/1_metier/5_international/EV_part/0_transverse/fiche_technique_impatries_gb.pdf (Accessed in April, 2024)

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
Italy[71] - Impatriate Regime	Exemption from income tax of 50% of the annual gross salary	5 years	The worker must be in possession of the high qualification or specialisation requirements defined by specific Italian legislation (a minimum three-year degree or higher educational qualification attested by the country of origin and recognized in Italy)	Jan 2024: For individuals becoming resident from 1 January 2024, relief under the expatriate regime is reduced to 50% from 70% or 90%, with a limit of EUR 600,000 on the amount of income eligible for relief. The relief will now be restricted to highly qualified or specialised individuals (applying the same definition as those who would qualify for a Schengen Blue Card).
The Netherlands[72] - The 30% facility	Exemption from income tax of 30% of the annual gross salary. The tax-free reimbursement will be a maximum of €69,900. (From 1 January 2024, qualified employee will only be entitled to a maximum tax-free reimbursement	5 years	To qualify, an employee must have a specific expertise[73] that is not or hardly found on the Dutch labour market.	(1) Jan 2012: The validity, which was previously for a period of 10 years, was shortened to 8 years; Added minimum salary requirements of €35,048 excluding the tax-free allowance of the 30%-ruling or €26,605 for people who are young than 30 and have a master's degree (2) Jan 2019: The validity of the policy was further extended to 5 years; (3) Jan 2024: The tax-free reimbursement will be limited to a maximum of €69,900, and it will no longer be capped at 30% of the salary for the entire duration of the decision.

[71] See https://taxing.it/italian-impatriates-regime-2024/ (Accessed in April, 2024)
[72] See https://www.belastingdienst.nl/wps/wcm/connect/en/individuals/content/coming-to-work-in-the-netherlands-30-percent-facility (Accessed in March, 2024)
[73] An employee has that expertise if their salary, not including the tax-free allowance in the Netherlands, is more than €46,107 in 2024. Or if an employee is younger than 30, has a Dutch academic master's degree and their salary, not including the tax-free allowance in the Netherlands, is more than €35,048 in 2024

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
	of 30% of the salary for the 1st 20 months of the time period of your decision. The 2nd 20 months, they will be entitled to 20%. And the 3rd 20 months to 10%.)			
Norway[74] - Standard Deduction for Foreign Workers	Exemption from income tax of 10% of the annual gross salary, up to a maximum of NOK 40,000 per year	2 years	-	-
Portugal[75] - Non-Habitual Resident (NHR) regime	Qualified employees pay a flat income tax rate of 20%	10 years	-	Jan 2024: The regime was discontinued
Spain[76] - The Beckham Law (Special	Taxed as a non-resident at a flat rate of 24% on	6 years	-	Jan 2023: The Spanish non-residence period requirement was shortened from 10 years to 5 years

[74] See https://www.euraxess.no/norway/information-assistance/taxation-and-salaries#:~:text=The%20most%20common%20tax%20deductions%20are%3A,income%2C%20maximum%20NOK%2040%20000. (Accessed in April, 2024)
[75] See https://immigrantinvest.com/blog/beneficial-tax-regime-nhr-in-portugal-en/ (Accessed in April, 2024)
[76] Third-party source. See https://www.ags-relocation.com/news/spains-beckham-law-tax-benefits/#:~:text=Named%20after%20the%20famous%20footballer,taking%20up%20employment%20in%20Spain. (Accessed in April, 2024)

Country/ Regime name	Tax incentive regime details			Regime amendments
	Tax reduction	**Validity**	**Qualification requirements**	
Regime for Workers Moving to Spain)	income up to €600,000 (above this threshold, the rate is 47%)			

Table 9-3: Regression Estimates of Tax Model 1 and 2

	Tax Model 1				Tax Model 2			
	OLS	FE (time)	FE (individual)	FE (twoways)	OLS	FE (time)	FE (individual)	FE (twoways)
(Intercept)	0.17 ***				0.16 ***			
NDGS	-0.02	-0.01	-0.07 **	-0.06 *	-0.02	-0.02	-0.07 **	-0.05 *
PTE	0.08 **	0.08 **	0.02	-0.01	0.08 ***	0.08 ***	0.01	-0.01
PLLA	-0.11 ***	-0.11 ***	-0.05	-0.07	-0.07 *	-0.07 *	-0.06	-0.08
ISCP	0.17 ***	0.16 ***	0.22 ***	0.17 ***	0.15 ***	0.12 **	0.23 ***	0.19 ***
TMC	0.20 ***	0.21 ***	0.10 **	0.09 **	0.18 ***	0.19 ***	0.09 *	0.07 .
FDS	0.00	0.00	0.03	0.03	-0.01	-0.01	0.03	0.03
BP	-0.03	-0.03	0.06 *	0.07 .	-0.03	-0.03 .	0.06 *	0.06 .
ABD	0.08 **	0.08 **	NA	NA	-0.02	-0.02	NA	NA
RDPS	-0.05 .	-0.05 .	0.07 *	0.07 *	0.05	0.04	0.06 *	0.06 .
VCE	0.04 *	0.03 .	0.01	0.01	0.04 *	0.04 *	0.01	0.01
DGFR	-0.06 ***	-0.07 ***	0.01	0.01	-0.06 ***	-0.06 ***	0.01	0.01
RDBS	0.20 ***	0.21 ***	0.17 ***	0.14 **	0.18 ***	0.18 ***	0.14 **	0.11 *
NRIE	0.05 *	0.05 **	0.10 ***	0.11 ***	0.03 .	0.04 .	0.10 ***	0.11 ***
IEPE	-0.01	-0.01	0.07 *	0.06 .	0.02	0.01	0.07 *	0.06 .
EICT	0.03	0.03 .	-0.05 *	-0.04 .	0.01	0.01	-0.05 *	-0.03
EICS	0.11 **	0.11 **	-0.14	-0.17 .	0.11	0.11 **	-0.09	-0.14
GDP	0.15 ***	0.14 ***	-0.20 *	-0.29 **	0.09 **	0.08 *	-0.21 *	-0.28 **
Tax Burden	-0.05 *	-0.05 .	-0.04	-0.04	-0.01 **	-0.01	-0.05	-0.05
Yes/No Policy	0.01	0.01	NA	NA				
Validity					0.02	0.02	0.04	0.05
Threshold Multiples					0.14 **	0.14 **	0.14	0.19
Aftertax Salary					0.15 .	0.18 *	0.15 *	0.13
Yes/No Threshold					0.06	0.06	0.02	0.00
Aftertax Salary*Yes/No Threshold					-0.33 ***	-0.35 ***	-0.38 .	-0.39 .
R-squared	0.904	0.904	0.578	0.410	0.920	0.920	0.594	0.434
Adjusted R-squared	0.898	0.895	0.486	0.261	0.913	0.911	0.496	0.277

Note: p-value in parentheses. '***' p < 0.001 '**' p < 0.01 ' *' p < 0.05 ' . ' p < 0.1

Table 9-4: Individual regression Estimates of Regime Components

	Tax Model 2.1				Tax Model 2.2				Tax Model 2.3				Tax Model 2.4			
	OLS	FE (time)	FE (individual)	FE (twoways)	OLS	FE (time)	FE (individual)	FE (twoways)	OLS	FE (time)	FE (individual)	FE (twoways)	OLS	FE (time)	FE (individual)	FE (twoways)
(Intercept)	0.17 ***				0.16 ***				0.17 ***				0.17 ***			
NDGS	-0.02	-0.01	-0.07 **	-0.06 *	-0.02	-0.01	-0.07 **	-0.06 *	-0.02	-0.01	-0.07 **	-0.06 *	-0.02	-0.02	-0.07 **	-0.05 *
PTE	0.08 ***	0.08 ***	0.02	-0.01	0.07 **	0.07 **	0.00	-0.02	0.08 ***	0.08 ***	0.02	-0.01	0.08 **	0.08 **	0.01	-0.01
PLLA	-0.12 ***	-0.12 ***	-0.05	-0.07	-0.09 **	-0.09 **	-0.06	-0.07	-0.13 ***	-0.13 ***	-0.05	-0.07	-0.11 ***	-0.11 ***	-0.06	-0.07
ISCP	0.19 ***	0.17 ***	0.22 ***	0.17 ***	0.17 ***	0.16 ***	0.22 ***	0.18 ***	0.19 ***	0.17 ***	0.22 ***	0.17 ***	0.18 ***	0.16 ***	0.22 ***	0.17 ***
TMC	0.20 ***	0.21 ***	0.10 **	0.09 *	0.21 ***	0.22 ***	0.11 **	0.10 **	0.19 ***	0.20 ***	0.10 **	0.09 **	0.20 ***	0.21 ***	0.11 **	0.10 **
FDS	0.01	0.01	0.03	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.04	0.03	0.00	0.00	0.04 .	0.03
BP	-0.03 .	-0.03 .	0.06 *	0.06 .	-0.02	-0.02	0.06 *	0.07 .	-0.04 *	-0.04 *	0.06 *	0.07 .	-0.03 .	-0.04 .	0.07 *	0.07 .
ABD	0.07 **	0.08 **			0.08 **	0.08 ***	NA	NA	0.06 *	0.06 *	NA	NA	0.08 **	0.08 **	NA	NA
RDPS	-0.03	-0.04	0.07 *	0.07 *	-0.05 .	-0.06 .	0.07 *	0.08 *	0.00	0.00	0.07 *	0.07 *	-0.05 .	-0.06 .	0.07 *	0.07 *
VCE	0.04 *	0.04 .	0.01	0.01	0.04 *	0.04 *	0.01	0.01	0.04 *	0.03 .	0.01	0.01	0.04 *	0.04 .	0.01	0.01
DGFR	-0.06 ***	-0.06 ***	0.01	0.01	-0.07 ***	-0.07 ***	0.01	0.01	-0.04 **	-0.05 **	0.01	0.01	-0.07 ***	-0.07 ***	0.01	0.01
RDBS	0.19 ***	0.19 ***	0.17 ***	0.14 **	0.21 ***	0.21 ***	0.16 ***	0.13 **	0.18 ***	0.18 ***	0.17 ***	0.13 **	0.20 ***	0.21 ***	0.17 ***	0.14 **
NRIE	0.05 **	0.05 **	0.10 ***	0.11 ***	0.04 *	0.04 *	0.11 ***	0.11 ***	0.05 *	0.05 **	0.10 ***	0.11 ***	0.05 *	0.05 **	0.11 ***	0.11 ***
IEPE	-0.02	-0.02	0.07 *	0.06 .	0.01	0.00	0.05	0.05	-0.03	-0.04	0.07 *	0.05	-0.01	-0.01	0.06 .	0.05
EICT	0.03	0.03	-0.05 *	-0.04 .	0.03 .	0.04 *	-0.06 **	-0.04 *	0.02	0.02	-0.05 *	-0.04 .	0.03 .	0.03 .	-0.05 *	-0.04 .
EICS	0.10 **	0.10 **	-0.14	-0.17 .	0.10 **	0.10 **	-0.10	-0.14	0.11 **	0.11 **	-0.14	-0.17 .	0.11 **	0.11 **	-0.14	-0.17 .
GDP	0.16 ***	0.15 ***	-0.20 *	-0.29 **	0.14 ***	0.13 ***	-0.22 *	-0.28 **	0.16 ***	0.16 ***	-0.20 *	-0.28 **	0.15 ***	0.14 ***	-0.20 *	-0.28 **
Tax Burden	-0.06 *	-0.05 *	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.06 **	-0.06 *	-0.04	-0.04	-0.05 *	-0.05 *	-0.04	-0.04
Validity													0.01	0.01	0.04	0.04
Threshold Multiples									0.09 ***	0.09 ***	0.01	0.02				
Aftertax Salary					-0.05	-0.05	0.13 .	0.11								
Yes/No Threshold	0.02	0.02	-0.01	-0.01												
R-squared	0.905	0.905	0.578	0.411	0.905	0.905	0.583	0.415	0.904	0.908	0.578	0.411	0.904	0.904	0.580	0.413
Adjusted R-squared	0.899	0.896	0.485	0.259	0.898	0.896	0.491	0.264	0.898	0.900	0.484	0.259	0.898	0.895	0.487	0.262

Note: p-value in parentheses. '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '.' p < 0.1

Table 9-5: Regression Estimates of Tax Model: Deep Dive

	Tax Model: Deep Dive			
	OLS	FE (time)	FE (individual)	FE (twoways)
(Intercept)	0.12 ***			
NDGS	0.03	0.03	-0.06 **	-0.06 *
PTE	0.05 *	0.05 *	-0.01	-0.01
PLLA	-0.06 *	-0.06 *	-0.06	-0.07
ISCP	0.16 ***	0.16 ***	0.19 ***	0.18 ***
TMC	0.17 ***	0.16 ***	0.09 *	0.08 *
FDS	-0.02	-0.02	0.03	0.03
BP	-0.01	-0.01	0.05	0.06
ABD	0.07 **	0.07 **	NA	NA
RDPS	0.00	-0.01	0.09 *	0.08 *
VCE	0.02	0.02	0.01	0.01
DGFR	-0.04 **	-0.04 *	0.01	0.01
RDBS	0.16 ***	0.16 ***	0.14 **	0.14 **
NRIE	0.06 ***	0.07 ***	0.10 ***	0.11 ***
IEPE	-0.02	-0.02	0.06 .	0.06 .
EICT	0.03 .	0.03 .	-0.05 *	-0.04 .
EICS	0.09 **	0.08 *	-0.16 .	-0.16 .
GDP	0.10 **	0.09 **	-0.26 *	-0.31 **
Tax Burden	-0.01	-0.01	-0.04	-0.04
Aftertax Salary 50	0.26 ***	0.28 ***	-0.05	0.03
Aftertax Salary 10	-0.07	-0.08	-0.01	-0.03
Aftertax Salary 1	-0.20 ***	-0.21 ***	0.02	0.10
Aftertax Salary Executives	0.09 .	0.10 .	0.13	-0.01
R-squared	0.924	0.925	0.586	0.413
Adjusted R-squared	0.918	0.917	0.488	0.253

Note: p-value in parentheses. '***' p < 0.001 '**' p < 0.01 ' *' p < 0.05 ' . ' p < 0.1

Table 9-6: Robustness Test 1 of Governance Control

	Tax Model 2		Tax Model: Deep Dive	
	FE		FE	
NDGS	-0.02		0.03	
PTE	0.08	***	0.04	.
PLLA	-0.07	*	-0.06	*
ISCP	0.12	**	0.14	***
TMC	0.19	***	0.17	***
FDS	-0.01		-0.02	
BP	-0.03		-0.01	
ABD	-0.02		0.06	**
RDPS	0.04		-0.02	
VCE	0.04	*	0.02	
DGFR	-0.06	***	-0.04	**
RDBS	0.18	***	0.16	***
NRIE	0.04	.	0.07	***
IEPE	0.01		-0.02	
EICT	0.01		0.03	
EICS	0.11	**	0.06	.
GDP	0.08	*	0.08	.
GOV	0.00		0.06	*
Tax Burden	-0.01		-0.01	
Validity	0.02			
Threshold Multiples	0.14	**		
Aftertax Salary	0.18	*		
Yes/No Threshold	0.06			
Aftertax Salary*Yes/No Threshold	-0.35	***		
Aftertax Salary 50			0.27	***
Aftertax Salary 10			-0.07	
Aftertax Salary 1			-0.21	***
Aftertax Salary Executives			0.09	
R-squared	0.920		0.93	
Adjusted R-squared	0.911		0.917	

*Note: This table reports the robust test by introducing governance control. The variable GOV is the governance control variable. Column (1, FE) is based on the regression estimates of Equation 5-3, and Column (2, FE) is based on the regression estimates of Equation 5-4. P-value in parentheses. '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '. ' p < 0.1*

Table 9-7: Robustness Test 2 of Alternative Innovation Output Measure

	Tax Model 2		Tax Model: Deep Dive	
	FE		FE	
NDGS	-0.03		-0.05	
PTE	-0.03		-0.01	
PLLA	-0.25	***	-0.11	**
ISCP	0.35	***	0.27	***
TMC	0.00		0.03	
FDS	0.04		0.01	
BP	-0.06	**	-0.04	.
ABD	0.10	**	0.05	.
RDPS	-0.03		-0.06	
VCE	0.04	.	0.03	
DGFR	0.02		-0.03	
RDBS	0.17	***	0.24	***
NRIE	0.06	**	0.04	
IEPE	-0.27	***	-0.19	***
EICT	-0.10	***	-0.07	**
EICS	0.48	***	0.45	***
GDP	0.51	***	0.44	***
Tax Burden	-0.15	***	-0.05	
Validity	0.01			
Threshold Multiples	0.20	***		
Aftertax Salary	-0.08			
Yes/No Threshold	-0.04			
Aftertax Salary*Yes/No Threshold	0.24	*		
Aftertax Salary 50			0.02	
Aftertax Salary 10			0.05	
Aftertax Salary 1			-0.39	***
Aftertax Salary Executives			0.43	***
R-squared	0.915		0.89	
Adjusted R-squared	0.905		0.882	

*Note: This table reports the robust test by adopting another Innovation Output measurement. The dependent variable is replaced by the output subindex of Global Innovation Index. Column (1, FE) is based on the regression estimates of Equation 5-3, and Column (2, FE) is based on the regression estimates of Equation 5-4. P-value in parentheses. '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '.' p < 0.1*