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Employment of PhD Holders in Greece Based on the 2011 and 2021 Censuses: Changes, Gender Differences, and Demographic Dynamics

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Abstract

This study examines the employment status of doctorate holders in Greece based on data from the 2011 and 2021 population censuses conducted by ELSTAT. It investigates gender and temporal differences in economic activity, distinguishing between active and inactive individuals and further categorising them into subgroups (e.g., employed, unemployed, retirees, students, homemakers). Statistical analysis includes the Chi-square test and Cramér's V to assess significance and strength of association. The findings reveal a statistically significant but very weak relationship between gender and economic activity (Cramér's V = 0,007). In contrast, a more substantial shift is observed over time, with an increase in economically active PhD holders from 2011 to 2021 (Cramér's V = 0,090, p < 0,001). Gender disparities are more evident among the economically inactive, particularly retirees and housekeepers (Cramér's V = 0,303). The results highlight evolving employment patterns among PhD holders over the last decade, reflecting broader socio-economic and gender-related dynamics. These insights contribute to ongoing research on doctoral employment and offer evidence to inform policies in higher education, labor market integration, and gender equality in Greece.

Keywords
Doctorate holders, Employment outcomes, Census data, Labor market, Gender differences, Human capital.

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Introduction

The employment of doctorate holders has become an area of increasing scholarly and policy interest, particularly at a time when the labor market is undergoing profound transformations under the pressure of socio-economic, technological, and institutional changes. Although PhD holders demonstrate the highest employment rates across all education levels—an average of 92% among OECD countries for individuals aged 25–64 (OECD, 2022; Hnátková et al., 2022) - the quality and stability of such employment are not equally guaranteed, especially for younger generations.

International data indicate that while doctoral graduates maintain strong employability, their career trajectories are increasingly diverging from traditional academic paths (OECD, 2022). Limited absorption capacity in education and research sectors has led to diversified career destinations, with many PhD holders employed in the private sector, consultancy, or industry (Robinson-Garcia et al., 2016). The literature emphasises the growing importance of interdisciplinarity, adaptability, and transferable skills for professional success (Pizzolato et al., 2023; Sala-Bubaré et al., 2023). Significant differences in employment and job satisfaction are observed across academic fields. Doctoral graduates in Engineering and Computer Science predominantly work in industry and services, reporting lower satisfaction in terms of knowledge application compared to those employed in universities or public research centres (Alfano, 2021). In contrast, graduates from the social sciences and humanities face greater challenges in securing positions that match their qualifications and salary expectations (Boulos, 2016). Moreover, PhDs from STEM disciplines generally enjoy better career outcomes than those from softer fields, such as sociology (Passaretta, 2018; Daouli, 2015). Investigating the link between field of study and career trajectory is therefore crucial to understanding patterns of PhD employment.

At the same time, gender remains a persistent axis of inequality within doctoral employment. Research consistently demonstrates that women are less likely to occupy leadership roles, more frequently hold precarious or part-time positions, and are underrepresented in STEM-related entrepreneurship (Van den Brink & Benschop, 2014; ERC, 2021; European Commission, 2024a). She Figures (2021, 2024) indicate that although parity between men and women has largely been achieved at the level of doctoral graduation, inequalities re-emerge and widen during the transition to the labor market (EKT, 2022; European Commission, 2021b, 2024b). Other studies further show

that specialised skills, previous academic experience, and professional networks affect men and women differently, often to the disadvantage of women, particularly in research-intensive careers (Herrera, 2016; Pham, 2023). These findings highlight the importance of institutional policies that support not only access to doctoral education but also equitable career advancement thereafter.

The gap between doctoral graduates' expectations during their studies and the actual conditions of employment highlights a broader misalignment between the design of doctoral education and the realities of the labor market. Many PhD holders end up working outside their field of specialization - often in roles that do not require a doctoral degree - leading to feelings of frustration and underutilisation of their professional potential (Hasgall et al., 2022).

In this context, international scholarship increasingly focuses on the need to realign doctoral education with the changing structure of the labor market and the evolving expectations of employers. Germain-Alamartine and Moghadam-Saman (2020) emphasise that the employability of PhD graduates depends on the degree to which doctoral programmes integrate transferable skills and establish meaningful links with industry and regional innovation systems. Similarly, Jones (2018) identifies a global shift towards more practice-oriented and professionally relevant doctoral programmes, which combine advanced research training with employability-driven competencies. These developments challenge traditional perceptions of the doctorate as a purely academic qualification and position it instead as a bridge between the research community and the wider economy.

Within the European Higher Education Area (EHEA), recent studies reveal an intensified debate over the aims and outcomes of doctoral education. Stamelos, Vassilopoulos, Kavasakalis, and Diakhaté (2025) highlight the case of Greece, where doctoral studies increasingly converge with European standards, yet structural challenges persist in connecting doctoral training with labour market demands. Comparative studies in other European countries show similar tensions: in Portugal, doctoral education is undergoing reforms to strengthen links with socio-economic needs and enhance graduates' career prospects (Chaleta & Semedo, 2025), while in Sweden, doctoral education is explicitly framed as a national investment for innovation and growth (Gougoulakis, 2025). Together, these studies underline the ongoing transformation of doctoral education systems towards models that promote employability, interdisciplinarity, and societal impact.

Despite such international progress, evidence suggests that many countries - especially in Southern Europe - continue to face difficulties in ensuring effective career transitions for PhD holders. The Greek case thus offers a particularly interesting example of how broader European trends interact with national realities. Understanding these dynamics can help to identify both the structural constraints and the potential policy pathways that could strengthen the employability of doctoral graduates in Greece.

Scientific emigration - or "brain drain" - has become a persistent trend and a defining characteristic of the Greek reality, with a substantial share of PhD holders leaving the country in search of better employment opportunities abroad (Deutsche Welle, 2019). Although this phenomenon is not necessarily negative - as it provides international experience and professional development opportunities - it raises concerns about the loss of highly skilled human capital and the long-term impact on the country's research capacity (Chalari & Koutantou, 2021).

Internationally, there is a growing trend of PhD holders moving beyond academia: in the United States, 60,4% are now employed in non-academic sectors, while in Finland the figure reaches 68%, and in the United Kingdom 53% (NCSES, 2021; University of Helsinki, 2023; Boman et al., 2017). The causes of this shift are twofold: a shrinking number of permanent academic positions and the increasing need for PhD holders to seek alternative career pathways. However, transitions into non-academic sectors are not always adequately supported. The lack of career guidance, limited market connections, and insufficient institutional structures that encourage the development of transferable skills contribute to the difficulty of career transitions (Kindsiko & Vadi, 2018). At the same time, a growing number of PhD holders report satisfaction with alternative career paths—provided these offer key elements such as employment stability, career development, and social contribution. The perception that only academic careers bring prestige or fulfilment is increasingly being challenged, with contemporary research highlighting high levels of job satisfaction among PhD holders employed outside academia (Sala-Bubaré et al., 2022).

In Greece, the absence of mechanisms to monitor and document the professional pathways of PhD holders makes it difficult to draw firm conclusions. Within this context, the population censuses conducted by ELSTAT in 2011 and 2021 provide a rare opportunity to comparatively examine employment trends among doctorate holders in Greece. These datasets constitute a unique source of information, enabling a mapping

of the relationship between employment status, gender, sector of economic activity, and temporal change.

This study seeks to map the employment status of PhD holders in Greece, drawing on comparative data from the 2011 and 2021 censuses. Specifically, it examines the relationships between gender, census year, and sector of economic activity with the employment status of doctorate holders. The aim is both to understand the emerging dynamics and to contribute to the development of targeted and effective policies that promote their employability.

1. Research Methodology

1.1 Research Design

This study adopts a quantitative approach and is based on the analysis of secondary data. The data used was drawn from the two most recent general population censuses conducted by the Hellenic Statistical Authority (ELSTAT) in 2011 and 2021 (ELSTAT, 2011; ELSTAT, 2021).

1.2 Data Processing

The data were processed using the statistical software package SPSS v20. The first part of the analysis presents descriptive statistics of the selected variables. This is followed by inferential statistical analysis, which was applied to answer the research questions. The results were computed, and conclusions were drawn based on the available dataset.

2. Results

2.1 Analysis of the Relationship between Gender and Employment Status among PhD Holders in Greece

This analysis examined whether a statistically significant relationship exists between gender and employment status (economically active or inactive) among Greek PhD holders, using data from the 2011 and 2021 ELSTAT population censuses.

According to ELSTAT's official labour-market classification - harmonised with Eurostat and ILO standards - economically active individuals are those employed or seeking employment, while economically inactive refers to persons outside the labor force (ELSTAT, 2023; ILO, 2018).

A total of 114800 doctorate holders were recorded (Table 1), comprising 61,2% men (70278) and 38,8% women (44522). Among the 87334 economically active, 61,0% were men and 39,0% women, while among the 27466 economically inactive the proportions were 61,8% men and 38,2% women. These minimal deviations from the overall population ratios indicate a nearly identical gender distribution across both categories.

Table 1: *Cross-tabulation of Occupational Status and Gender among PhD Holders in Greece*

			Gender		**Total**
			Male	Female	
occupation_status	economically active	Count	53299	34035	87334
		Expected Count	53463,9	33870,1	87334,0
		% within occupation_status	61,0%	39,0%	100,0%
	economically inactive	Count	16979	10487	27466
		Expected Count	16814,1	10651,9	27466,0
		% within occupation_status	61,8%	38,2%	100,0%
Total		Count	70278	44522	114800
		Expected Count	70278,0	44522,0	114800,0
		% within occupation_status	61,2%	38,8%	100,0%

The Chi-square (χ^2) test of independence (Appendix A, Table A1) yielded $p = 0,019 < 0,05$, signifying a statistically significant association between gender and employment status. However, the effect size was negligible (Cramér's $V = 0,007$; Appendix A, Table A2). This significance largely reflects the very large sample rather than a meaningful difference, as the proportion of men differs by only 0,8 percentage points between the two groups (61,0% vs 61,8%).

In conclusion, while the test identifies a statistically significant link between gender and employment status, the association's minimal strength implies that gender does not substantially determine whether a PhD holder is economically active or inactive.

This finding carries two implications: first, that PhD holders in Greece - both men and women - display similar participation rates in the labor market, reflecting a relatively equitable access to employment opportunities; and second, that potential gender disparities are likely to emerge not in overall labor force participation but in specific aspects of employment quality, such as contract type, position level, or career

progression. These dimensions merit further investigation to fully capture gender dynamics among highly educated populations.

2.2 Correlation Analysis Between Census Year and Employment Status of PhD Holders in Greece

This analysis examined the association between census year (2011, 2021) and the employment status of Greek PhD holders using the Chi-square (χ^2) test of independence. The dataset included 114800 valid observations classified by census year and economic activity (economically active or inactive).

As shown in Table 2, significant temporal changes occurred over the decade. In 2011, 81,2% of PhD holders were economically active and 18,8% inactive, whereas in 2021 the active share fell to 73,2% and the inactive rose to 26,8%. This eight-point decline suggests a contraction in doctoral participation in the labor force, potentially linked to population ageing, retirements, and limited employment opportunities for younger PhD holders.

Expected frequencies deviated notably from the observed figures, especially in 2021, with fewer active and more inactive PhD holders than anticipated, reflecting an expanding inactive scientific workforce. Interpreted within the broader socio-economic context - marked by the financial crisis, recession, public-sector contraction, and the COVID-19 pandemic - these trends indicate deteriorating labour-market conditions for highly skilled researchers.

Table 2:
Cross-tabulation of Occupational Status and Census Year among PhD Holders in Greece

			occupation_status		**Total**
			economically active,	economically inactive	
Year	2011	Count	33533	7779	41312
		Expected Count	31428,1	9883,9	41312,0
		% within Year	81,2%	18,8%	100,0%
	2021	Count	53801	19687	73488
		Expected Count	55905,9	17582,1	73488,0
		% within Year	73,2%	26,8%	100,0%
Total		Count	87334	27466	114800
		Expected Count	87334,0	27466,0	114800,0
		% within Year	76,1%	23,9%	100,0%

The Chi-square test (Appendix A, Table A3) produced $\chi^2 = 920,51$, df = 1, $p < 0,001$, confirming a statistically significant relationship between census year and

employment status. Complementary tests (continuity correction = 920,08; likelihood ratio = 944,70; Fisher's exact $p < 0,001$) reinforced this finding. The strength of association, however, was weak (Phi and Cramer's $V = 0,09$; $p < 0,001$; Appendix A, Table A4).

In conclusion, the census year significantly affects the employment status of PhD holders, but the weak strength of association indicates that temporal change alone does not explain the variation. Broader structural and economic factors—such as austerity measures, shifting public funding priorities, and limited academic openings—likely played a more decisive role.

From a policy perspective, this finding highlights the need to strengthen long-term labor-market integration mechanisms for PhD holders in Greece. The decline in economic activity, combined with the increasing proportion of inactive doctorates, suggests the underutilisation of highly skilled human capital, underscoring the urgency of policies that link research qualifications with sustainable employment opportunities.

2.3 Correlation Analysis Between Gender and Economically Active PhD Holders in Greece

This analysis examined the association between gender (male, female) and the employment status of economically active PhD holders (employed, formerly employed, newly unemployed) using the Chi-square (χ^2) test of independence.

According to ELSTAT and ILO standards, the economically active population includes both employed and unemployed individuals - those working or actively seeking work - thus the "newly unemployed" category is part of the active, not inactive, labor force (ELSTAT, 2023; ILO, 2018). The dataset contained 87335 valid observations.

Census data from 2011 and 2021 (Table 3) show high labor-market absorption among PhD holders, with limited gender variation. Among men, 95,8% were employed, 3,0% formerly employed, and 1,1% newly unemployed; among women, the figures were 95,0%, 3,8%, and 1,2%, respectively. Slight overrepresentation of women among the formerly employed may indicate structural barriers such as work–family conflicts or persistent gender inequalities in academia.

Overall, the vast majority of economically active PhD holders - regardless of gender - are employed, underscoring the strong integration of this group into the labor market. Nevertheless, the somewhat higher proportions of women among the formerly

employed and recently unemployed suggest that gender continues to exert a limited yet discernible influence on career trajectories. These findings highlight the need for further investigation into gendered employment patterns at the highest levels of education, along with the formulation of targeted equal-opportunity policies aimed at enhancing women's participation across scientific and professional fields.

Table 3: *Cross-tabulation of gender and economic activity among PhD holders in Greece*

			Economically Active			**Total**
			Employed	Formerly Employed	Newly Unemployed	
Gender	Male	Count	51078	1616	606	53300
		Expected Count	50899,1	1772,9	628,0	53300,0
		% within Gender	95,8%	3,0%	1,1%	100,0%
	Female	Count	32323	1289	423	34035
		Expected Count	32501,9	1132,1	401,0	34035,0
		% within Gender	95,0%	3,8%	1,2%	100,0%
Total		Count	83401	2905	1029	87335
		Expected Count	83401,0	2905,0	1029,0	87335,0
		% within Gender	95,5%	3,3%	1,2%	100,0%

The Chi-square test (Appendix A, Table A5) produced $\chi^2 = 39{,}22$, df = 2, $p < 0{,}001$, confirming a statistically significant association between gender and employment status. Supporting statistics (likelihood ratio = 38,70; linear-by-linear association = 25,18; all $p < 0{,}001$) corroborated the result. However, the effect size was negligible (Phi and Cramer's V = 0,021; $p < 0{,}001$; Appendix A, Table A6).

In sum, while statistical tests indicate a significant link between gender and employment status, the relationship is extremely weak. Men display slightly higher employment rates, whereas women are marginally more represented among the formerly employed and recently unemployed. These minor deviations lack practical significance but nonetheless suggest that subtle gendered dynamics persist within the employment patterns of Greece's highly educated population.

2.4 Correlation Analysis Between Census Year and Economically Active PhD Holders in Greece

This analysis examined the relationship between census year (2011, 2021) and the employment status of economically active PhD holders (employed, formerly employed, newly unemployed) using the Chi-square (χ^2) test of independence. The dataset comprised 87335 valid observations, with no missing data.

Comparative analysis of census data (Table 4) reveals clear improvements in the employment outcomes of PhD holders over the decade. In 2011, 94,4% were employed, 3,7% formerly employed, and 2,0% newly unemployed. By 2021, the proportion of employed individuals had risen to 96,2%, while formerly employed decreased to 3,1% and newly unemployed fell sharply to 0,7%. This shift indicates a significant decline in unemployment and higher labor-market retention among doctoral graduates.

Expected and observed frequencies diverged slightly, particularly in 2021, when the number of employed individuals exceeded expectations and the newly unemployed fell well below them - signalling an increasingly resilient doctoral labor market. In contrast, the 2011 data, collected during the economic crisis, show almost twice the expected rate of new unemployment, reflecting the impact of austerity and hiring restrictions, especially in academia and the public sector.

Table 4:
Cross-tabulation of Census Year and Economically Active among PhD Holders in Greece

			Economically Active			**Total**
			Employed,	Formerly Employed,	Newly Unemployed	
Year	2011	Count	31641	1231	661	33533
		Expected Count	32022,5	1115,4	395,1	33533,0
		% within Year	94,4%	3,7%	2,0%	100,0%
	2021	Count	51760	1674	368	53802
		Expected Count	51378,5	1789,6	633,9	53802,0
		% within Year	96,2%	3,1%	0,7%	100,0%
Total		Count	83401	2905	1029	87335
		Expected Count	83401,0	2905,0	1029,0	87335,0
		% within Year	95,5%	3,3%	1,2%	100,0%

The χ^2 test (Appendix A, Table A7) yielded $\chi^2 = 317,33$, df = 2, $p < 0,001$, indicating a statistically significant association between year and employment status. Supporting tests (likelihood ratio = 306,70; linear-by-linear association = 262,95; all p <

0,001) confirmed this result. However, the strength of association was weak (Phi and Cramer's V = 0,06; p < 0,001; Appendix A, Table A8).

The results show that although the change in employment status from 2011 to 2021 is statistically significant, the strength of this association is not particularly strong. This suggests that the observed shifts in employment status (e.g., increase in employment, reduction in new unemployment) are not solely attributable to the year but are likely the result of other factors influencing employment. Furthermore, the relatively small value of Cramer's V suggests that this relationship may have limited practical significance despite its statistical relevance.

Overall, the results highlight a clear positive evolution in the employment status of PhD holders in Greece over the 2011–2021 decade. The reduction in unemployment, the stabilisation of employment, and the containment of workforce exits indicate increased demand for highly specialised individuals. These findings reaffirm the critical role of PhD holders in the national research and production systems, underscoring the necessity for continued policy support and better utilisation of this highly skilled human capital.

2.5 Correlation Analysis Between Gender and Economically Inactive PhD Holders in Greece

This analysis examined the relationship between gender (male/female) and the economically inactive population of Greek PhD holders—classified as Students, Retirees, Income Recipients, Homemakers, and Others - using the Chi-square (χ^2) test of independence. The dataset comprised 27466 valid observations, with no missing values.

The distribution of economically inactive PhD holders reveals distinct gender-based patterns in the reasons for withdrawal from the labor market (Table 5). Among men, the majority (83,9%) are retirees, while smaller proportions are students (4,3%), income recipients (2,3%), or classified under "Others" (8,6%), which includes individuals inactive due to health issues, volunteer work, or other causes. Men's participation in the "Household" category is minimal (1%).

Women show a more diverse profile: although most are also retirees (74,3%), a substantial proportion (15,3%) are in the "Household" category - a rate over twice the expected value - indicating persistent gendered divisions of labor even among the highly educated. Female PhD holders are also slightly overrepresented among students

(6%), suggesting continued academic engagement or retraining. Conversely, women are underrepresented among income recipients (1,5%) and the "Others" category (2,9%).

Overall, these results indicate that men typically exit the labor market primarily through retirement, whereas women display a broader range of reasons for inactivity, often linked to unpaid domestic responsibilities. The elevated proportion of women classified as homemakers underscores the continuing influence of social and cultural norms shaping female labor participation.

Table 5: *Cross-tabulation of Gender and Economically Inactive among PhD Holders in Greece*

			Economically Inactive					**Total**
			Students	Retirees	Individuals living on private income	Homemakers	Others	
Gender	Male	Count	729	14238	385	166	1462	16980
		Expected Count	836,5	13620,6	336,9	1093,6	1092,4	16980,0
		% within Gender	4,3%	83,9%	2,3%	1,0%	8,6%	100,0%
	Female	Count	624	7794	160	1603	305	10486
		Expected Count	516,5	8411,4	208,1	675,4	674,6	10486,0
		% within Gender	6,0%	74,3%	1,5%	15,3%	2,9%	100,0%
Total		Count	1353	22032	545	1769	1767	27466
		Expected Count	1353,0	22032,0	545,0	1769,0	1767,0	27466,0
		% within Gender	4,9%	80,2%	2,0%	6,4%	6,4%	100,0%

The Chi-square test (Appendix A, Table A9) confirmed a statistically significant association between gender and economic inactivity ($\chi^2 = 2515,92$, df = 4, $p < 0,001$). Supporting tests - the Likelihood Ratio (2641,24) and Linear-by-Linear Association (65,67), both with $p < 0,001$ - corroborated this result. The strength of the association, measured by Phi and Cramer's V (both = 0,303, $p < 0,001$; Appendix A, Table A10), indicates a moderate effect size.

In summary, gender is significantly and moderately associated with economic inactivity among Greek PhD holders. Men predominantly retire from the workforce, while women are overrepresented in the household category, reflecting enduring structural and cultural inequalities. These patterns highlight the persistence of gendered

role allocation, even at the highest educational levels, and underscore the need for policies that recognise unpaid labor and promote equal participation in the workforce.

2.6 Correlation Analysis Between Year and Economically Inactive PhD Holders in Greece

This analysis examined the relationship between census year (2011, 2021) and the economically inactive population of Greek PhD holders - classified as Students, Retirees, Income Recipients, Homemakers, and Others - using the Chi-square (χ^2) test of independence. The dataset comprised 27466 valid observations, with no missing values.

The comparative analysis reveals marked changes in the structure of economic inactivity between the two census years (Table 6). In 2011, retirees accounted for 72% of inactive PhD holders, students 8%, homemakers 6,1%, income recipients 1,8%, and "others" 12,1%. A decade later, in 2021, retirees had risen sharply to 83,5%, while students declined to 3,7% and "others" fell to 4,2%. The proportion of homemakers increased slightly to 6,6%, and income recipients remained stable at around 2%.

These changes suggest that the inactive PhD population in Greece has undergone an evident ageing process, with retirement emerging as the dominant reason for non-participation in the labor force. The simultaneous decrease in students and "others" likely reflects the stabilisation and maturity of the PhD-holder population, as earlier cohorts exit the workforce and fewer younger doctorates remain in transition. The decline of the "others" category may also indicate improved labor-market integration or better social support mechanisms enabling re-entry into work.

Comparison between observed and expected values shows that, in 2011, students and "others" were overrepresented and retirees underrepresented, while in 2021 this pattern was reversed - retirees far exceeded expected counts, with the rest underrepresented. This inversion highlights a structural demographic shift rather than short-term labor fluctuations.

Table 6:

Cross-tabulation of Genus Year and Economically Inactive among PhD Holders in Greece

			Economically Inactive					**Total**
			Students	Retirees	Individuals living on private income	Homemakers	Others	
Year	2011	Count	622	5599	143	477	938	7779
		Expected Count	383,2	6240,0	154,4	501,0	500,5	7779,0

		% within Year	8,0%	72,0%	1,8%	6,1%	12,1%	100,0%
	2021	Count	731	16433	402	1292	829	19687
		Expected Count	969,8	15792,0	390,6	1268,0	1266,5	19687,0
		% within Year	3,7%	83,5%	2,0%	6,6%	4,2%	100,0%
Total		Count	1353	22032	545	1769	1767	27466
		Expected Count	1353,0	22032,0	545,0	1769,0	1767,0	27466,0
		% within Year	4,9%	80,2%	2,0%	6,4%	6,4%	100,0%

The Chi-square test (Appendix A, Table A11) confirmed a statistically significant association between census year and economic inactivity ($\chi^2 = 835,94$, df = 4, $p < 0,001$). Supporting tests (Likelihood Ratio = 761,85; Linear-by-Linear Association = 225,00; all $p < 0,001$) validated the result. The strength of the relationship, measured by Phi and Cramer's V (both = 0,174, $p < 0,001$; Appendix A, Table A12), indicates a weak to moderate association, consistent with medium demographic effects.

In summary, while the association between census year and economic inactivity is statistically significant, its intensity is moderate - reflecting the gradual demographic ageing of the doctoral population rather than abrupt socio-economic disruptions. The dominant presence of retirees in 2021, coupled with the sharp decline in students and "others," suggests the stabilisation of academic and professional pathways and possibly improved integration of younger PhD holders into employment.

These findings underscore the need for targeted public policies to support PhD holders at transitional career stages, particularly women and individuals temporarily inactive due to caregiving or health reasons. Continuous monitoring of these trends is essential to ensure that Greece fully utilises its highly educated human capital in research, innovation, and the broader economy.

3. Conclusions

The analysis of ELSTAT data from the 2011 and 2021 population censuses regarding PhD holders in Greece provides a multidimensional view of the transformations that occurred in their employment patterns over the decade. Through statistical processing,

key trends emerge concerning gender, census year, and the specific subcategories of economically active and inactive doctorate holders.

Firstly, the share of economically active PhD holders declined from 81,2% in 2011 to 73,2% in 2021. Although this decrease is statistically significant, its intensity is weak, suggesting that, beyond temporal variation, additional factors - such as age distribution, structural changes in the labor market, and sectoral employment opportunities - affect the overall level of economic participation. Similar tendencies have been observed internationally, where PhD employability remains high but with growing instability and diversification of career trajectories (OECD, 2022; Germain-Alamartine & Moghadam-Saman, 2020).

The gender distribution shows that men continue to outnumber women, with proportions remaining relatively stable (61% men, 39% women). While the statistical association between gender and economic activity is significant but weak, the persistence of small yet consistent gender differences echoes broader European evidence of unequal career advancement between male and female PhD holders (European Commission, 2024b; Van den Brink & Benschop, 2014). Within the economically active group, both genders display very high employment rates (over 95%), although women record slightly higher unemployment and early labor market exit, a finding that may reflect social expectations and the unequal distribution of care responsibilities - patterns identified in other European countries as well (ERC, 2021).

Between 2011 and 2021, the employment status of economically active PhD holders appears to have improved: the proportion of employed individuals increased from 94,4% to 96,2%, while the rate of newly unemployed was reduced by half (from 2,0% to 0,7%). Despite the weak correlation strength, this evolution aligns with recent literature highlighting gradual diversification and improved labor market absorption of doctoral graduates through roles outside academia, particularly in the private and research-intensive sectors (Robinson-Garcia et al., 2016; Sala-Bubaré et al., 2023).

More pronounced differences appear within the economically inactive population, where gender disparities are clearer. Among men, the majority are retirees (83,9%), while among women this share drops to 74,3%, accompanied by a notable increase in those classified under “household responsibilities” (15,3%). The association between gender and non-employment categories is statistically significant and of moderate intensity, confirming that social and institutional structures continue to influence women’s professional participation. This mirrors international findings

showing that, even among the most educated groups, gendered divisions of labor persist (Herrera, 2016; Pham, 2023).

The comparison across census years also reveals an ageing doctoral population, with retirees increasing from 72% in 2011 to 83,5% in 2021, while the shares of students and those in "Other" categories decreased. These changes suggest a stabilisation and maturation of the PhD-holder population in Greece. Although such demographic trends are common across advanced economies (OECD, 2022), they raise important questions about generational renewal in the research and higher education systems.

Overall, the findings indicate that while the participation of PhD holders in the Greek labour market remains relatively high, notable variations linked to gender and ageing persist. Weak but consistent associations point to structural issues rather than random variation, reflecting social roles and institutional dynamics similar to those documented elsewhere in Europe (European Commission, 2024a; Sala-Bubaré et al., 2022). The high proportion of retirees highlights the need for policies promoting generational renewal and stronger links between doctoral education and employment systems.

Future research should explore micro-level factors influencing employability - such as field of study, research experience, and the role of transferable skills - in order to better understand how individual and structural variables interact. Policy interventions could focus on strengthening doctoral career development frameworks, enhancing collaboration between universities and the private sector, and promoting gender-sensitive measures that enable equal professional participation. These actions would contribute to the more effective integration of highly skilled human capital into the national economy, aligning the Greek context with broader European objectives for inclusive and innovation-driven growth.

4. Policy Implications and Recommendations

The findings of this study highlight important developments and enduring challenges concerning the employment and integration of PhD holders into the Greek labor market. Between 2011 and 2021, the number and proportion of economically active doctorate holders increased, signalling a gradual recovery from the economic crisis and improved absorption of highly educated individuals into the workforce. This trend reflects broader

European patterns that emphasise the growing demand for advanced qualifications in knowledge-based economies (European Commission, 2021a).

Despite this progress, persistent gender disparities - particularly among economically inactive subgroups such as retirees and homemakers - underscore the need for targeted interventions to enhance equality in access and career progression. Women remain underrepresented in high-level research and innovation positions and are more concentrated in lower-paying sectors with limited mobility, such as the social sciences (EKT, 2022; Psacharopoulos, 2016; Pouliakas & Livanos, 2008). Moreover, their participation in business-sector R&D continues to lag behind that of men (EKT, 2015).

The consistent overrepresentation of PhD holders in the public sector, combined with their limited engagement in private sector employment and entrepreneurship, highlights structural mismatches between doctoral education and labor market demand (EKT, 2023; Labrianidis et al., 2022). These findings support international evidence pointing to underemployment and skill mismatch, particularly in Southern Europe and post-crisis contexts (Triguero & Suárez, 2024; Dias Lopes & Hancock, 2024).

To address these issues, the following policy recommendations are proposed:

- Develop longitudinal tracking systems to monitor PhD career outcomes and inform data-driven policy planning. Resources such as the National Archive of PhD Theses could serve as foundational tools for such efforts (EKT, 2023).
- Align doctoral training with national priority sectors, including digital transformation, green growth, energy, and education, to enhance the relevance and societal impact of doctoral research.
- Promote doctoral employment beyond academia, encouraging the integration of PhD holders into small and medium-sized enterprises (SMEs), regional development bodies, and social innovation organisations.
- Support intersectoral mobility through postdoctoral fellowships and collaborative research programmes with private-sector actors, fostering knowledge transfer and professional adaptability.
- Enhance gender equality measures, including flexible working arrangements and leadership development opportunities for women in research and innovation fields.

These recommendations contribute to the broader discourse on the role of doctoral education in advancing sustainable economic development, social cohesion, and innovation. Ensuring the full and equitable utilisation of PhD-level human capital is

essential to boosting national productivity and resilience in an increasingly knowledge-driven economy.

References

Alfano, V., Gaeta, G. and Pinto, M. (2021), "Non-academic employment and matching satisfaction among PhD graduates with high intersectoral mobility potential", International Journal of Manpower, Vol. 42 No. 7, pp. 1202-1223. https://doi.org/10.1108/IJM-10-2020-0489

Boman, J., Baginskaite, J., Sturtz, T., De Young Becker, E., Brecko, B., & Berzelak, N. (2017). 2017 Career Tracking Survey of Doctorate Holders. European Science Foundation (ESF), Science Connect. https://www.esf.org/fileadmin/user_upload/esf/F-FINAL-Career_Tracking_Survey_2017__Project_Report.pdf

Boulos, A. (2016) The labour market relevance of PhDs: an issue for academic research and policy-makers, Studies in Higher Education, 41:5, 901-913, https://doi.org/10.1080/03075079.2016.1147719

Chalari, A., & Koutantou, E.-I. (2021). Narratives of leaving and returning to homeland: The example of Greek brain drainers living in the UK. Sociological Research Online, 26(1), 3–20. https://doi.org/10.1177/1360780420965981

Chaleta, E., & Semedo, C. (2025). Doctoral studies in Portugal. ACADEMIA, 38, 91-105. https://doi.org/10.26220/aca.5077

Daouli, J., Demoussis, M., Giannakopoulos, N., Lampropoulou, N. (2015). "The Ins and Outs of Unemployment in the Current Greek Economic Crisis," South-Eastern Europe Journal of Economics, Association of Economic Universities of South and Eastern Europe and the Black Sea Region, vol. 13(2), pages 177-196. https://www.asecu.gr/old_files/Seeje/issue25/issue25-daouli-demoussis-giannakopoulos-lampropoulou.pdf

Deutsche Welle. (2019, December 28). Greece tries to stem brain drain. https://www.dw.com/en/greece-moves-to-end-brain-drain-with-high-paying-jobs/a-51787172

Dias Lopes, A., Hancock, S. International mobility after the PhD: exploring the characteristics and early labour market outcomes of UK doctoral graduates. High Educ (2024). https://doi.org/10.1007/s10734-024-01357-0

European Commission (2021a). After a PhD, what's next? CORDIS News. https://cordis.europa.eu/article/id/435708-after-a-phd-what-s-next

European Commission. (2021b). She Figures 2021: Gender in research and innovation : statistics and indicators. https://op.europa.eu/en/publication-detail/-/publication/67d5a207-4da1-11ec-91ac-01aa75ed71a1

European Commission. (2024a). She Figures 2024: Gender in research and innovation: statistics and indicators. Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/7646222f-e82b-11ef-b5e9-01aa75ed71a1/language-en

European Commission. (2024b). She Figures 2024: The road to gender equality in R&I. https://ec.europa.eu/assets/rtd/shefigures/2024/files/shefigures2024fiche-el.pdf

European Research Council (2021). ERC Gender Equality Plan 2021–2027. https://erc.europa.eu/sites/default/files/document/file/ERC_ScC_Gender_Equality_Plan_2021-2027.pdf

Germain-Alamartine, E., & Moghadam-Saman, S. (2020). Aligning doctoral education with local industrial employers' needs: a comparative case study. European Planning Studies, 28(2), 234–254. https://doi.org/10.1080/09654313.2019.1637401

Gougoulakis, P. (2025). Swedish doctoral education: Investment for innovation, international competitiveness and growth. ACADEMIA, 38 129-149. https://doi.org/10.26220/aca.5079

Hasgall, A., & Peneoasu, A.-M. (2022). Doctoral education in Europe: current developments and trends. European University Association – Council for Doctoral Education (EUA-CDE). Ανακτήθηκε από https://www.eua.eu/publications/reports/doctoral-education-in-europe-current-developments-and-trends.html

Hellenic Statistical Authority (ELSTAT). (2021). Population and Housing Census 2021. Permanent population by sex, educational level, and employment status. https://www.statistics.gr/el/statistics/-/publication/SAM04/2021

Hellenic Statistical Authority (ELSTAT). (2011). Population and Housing Census 2011. Permanent population by sex, educational level, and employment status. https://www.statistics.gr/el/statistics/-/publication/SAM04/2011

Hellenic Statistical Authority (ELSTAT). (2023). Definitions of employment and unemployment (Labour Force Survey methodology). Hellenic Statistical Authority. https://www.statistics.gr/documents/20181/6e824adf-042b-c3c6-2bcd-6cdf3d1c35ea

Herrera, L & Nieto, M. (2016) PhD careers in Spanish industry: Job determinants in manufacturing versus non-manufacturing firms. Technological Forecasting and Social Change, Elsevier, vol. 113(PB), pages 341-351 https://doi.org/10.1016/j.techfore.2015.09.019

Hnátková, E., Degtyarova, I., Kersschot, M., & Boman, J. (2022). Labour market perspectives for phd graduates in europe. European Journal of Education, 57(3), 395-409. https://onlinelibrary.wiley.com/doi/epdf/10.1111/ejed.12514

International Labour Organization (ILO). (2018). Resolution to amend the 19th ICLS resolution concerning statistics of work, employment and labour underutilization. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40dgreports/%40stat/documents/normativeinstrument/wcms_230304.pdf

Jones, M. (2018). Contemporary trends in professional doctorates. Studies in Higher Education, 43(5), 814–825. https://doi.org/10.1080/03075079.2018.1438095

OECD (2022). OECD Employment Outlook 2022. OECD Publishing. https://doi.org/10.1787/1bb305a6-en

Kindsiko, E. and Vadi, M. (2018). Career patterns of doctoral graduates: evidence from estonia. Trames Journal of the Humanities and Social Sciences, 22(2), 105. https://doi.org/10.3176/tr.2018.2.01

Labrianidis, L., Sachini, E., Karampekios, N. (2022). Geographical, scientific and professional mobility of Greek doctorate holders, EKT, Athens. https://metrics.ekt.gr/en/publications/553

National Documentation Centre (EKT). (2015). Careers and Mobility of Doctorate Holders in Greece - Edition 2015, Athens: National Documentation Centre. https://metrics.ekt.gr/en/publications/105

National Documentation Centre (EKT). (2022). The participation of women in Research and Development in Greece, a new study by EKT. https://www.ekt.gr/en/news/27182

National Documentation Centre. (2023). Statistical data on PhD holders who graduated from Greek universities in 2022. https://www.ekt.gr/en/news/29869

National Science Foundation, National Center for Science and Engineering Statistics (NCSES). (2021). U.S. Residing Doctoral Scientists and Engineers Report Modest Professional Impacts from the Coronavirus Pandemic: Findings from the 2021 Survey of Doctorate Recipients. Ανακτήθηκε από https://new.nsf.gov/reports/statistics/us-residing-doctoral-scientists-engineers-report-modest

Passaretta, G., Trivellato, P., Triventi, M. (2018) Between academia and labour market–the occupational outcomes of PhD graduates in a period of academic reforms and economic crisis. Higher Education 77(3). https://doi.org/10.1007/s10734-018-0288-4

Pham, T. (2023): What really contributes to employability of PhD graduates in uncertain labour markets?, Globalisation, Societies and Education, https://doi.org/10.1080/14767724.2023.2192908

Pizzolato, D., Elizondo, A., Bonn, N., Taraj, B., Roje, R., & Konach, T. (2023). Bridging the gap – how to walk the talk on supporting early career researchers. Open Research Europe, 3, 75. https://doi.org/10.12688/openreseurope.15872.1

Pouliakas, Konstantinos and Livanos, Ilias (2008): The Gender Wage Gap as a Function of Educational Degree Choices in an Occupationally Segregated EU Country (Greece). https://mpra.ub.uni-muenchen.de/19166/

Psacharopoulos, G. (2016). The value of an academic degree in Greece: A comparative study. Open Journal of Social Sciences, 4(4), 65–75. https://file.scirp.org/Html/9-1760819_64952.htm

Robinson-Garcia, N., Cañibano, C., Woolley, R., & Costas, R. (2016). Tracing scientific mobility of Early Career Researchers in Spain and The Netherlands through their publications. https://arxiv.org/pdf/1606.00155

Sala-Bubaré, A., García-Morante, M., Castelló, M., & Weise, C. (2023). Phd holders' working conditions and job satisfaction in spain: a cross-sector comparison.. https://doi.org/10.21203/rs.3.rs-2566196/v1

Stamelos, G., Vassilopoulos, A., Kavasakalis, A., & Diakhaté, A. (2025). Doctoral studies in Greece within the European Higher Education Area: Convergences and challenges. ACADEMIA, 38, 69-90. https://doi.org/10.26220/aca.5076

Triguero, Á., & Suárez, M. J. (2024). Education and employment in Spain: Effects of economic crises on inequality. arXiv preprint. https://arxiv.org/abs/2407.04437

University of Helsinki. (2023, March 22). High satisfaction and low unemployment among University of Helsinki graduates. Retrieved from https://www.helsinki.fi/en/news/university/high-satisfaction-and-low-unemployment-among-university-helsinki-graduates

Van den Brink, M., & Benschop, Y. (2014). Gender in Academic Networking: The Role of Gatekeepers in Professorial Recruitment. Journal of Management Studies, 51(3), 460–492. https://doi.org/10.1111/joms.12060

Appendix A

Table A1:

Chi-Square Test Results for the Association Between Occupational Status and Gender among PhD Holders in Greece

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	5,483[a]	1	,019		
Continuity Correction[b]	5,450	1	,020		
Likelihood Ratio	5,490	1	,019		
Fisher's Exact Test				,020	,010
Linear-by-Linear Association	5,483	1	,019		
N of Valid Cases	114800				
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 10651,93.					
b. Computed only for a 2x2 table					

Table A2:

Symmetric Measures of Association Between Occupational Status and Gender among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	-,007	,019
	Cramer's V	,007	,019
N of Valid Cases		114800	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			

Table A3:
Chi-Square Test Results for the Association Between Occupational Status and Census Year among PhD Holders in Greece

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	920,514[a]	1	,000		
Continuity Correction[b]	920,077	1	,000		
Likelihood Ratio	944,704	1	,000		
Fisher's Exact Test				,000	,000
Linear-by-Linear Association	920,506	1	,000		
N of Valid Cases	114800				

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 9883,93.
b. Computed only for a 2x2 table

Table A4:
Symmetric Measures of Association Between Occupational Status and Census Year among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	,090	,000
	Cramer's V	,090	,000
N of Valid Cases		114800	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			

Table A5:
Chi-Square Test Results for the Association Between Gender and Economically Active among PhD Holders in Greece

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	39,222[a]	2	,000
Likelihood Ratio	38,699	2	,000
Linear-by-Linear Association	25,179	1	,000
N of Valid Cases	87335		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 401,01.			

Table A6:
Symmetric Measures of Association Between Gender and Economically Active among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	,021	,000
	Cramer's V	,021	,000
N of Valid Cases		87335	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			

Table A7:
Chi-Square Test Results for the Association Between Census Year and Economically Active among PhD Holders in Greece

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	317,329[a]	2	,000
Likelihood Ratio	306,703	2	,000
Linear-by-Linear Association	262,950	1	,000
N of Valid Cases	87335		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 395,09.			

Table A8:
Symmetric Measures of Association Between Census Year and Economically Active among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	,060	,000
	Cramer's V	,060	,000
N of Valid Cases		87335	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			

Table A9:
Chi-Square Test Results for the Association Between Gender and Economically Inactive among PhD Holders in Greece

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	2515,915[a]	4	,000
Likelihood Ratio	2641,239	4	,000
Linear-by-Linear Association	65,666	1	,000
N of Valid Cases	27466		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 208,07.			

Table A10:
Symmetric Measures of Association Between Gender and Economically Inactive among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	,303	,000
	Cramer's V	,303	,000
N of Valid Cases		27466	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			

Table A11:
Chi-Square Test Results for the Association Between Genus Year and Economically Inactive among PhD Holders in Greece

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	835,941[a]	4	,000
Likelihood Ratio	761,851	4	,000
Linear-by-Linear Association	225,001	1	,000
N of Valid Cases	27466		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 154,36.			

Table A12:
Symmetric Measures of Association Between Genus Year and Economically Inactive among PhD Holders in Greece

		Value	**Approx. Sig.**
Nominal by Nominal	Phi	,174	,000
	Cramer's V	,174	,000
N of Valid Cases		27466	
a. Not assuming the null hypothesis.			
b. Using the asymptotic standard error assuming the null hypothesis.			