ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Research Article *Araştırma Makalesi* DOI: 10.16951/trendbusecon.1473077

Higher Education and Unemployment in Turkey: Regional Panel Analysis with Undergraduate, Master's, and PhD Perspectives

Türkiye'de Yükseköğretim ve İşsizlik: Lisans, Yüksek Lisans ve Doktora Düzeyinde Bölgesel Panel Veri Analizi

Yahya ALGÜL[1]

[1] Erzurum Technical, University Faculty of Economics and Administrative Sciences, Erzurum, Türkiye

ABSTRACT

In the past two decades, Turkey has experienced a noteworthy increase in the establishment of universities and enrollment of students across various degree programs. However, this surge in higher education has been accompanied by a growing number of unemployed higher education graduates. To address this phenomenon, this research conducts a comprehensive analysis of the relationship between different levels of tertiary education, undergraduate, master's, and Ph.D. (Doctorate) and unemployment. The study utilizes TurkStat's regional database, covering data from 26 provinces in Turkey spanning the years 2008 to 2021. Prior to delving into coefficient analysis, the Dumitrescu and Hurlin (2012) panel causality test was applied to identify the direction of potential causality and to establish an accurate model. The findings suggest a potential causal relationship running from being a higher education graduate, at all levels (bachelor's, master's, and PhD), to unemployment rate. Subsequently, to further scrutinize this relationship in light of causality findings, the Panel Augmented Mean Group estimator (AMG) was employed. The results indicate that a 1% increase in the total number of Bachelor's degree graduates is associated with a 1.16% increase in unemployment rate. Based on these findings, it can be argued that, instead of further investing in higher education, a policy approach targeting middle-skilled jobs through advanced investment in vocational high schools may be more cost-effective.

Jel Codes: E24, I23, J64

Keywords: Employment and Unemployment, Higher Education, Regional Economics, Turkey, Panel Causality, Panel Augmented Mean Group (AMG)

ÖZ

Türkiye'de 2000'li yıllardan itibaren açılmakta olan çok sayıdaki üniversiteyle birlikte yükseköğretimdeki öğrenci ve mezun sayılarında önemli bir artış yaşanmaktadır. Yükseköğrenimdeki bu yükselişin yanında, işsiz yükseköğretim mezunlarının sayısında da önemli bir artış gözlemlenmektedir. Bu olguyla ilgili olarak, bu araştırma yükseköğretimdeki lisans, yüksek lisans ve doktora gibi farklı mezuniyet düzeyleriyle, işsizlik oranı arasındaki ilişkiyi kapsamlı bir şekilde analiz etmektedir. Çalışma, 2008-2021 yıllarını kapsayan TÜİK'in Düzey iki bölgesel veri tabanını kullanmakta ve Türkiye'nin 26 bölgesini içermektedir. Katsayı analizine geçmeden önce potansiyel ilişkinin nedensellik yönünü tespit etmek ve doğru bir model kurabilmek için Dumitrescu ve Hurlin (2012) panel nedensellik testi uygulanmıştır ve bulgular her düzeyde (lisans, yüksek lisans ve doktora) yükseköğretim mezunluğundan işsizlik oranına doğru bir potansiyel nedenselliğe işaret etmektedir. Sonrasında, nedensellik bulguları ışığında bu ilişkiyi daha derinlemesine incelemek için Panel Genişletilmiş Ortalama Grup tahmincisi (AMG) kullanılmıştır. Sonuçlar, Lisans mezunlarının toplam sayısındaki %1'lik bir artışın işsizlik oranındaki %1,16'lık bir artışa neden olabileceğine işaret etmektedir. Bu bulgular temel alındığında, yükseköğretime daha fazla yatırım yapmak yerine, meslek lisesi odaklı ara eleman ve teknik eleman eğitimine yönelen bir politikanın işsizlikle mücadele ve kaynakların verimli kullanımı bağlamında daha etkin olabileceği değerlendirilmektedir.

Jel Kodları: E24, I23, J64,

Anahtar Kelimeler: İşsizlik ve istihdam, Yükseköğretim, Bölgesel İktisat, Türkiye, Panel Nedensellik, Panel Genişletilmiş Ortalama Grup tahmincisi (AMG)

Introduction

Education stands out as a crucial asset capable of fostering economic growth within any nation. Its significance has been consistently recognized since the era of the industrial revolution. With the advent of advanced production techniques involving machinery, a need emerged for a skilled workforce capable of adapting to the discipline of mass production. Furthermore, this workforce needed the ability to comprehend production systems and operate new machinery effectively.

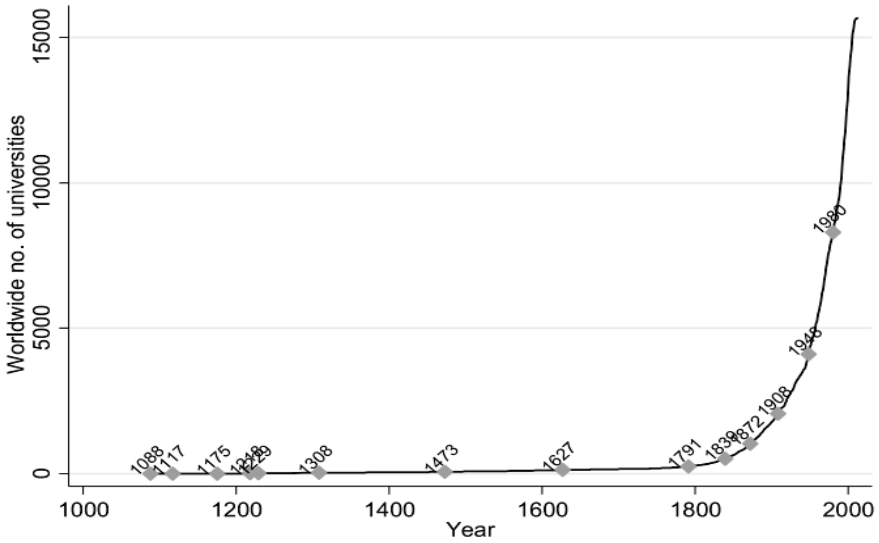
Nevertheless, its significance has witnessed a substantial rise in the contemporary era marked by the integration of computer and internet technologies. In this evolving landscape, beyond elementary and secondary education, higher education has emerged as a pivotal instrument. The rationale behind this shift lies in the acknowledgment that merely perpetuating existing production techniques is insufficient for sustained growth and development in this new era. Instead, it aligns with the well-articulated concept in Joseph Schumpeter's seminal work (1994), where he characterizes creative destruction as an ongoing process of industrial mutation

Geliş Tarihi/Received 09.12.2023
Kabul Tarihi/Accepted 08.01.2024
Yayın Tarihi/Publication Date 15.04.2024

Sorumlu Yazar/Corresponding author: Yahya ALGÜL
E-mail: yahya.algul@erzurum.edu.tr
Cite this article: Algul, Y. (2024). Higher Education and Unemployment in Turkey: Regional Panel Analysis with Undergraduate, Master's, and PhD Perspectives. *Trends in Business and Economics*, *38*(2), 128-136.

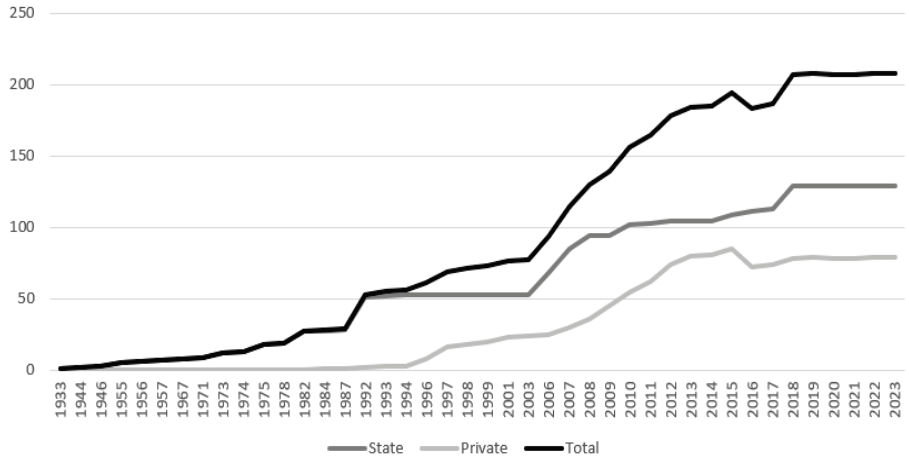
that revolutionizes the economic structure from within. This process incessantly dismantles the old while simultaneously giving rise to the new.

In the contemporary era, higher education facilitates the cultivation of intellectuals, researchers, critical thinkers, innovators, and entrepreneurs within societies, enabling the development of new, improved, and more efficient production methods to gain a competitive advantage against other economies and ensure sustained economic growth (Qazi et al., 2017). Consequently, the significance of higher education has heightened over the years, prompting countries to make substantial investments in this sector.



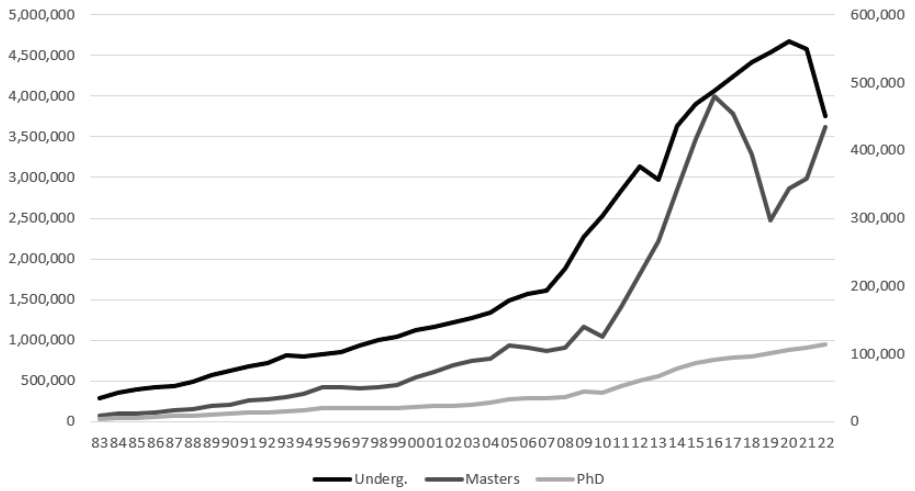
Source: (Valero and Van Reenen, 2019)
Figure1: *Total Number of Universities Globally*

This trend is clearly illustrated in Figure 1, depicting a rapid increase in the total number of universities from the early 19th century. Notably, the figures have surged dramatically since the early 20th century, with the number of universities per 1 million population globally rising from 0.7 in the mid-19th century to nearly 2.5 in the early 21st century (Valero and Van Reenen, 2019).



Source: (Günay and Günay, 2011; THEC)
Figure2 *The Number of Higher Education Institutions in Turkey*

A similar situation is evident in Turkey as it is seen in figure2, albeit with a slight delay compared to global examples. For instance, Istanbul University, the first university in Turkey, was established in 1933, and by 1982, the total number of universities had only reached 27, all of which were state universities (Günay and Günay, 2011). According to the Turkish Higher Education Council (THEC) statistics, in 1984, there were only 28 state universities, with the first private university founded in late 1984, bringing the total to 29 universities (THEC). However, by 2023, this number had surged to 129 state universities, 79 private universities, totaling 208 institutions—a 617% increase in the overall number of higher education institutions in just 39 years. Concurrently, there has been a substantial rise in the number of students across various degree programs in universities, as illustrated in Figure 3. Detailed data on the number of students and graduates for different degree programs from 1983 to 2022 can be found in Appendix 1: Total Number of Students and Graduates in Turkey table.



Notes: *The left axis denotes the total number of undergraduate students, while the right axis represents the total number of Master's and PhD students.*
***Source**: (THEC)*

Figure 3 *Total Number of Students in Turkey*

The implementation of supply-side policies led to a substantial increase in the number of higher education institutions and degree programs. The surge in the number of higher education students is also attributable to robust demand-side policies in Turkey. The appeal and strength of these policies are evident in various forms, such as the growing availability of state dormitories and affordable food options, either provided free of charge or at a nominal cost for state university students. Additionally, a significant proportion of state university students receive monthly scholarships, grants, or state-supported higher education credits. Notably, Turkish students attending state universities are exempt from paying tuition or fees, rendering their university education essentially cost-free. Consequently, in comparison to their Western counterparts, Turkish students graduate with minimal or no debt.

Given the conducive environment in Turkish higher education, one might inquire whether this scenario has positively impacted the unemployment issue in Turkey. Examining Figure 3, it is evident that, until the 1970s, unemployment generally remained below 5%, even during periods such as the Great Depression and World War II. However, post the 1970s, unemployment exhibited a gradual upward trend, with a pronounced surge occurring after the turn of the millennium, coinciding with a significant increase in the number of universities. Notably, this escalating trend in unemployment persisted despite Turkey's record growth rates, particularly following the adoption of an export-oriented trade regime in the 1980s.

Source: Data for the period from 1923 to 1987 is derived from Kafkas (2014), as cited in Apaydın (2018). Data from 1988 to 2022 is obtained from the Turkish Statistical Institute, Labor Statistics (TurkStat).
Notes: The unemployment rate data for the year 2023 is inclusive up to September.

Figure 4 *Unemployment Rates in Turkey*

In exploring the literature to grasp the underlying dynamics of this noteworthy situation, various assumptions and arguments emerge. Among the oldest and more commonly cited explanations are rooted in Human Capital Theory. Human capital refers to the skills or abilities acquired through education and training that enhance the productivity and value of labor. While the initial roots of human capital theory can be traced back to Adam Smith's writings, the concept gained prominence in the 1950s and 1960s through the works of economists like Jacob Mincer, Gary Becker, Theodore Schultz, and others (Goldin, 2016). The human capital theory posits that individuals, by enhancing their skills and abilities through education, can experience reduced unemployment and increased employment stability (Cairó and Cajner, 2018).

While the majority of studies investigate the impact of education in general on unemployment rates, there are considerably fewer studies that specifically explore the role of higher education in influencing

unemployment. These studies present varying perspectives, with some supporting the human capital arguments and others proposing opposing viewpoints. For instance, Qazi and colleagues (2017), based on the findings of various cointegration tests, assert that the development of higher education has a noteworthy negative impact on unemployment rates. Another study by Hermannsson et al. (2021), conducted as a macro-panel study of European countries, concludes that higher education plays a mitigating role in addressing youth unemployment. Similarly, Núñez and Livanos (2010), through an analysis of Labour Force Survey data across Europe, suggest that higher education is likely to decrease unemployment rates.

Conversely, a relatively large number of studies have elucidated the nature of the relationship in an opposing manner. For instance, Erdem and Tugcu (2012), utilizing the ARDL approach, have deduced that in Turkey, higher education may contribute to an increase in the unemployment rate, both in the short and long run. Similarly, Kettunen (1997), employing a Finnish microeconomic database, has found that while obtaining the lowest degree of additional education may augment the likelihood of reemployment, the highest level of education is associated with a decrease in the odds of reemployment.

Likewise, Li et al. (2014) reached a conclusion through the use of the difference-in-difference methodology, suggesting that the robust expansion of higher education in China could potentially elevate the unemployment rate for young university graduates. Similar results have been identified in some other studies as well (Foley, 1997; Schomburg, 2000; Woodley and Brennan, 2000; Moreau and Leathwood, 2006). On the other hand, some investigations, examining both the short run and long run, have yielded mixed results. For instance, Xing et al. (2018) concluded that higher education is likely to increase unemployment rates in the short run, although this negative effect diminishes significantly after five years. Comparable findings were also obtained by Dănăcică et al. (2023) in the context of Romania.

Plümper and Schneider (2007) approached the issue from a distinct perspective. The authors suggested that, as students in education are not counted in the labor force, German states intentionally increased the number of university students without allocating sufficient budget for higher education, thereby reducing unemployment rates for political motives. This assertion is characterized as Fiscal Opportunism, where states, without incurring a budget deficit to address unemployment, exploited higher education as a tool for political influence. However, this process ultimately led to both underfunded universities and higher unemployment rates. Consequently, a review of various studies indicates a lack of a clear consensus on the impact of higher education on unemployment.

Upon reviewing the existing literature, certain gaps have become evident, and these gaps serve as the primary motivation for undertaking this study. Firstly, the utilization of regional macro panel data for analysis stems from the absence of studies in the literature that investigate the relationship between higher education and unemployment in Turkey at the regional level. This gap is not unique to Turkey; globally, there isn't any considerable research conducted at the regional or provincial level. Secondly, in Turkey, geographical regions significantly differ from one another in terms of socioeconomic and cultural factors. For instance, by the end of 2022, the TRB2 region (Van, Muş, Bitlis, Hakkari) exhibited the highest unemployment rate at 19.2%, while the lowest unemployment rate was observed in the TR82 region (Kastamonu, Çankırı, Sinop) at 6.2% (TurkStat2). This considerable threefold difference in unemployment rates is mirrored in the status of higher education. According to TurkStat, in the Ankara region, 26.3% of the population has completed higher education, whereas this ratio is only 12.3% in the TRA2 region (Ağrı, Kars, Iğdır, Ardahan). Consequently, the substantial variations among regions in Turkey enhance the significance of the findings from this study.

Thirdly, a majority of studies in the literature rely on micro databases. However, micro studies may not be suitable for addressing macro-level demand issues, particularly in underdeveloped and developing economies. Since, even if the entire young population is provided with the highest education opportunities available, there may not be a robust growth and industrial environment to generate sufficient labor demand and create employment opportunities for all. Hence, for these reasons, this study utilizes macroeconomic panel regional data.

Furthermore, for the first time, a comprehensive analysis of the impact of various levels of tertiary education—undergraduate, master's, and Ph.D.—on unemployment is conducted. This represents a significant and original contribution to the broader literature and holds particular relevance for the Turkish context. As illustrated in Appendix 1, the total number of undergraduate, master's, and Ph.D. students has increased by more than 13, 47, and 26 times, respectively, since 1983. This trend, while perhaps not as pronounced in Turkey as in other regions, may be indicative of a global pattern where individuals are increasingly pursuing education beyond the undergraduate level. When considering this against the backdrop of markedly elevated unemployment rates, particularly among the youth, recorded at 19.4% at the close of 2022 (TurkStat), the examination of the distinct effects of master's and Ph.D. education on unemployment amplifies the significance of this study.

Following this introductory section, the subsequent methodology section employs a province level two-form macro panel dataset encompassing 26 regions of Turkey over the period from 2008 to 2021 to examine the relationship between higher education and unemployment. For empirical analysis, Dumitrescu and Hurlin's (2012) Panel Causality Tests are applied to all independent variables, and the Panel Augmented Mean Group (AMG) estimator is utilized. The Results section then presents the empirical findings. Finally, the conclusion section draws upon these empirical findings to provide interpretations and offer policy suggestions.

Methodological Framework

Data and descriptive statistics

The data utilized in this research spans the timeframe from 2008 to 2021, encompassing 14 years of annual data at the regional level. The data was sourced from the Turkish Statistical Institute's (TurkStat) Regional Statistic Database, specifically in the regional level 2 format, comprising 26 NUTS (Nomenclature of Territorial Units for Statistics) regions in Turkey and in all analyses, the Stata software package was employed. The variables examined include unemployment rates, agricultural gross domestic product at current prices (2009), gross domestic product for the service sector at current prices (2009), gross domestic product for the industrial sector at current prices (2009), total number of Bachelor's degree graduates, total number of master's degree graduates, and total number of doctorate (PhD) degree graduates. Additionally, total GDP and employment variables were obtained and employed as instruments for productivity, calculated by dividing total GDP by total employment. Given the diverse range of variables, all were transformed into logarithmic form for analysis. Table 1 provides descriptive statistics for the variables considered in this study.

Table 1: *Descriptive Statistics*

	Obs.	Mean	Std. Dev.	Minimum	Maximum
Employment(1000)	364	998.69	898.13	259	5899
Gdp(1000TL)	364	1.06e+08	1.97e+08	5927116	2.20e+09
Productivity(GDP/Employment)	364	85229.44	56741.83	18816.24	380929.9
Gdp(Agriculture, 1000TL)	364	6860703	5177807	421197	2.89e+07
Gdp(Industry, 1000TL)	364	3.00e+07	5.27e+07	545284	5.32e+08
Gdp(Service, 1000TL)	364	5.72e+07	1.26e+08	3200761	1.43e+09
Unemployment(%)	364	10.69	4.66	3.40	33.50
Higher Education Graduates	364	294294.5	356958.3	19084	2586331
Master Graduates	364	26435.53	46533.93	1195	370978
PhD Graduates	364	6205.10	9360.663	238	58231

Methods

To thoroughly explore the connection between higher education, graduate-level programs (such as Master's and Ph.D. degrees), and unemployment, it is imperative to examine the cross-sectional dependency and homogeneity status of observations. Given that, unlike cross-country panel data studies, the 26 regions of Turkey may exhibit close integration in various aspects, several tests are applied to assess these aspects. The Breusch and Pagan (1980) LM test, the Pesaran, Ullah, and Yamagata (2008) bias-adjusted LM test, and Pesaran (2004) CD tests are employed. The Pesaran, Ullah, and Yamagata (2008) bias-adjusted LM test is utilized when the homogeneity assumption is satisfied, whereas the Pesaran (2004) CD test is applicable in both homogenous and heterogenous slope cases.

The Delta test, developed by Pesaran and Yamagata (2008), is designed to evaluate whether the slope coefficients and constant terms of all variables are uniformly distributed across all observations. The fundamental formula for assessing slope heterogeneity, as proposed by Pesaran and Yamagata (2008), can be represented as follows (Azam and Haseeb, 2021).

$$\Delta_{SH} = (N)^{\frac{1}{2}}(2k)^{\frac{1}{2}}\left(\frac{1}{N}\mathrm{S}-\mathrm{k}\right) \quad (1)(\text{Azam and Haseeb, 2021})$$

$$\Delta_{SH} = (N)^{\frac{1}{2}}\left(\frac{2k(T-k-1)}{T+1}\right)^{\frac{1}{2}}\left(\frac{1}{N}S-2\mathrm{k}\right) \quad (2)(\text{Azam and Haseeb, 2021})$$

The application of cross-sectional dependence tests and homogeneity tests is essential in selecting an appropriate unit root test and cointegration test. Subsequently, following the confirmation of data properties related to homogeneity and cross-sectional dependency, the subsequent step involves the implementation of a suitable unit root test to assess the existence of a valid long-run relationship among all variables. Pesaran (2007) introduced a method for testing unit root conditions known as the cross-sectionally augmented IPS test (CIPS), which is based on the average of CADF statistics. A notable characteristic of this test is its robustness in yielding reliable results even in the presence of cross-sectionally dependent panels. The unit root test is employed to examine the sequential incorporation of variables among the variables (Ali et al., 2020).

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} CADF_i \quad (3)\ (\text{Shahbaz, et. al., 2018})$$

CIPS is estimated with the 3rd equation where $CADF_i$ is the cross sectionally augmented Dickey–Fuller test for the i_{th} cross sectional piece set by the t ratio of ρ_i in the CADF regression (Shahbaz, et. al., 2018).

Following the unit root tests, a panel cointegration test is employed to assess the presence of long-term relationships among variables. In cases where all series exhibit a unit root relation in their first difference (I(1)), second-generation tests are deemed more appropriate than first-generation tests. This preference arises from the second-generation tests' ability to handle cross-sectional dependency among variables (Çetin and Bakırtaş, 2022). The Westerlund (2005) Panel Cointegration test is utilized in this study. In this process the mean of the series across panels is calculated, and the subtraction of this mean from the series is employed in the calculations. This error-correction procedure ensures the robustness of results even in the presence of cross-sectional dependence situations (Levin et al., 2002; Halkos and Tsirivis, 2023).

Education is widely recognized as a crucial component of human capital. Consequently, conventional models often attribute unemployment, beyond macroeconomic conditions, to a lack of education. However, the current trend of unemployment among higher education graduates raises concerns about potential reverse causality between education level and unemployment. To explore this, the Dumitrescu and Hurlin (2012) panel causality test is employed. This test serves a dual purpose: first, to ascertain the existence of a causality relationship, and second, to determine the direction of causality among different variables related to unemployment. The preference for the Dumitrescu and Hurlin test is rooted in its improved nature compared to the Granger causality test, as it accounts for heterogeneity among panels. The Dumitrescu and Hurlin test considers two stationary series and the subsequent linear panel regression models elucidated in equations 4 and 5. It posits the null hypothesis of homogeneous non-causality against the alternative hypothesis of heterogeneous non-causality (Albaladejo et al., 2023).

$$y_{it} = \alpha_i + \sum_{j=1}^{p}\gamma_i^{(j)}y_{i,t-j} + \sum_{j=1}^{p}\beta_i^{(j)}x_{i,t-j} + \varepsilon_{yit} \quad (4)(\text{Albaladejo, et. al, 2023})$$

$$x_{it} = \delta_i + \sum_{j=1}^{p}\theta_i^{(j)}x_{i,t-j} + \sum_{j=1}^{p}\lambda_i^{(j)}y_{i,t-j} + \varepsilon_{xit} \quad (5)(\text{Albaladejo, et. al, 2023})$$

Subsequently, after the confirmation of cointegration relationships among the variables through cointegration tests, the Panel Augmented Mean Group (AMG) estimator is employed to conduct long-run coefficient estimations based on the main model of the study, as elucidated in equation (6).

$$UNEMP_{i,t} = \alpha_0 + \beta_1 AGRGDP_{i,t} + \beta_2 INDGDP_{i,t} + \beta_3 SERGDP_{i,t} + \beta_4 PROD_{i,t} + \beta_5 HE_{i,t} + \beta_6 MASTER_{i,t} + \beta_7 PHD_{i,t}\,\epsilon_{i,t} \quad (6)$$

The variables UNEMP, AGRGDP, INGDP, SERGDP, PROD, HE, MASTER, and PHD represent unemployment, agricultural GDP, industrial GDP, service sector GDP, productivity, higher education graduates, master's degree graduates, and PhD graduates, respectively, as previously explained. In this study, the Panel Augmented Mean Group (AMG) Estimator, developed by Eberhardt and Teal (2010), is chosen. This selection is based on the robustness of results it provides in the presence of panel heterogeneity and cross-sectional dependency.

While other estimators, such as Pesaran's (2006) common correlated effects mean group estimator (CMG), can be used in cases of heterogeneity and cross-sectional dependency, the AMG estimator is preferred due to its specific advantages. Unlike the CMG estimator, which treats time-variant unobservable factors as nuisances, the AMG estimator can discern differences between temporal and general dynamics (Pesaran, 2006; Shahbaz et al., 2018). As a result, the AMG estimator has the capability to consider common factors that are not directly observable (Dineri, 2020).

Empirical Results and Findings

Prior to presenting the estimation results, it is essential to report the outcomes of preliminary tests, such as the cross-sectional dependence test and homogeneity test. These tests serve as guides in the empirical research process, helping to determine the most appropriate methodology for the given data. The results of the cross-sectional dependence tests are presented in Table 2.

Table 2: *Cross-Sectional Dependence Tests*

	LM Test		LM Adj.		LM CD	
	Statistics	p-value	Statistics	p-value	Statistics	p-value
Gdp(Agriculture)	1483	0.00*	84.78	0.00*	32.99	0.00*
Gdp(Industry)	1570	0.00*	91.38	0.00*	34.43	0.00*
Gdp(Service)	1530	0.00*	88.15	0.00*	33.2	0.00*
Productivity	1521	0.00*	87.57	0.00*	32.74	0.00*
Higher Education Graduates	1596	0.00*	93.22	0.00*	36.17	0.00*
Master Graduates	1576	0.00*	91.72	0.00*	34.27	0.00*
PhD Graduates	1573	0.00*	91.68	0.00*	35.6	0.00*

Note: *implies signifcance level at 1% under the H0: Cov(uit,ujt) = 0 for all t and i!=j

The outcomes of the LM, LM Adj., and LM CD tests indicate robust cross-sectional dependence. In this context, cross-sectional dependency suggests that shocks originating from diverse sources and types in one of the 26 regions may impact the other regions as well. In situations where panels exhibit considerable heterogeneity, as observed in this case, assuming a priori homogeneity of slopes may result in biased estimates (Breitung, 2005). To examine the homogeneity condition of variables, the Delta test is conducted, and the test results are presented in Table 3.

Table 3: *Slope Homogeneity Analyzes*

	Gdp(Agr)	Gdp(Ind)	Gdp(Ser.)	Prod.	Higher Edu.	Master	PhD
Δ	1.98	2.09	2.58	2.43	3.11	2.97	3.45
p-value	0.04**	0.03**	0.01**	0.01**	0.00*	0.00*	0.00*
Δ_{adj}	2.24	2.35	2.92	2.75	3.50	3.35	3.90
p-value	0.02**	0.01**	0.00*	0.00*	0.00*	0.00*	0.00*

Note: *, ** implies significance level at 1% and 5% respectively, under H0: slope coefficients are homogenous.

Given that the null hypothesis (H0) of homogeneous slope is not accepted at a 1% level of significance, as evident in Table 3, it indicates that the slope coefficients of parameters are not homogeneous across the panel. Cross-sectional dependence and homogeneity tests are also instrumental in selecting an appropriate unit root test and cointegration test. Upon understanding the data properties, the subsequent step involves applying a suitable unit root test to examine the existence of a valid long-run relationship among all variables. The results of the CIPS unit root test are presented in Table 4.

Table 4: *CIPS Unit Root Tests*

	Level		1st Difference	
	CIPS Statistic	Critical Value	CIPS Statistic	Critical Value
Unemployment	-2.12***	-2.07	-3.33*	-2.34
Gdp(Agriculture)	-2.83*	-2.34	-4.21*	-2.34
Gdp(Industry)	-2.04	-2.07	-2.97*	-2.34
Gdp(Service)	-2.20**	-2.17	-3.41*	-2.34
Productivity	-2.27**	-2.17	3.30*	-2.34
Higher Education Graduates	-1.89	-2.07	-3.97*	-2.34
Master Graduates	-1.95	-2.07	-2.99*	-2.34
PhD Graduates	-2.23**	-2.17	-3.80*	-2.34

Note: *, **, *** implies significance level at 1%, 5% and 10% respectively, under H0 (homogeneous non-stationary): $b_i = 0$ for all i

The statistical analysis reveals that the agricultural GDP variable exhibits stationarity at a significance level of 1%, while variables associated with GDP in the service sector, productivity, and the number of PhD graduates show stationarity at a 5% significance level. Additionally, the unemployment variable demonstrates stationarity at a 10% significance level, whereas the remaining variables do not exhibit stationarity at the level. However, when examining first differences, all variables display stationarity at a 1% significance level. This suggests that the long-term coefficient estimates are robust, reliable, and meaningful, eliminating the necessity for further scrutiny of panel cointegration (Xia et al., 2022).

However, to double check these findings, a Westerlund (2005) panel cointegration test was conducted. This test, being grounded in error-correction, mitigates cross-section dependence effects and yields

superior size accuracy and increased power compared to residual-based co-integration tests like those of Pedroni (Çetin and Bakırtaş, 2022). The results of the Westerlund (2005) panel cointegration test indicate a p-value of 0.02. Rejecting the null hypothesis of no cointegration implies that certain panels exhibit cointegration.

Following the confirmation and verification of the co-integration status of the variables, the outcomes of the Dumitrescu and Hurlin (2012) panel causality test for all variables are detailed in Table 6. Despite the insights provided by the Panel Augmented Mean Group (AMG) coefficient estimation process regarding the interrelationships among variables, the application of the Dumitrescu and Hurlin (2012) panel causality test is employed to emphasize and corroborate the causal relationships.

Table5: *Dumitrescu and Hurlin (2012) Panel Causality Test*

	Ind. Var. ⇒ Unemp			Unemp ⇒ Ind. Var.			Causality
	W Bar	Zbar(p)*	ZbarT(p)**	WBar	Zbar(p)*	ZbarT(p)**	
Gdp(Agriculture)	5.57	9.10(0.00)	3.30(0.00)	1.98	3.53(0.00)	1.72(0.08)	**Unemp ⇔ Gdp(Agr)**
Gdp(Industry)	5.63	9.25(0.00)	3.37(0.00)	6.15	10.58(0.00)	3.99(0.00)	**Unemp ⇔ Gdp(Ind)**
Gdp(Service)	1.18	0.66(0.50)	-0.15(0.87)	6.42	11.27(0.00)	4.31(0.00)	**Unemp ⇒ Gdp(Ser.)**
Productivity	1.06	0.24(0.80)	-0.42(0.66)	5.05	7.79(0.00)	2.68(0.00)	**Unemp ⇒Prod.**
Higher Edu.Grad.	5.79	9.68(0.00)	3.57(0.00)	2.66	1.69(0.08)	-0.15(0.87)	**Unemp ⇐ Higher**
Master Grad.	4.33	5.96(0.00)	1.83(0.06)	0.70	-1.04(0.29)	-1.27(0.20)	**Unemp ⇐ Master**
PhD Grad.	5.21	8.20(0.00)	2.88(0.00)	1.12	0.43(0.66)	-0.30(0.76)	**Unemp ⇐ PhD**

Note: For optimal number of lags Akaike information criterion (AIC) is used. * implies Z-bar (p-value). ** implies Z-bar tilde (p-value)

As per the results of the Dumitrescu and Hurlin (2012) panel causality test, a reciprocal causal relationship is identified between changes in the unemployment rate and changes in the GDP of the agricultural sector. Similarly, bidirectional causation is observed in the case of the industrial GDP variable. Concerning the GDP in the service sector, the causal relationship is unidirectional, indicating that changes in the unemployment rate lead to changes in the GDP of the service sector. In the case of the productivity variable, causation is established from the unemployment rate to productivity. Lastly, across all variables related to educational levels—total number of higher education graduates, Master's degree graduates, and PhD degree graduates—the causal relationship is from the total number of graduates to the unemployment rate. This implies that alterations in the total number of graduates at any level prompt changes in the unemployment rate.

Finally, the results of the Panel Augmented Mean Group (AMG) model estimation are presented in Table 7. The chi-squared statistics indicate that the model as a whole is statistically significant. According to the estimation outcomes, a 1% increase in agricultural GDP corresponds to a 0.27% reduction in the unemployment rate—a predictable outcome given the pivotal role of labor as a production input, with an increase in production expected to lead to a decrease in the unemployment rate.

In the case of the industrial and service sectors, a 1% growth in production is associated with a 0.49% and 1.26% decrease in the unemployment rate, respectively. A noteworthy observation pertains to the service sector, where the most substantial impact on the unemployment rate is observed. This aligns with expectations, as service sectors typically exhibit higher labor intensity compared to other sectors. Consequently, the expansion of service-related sectors is likely to generate more employment opportunities and contribute to a decline in the unemployment rate.

The estimations reveal a positive correlation between productivity and unemployment, indicating that a 1% increase in productivity is linked to a 1.76% rise in unemployment. This observation is noteworthy as it may align with an expectation that the adoption of more efficient and technologically advanced production techniques tends to reduce the demand for labor. Consequently, it is logically anticipated that productivity and the unemployment rate are positively correlated, exhibiting a simultaneous increase.

Examining the results pertaining to education variables, the higher education variable exhibits statistical significance at the 1% level. Specifically, a 1% increase in the total number of Bachelor's degree graduates corresponds to a 1.16% increase in unemployment. Similarly, a positive relationship is observed for the Master's degree variable, although the findings do not attain statistical significance. Conversely, for the PhD variable, contrary outcomes are noted, indicating a decrease in unemployment as the total numb0er of PhD graduates increases. However, given the lack of statistical significance, these results do not carry meaningful implications.

Table 6: *Panel AMG Coefficient Estimations Results*

Prob > chi^2= 0.00	Coefficient	Std. Error	z	P>|z|	[95% Conf. Interval]	
Agrgdp	-0.27	0.14	-1.94	0.05**	-0.55	0.00
Indgdp	-0.49	0.28	-1.75	0.08***	-1.05	0.06
Sergdp	-1.26	0.48	-2.62	0.00*	-2.21	-0.31
Prod	1.76	0.33	5.21	0.00*	1.09	2.42
He	1.16	0.40	2.86	0.00*	0.36	1.96
Master	0.65	0.44	1.46	0.14	-0.22	1.52
PhD	-0.81	0.52	-1.55	0.12	-1.83	0.21
__00000R_c	1.15	0.17	6.74	0.00	0.81	1.48
Constant	3.49	2.38	1.46	0.14	-1.18	8.16

Note: Variable __00000R_c refers to the common dynamic process. *, ** and *** implies significance level at 1%, 5% and 10% respectively.

Conclusion

In Turkey, the issue of unemployment, particularly among higher education graduates, has become an escalating concern. Causality analysis indicates that there is a causal relationship running from being a higher education graduate, at all levels (bachelor's, master's, and Ph.D.), to unemployment. This implies that alterations in the total number of graduates across these levels lead to corresponding changes in the unemployment rate. Additionally, the results from the Panel Augmented Mean Group (AMG) estimator suggest that an increase in the number of graduates with a bachelor's degree is associated with a concurrent increase in the unemployment rate.

As previously discussed, at the micro level, widespread access to higher education may yield significant benefits for individuals, encompassing various cultural, social, and psychological advantages, and for the economy, contributing to overall productivity. However, in the absence of a robust macro-level economic growth capacity, the labor market may struggle to absorb the surplus of highly educated individuals. Furthermore, the impact of unemployment on higher education graduates can be particularly severe compared to those with less education. This is due to the substantial sunk costs incurred by higher education graduates, both in financial terms and in terms of the years dedicated to their education. Additionally, changing careers after a certain age is challenging in Turkey, given the explained macro-level issues, making it difficult for individuals to transition to new professions. Consequently, investing significant financial resources and years in the higher education for all of this young population, can be viewed as a potential misallocation of national wealth.

A more effective policy strategy could involve emphasizing the importance of vocational high schools and providing increased budgets and opportunities to support them. This recommendation aligns with the prevailing sentiment in public opinion, indicating that, beyond higher-skilled roles such as engineering and teaching, there is a substantial demand for middle-skilled jobs in Turkey. Furthermore, implementing policies to cultivate an industrial environment in higher value-added sectors, particularly through collaboration with the private sector, where entry barriers exist, and competitiveness with international peers is limited, has the potential to enhance employment opportunities for individuals with higher education. Failure to adopt such targeted measures, as elucidated by Plümper and Schneider (2007), may result in the short-term benefits of higher education as a cost-effective tool to combat unemployment being outweighed by the potential emergence of larger segments of unemployed and highly educated individuals in the long run.

Peer-review: Externally peer-reviewed.
Declaration of Interests: The author declare that have no competing interest.
Funding: None
Hakem Değerlendirmesi: Dış bağımsız.
Çıkar Çatışması: Yazar çıkar çatışması bildirmemiştir.
Finansal Destek: Yok

References

Albaladejo, I. P., Brida, J. G., González-Martínez, M. I., & Segarra, V. (2023). A new look to the tourism and economic growth nexus: A clustering and panel causality analysis. *The World Economy*, 46(9), 2835-2856. [CrossRef]

Ali, M., Raza, S. A., & Khamis, B. (2020). Environmental degradation, economic growth, and energy innovation: evidence from European countries. *Environmental Science and Pollution Research*, 27, 28306-28315. [CrossRef]

APAYDIN, F. (2018). Türkiye'de İşsizliğin Karakteristiklerinin Karşılaştirmali Analizi. *Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, (30), 159-200. [CrossRef]

Azam, M., & Haseeb, M. (2021). Determinants of foreign direct investment in BRICS-does renewable and non-renewable energy matter?. *Energy Strategy Reviews*, 35, 100638. [CrossRef]

Breitung, J. (2005). A parametric approach to the estimation of cointegration vectors in panel data. *Econometric Reviews*, 24(2), 151-173. [CrossRef]

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The review of economic studies*, 47(1), 239-253. [CrossRef]

Cairó, I., & Cajner, T. (2018). Human capital and unemployment dynamics: Why more educated workers enjoy greater employment stability. *The Economic Journal*, 128(609), 652-682. [CrossRef]

Çetin, M. A., & Bakırtaş, İ. (2022). The Mitigating Role of Renewable Energy Sources on the Welfare Cost of Air Pollution in APEC Countries, *Journal of Abant Social Sciences*, 22(1), 277-292. [CrossRef]

Dănăcică, D. E., Babucea, A. G., Paliu-Popa, L., Bușan, G., & Chirtoc, I. E. (2023). The Nexus between Higher Education and Unemployment—Evidence from Romania. *Sustainability*, 15(4), 3641. [CrossRef]

Dineri, E. (2020). Are Number Of Tourist Arrivals The Driving Force Of Economic Growth in Mediterranean Countries?: Augmented Mean Group Estimator. *Kahramanmaraş Sütçü İmam University Journal of Social Sciences*, 17 (2), 987-1006. [CrossRef]

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic modelling*, 29(4), 1450-1460. [CrossRef]

Eberhardt, M., & Teal, F. (2010). Productivity Analysis in Global Manufacturing Production. *Department of Economics (University of Oxford).* [CrossRef]

Erdem, E., & Tugcu, C. T. (2012). Higher Education and Unemployment: a cointegration and causality analysis of the case of Turkey. *European Journal of Education*, 47(2), 299–309. [CrossRef]

Foley, M. C. (1997). Determinants of unemployment duration in Russia. Center Discussion Paper no. 779. Yale University. [CrossRef]

Goldin, Claudia. 2016. "Human Capital." In Handbook of Cliometrics, ed. Claude Diebolt and Michael Haupert, 55-86. Heidelberg, Germany: Springer Verlag. [CrossRef]

Günay, D., & Günay, A. (2011). 1933'den Günümüze Türk Yükseköğretiminde Niceliksel Gelişmeler. *Yükseköğretim ve Bilim Dergisi*, (1), 1-22. [CrossRef]

Halkos, G. E., & Tsirivis, A. S. (2023). Sustainable Development of the European Electricity Sector: Investigating the Impact of Electricity Price, Market Liberalization and Energy Taxation on RES Deployment. *Energies*, 16(14), 5567. [CrossRef]

Hermannsson, K., Scandurra, R., & Graziano, M. (2021). The Effect of Higher Education on Youth Unemployment in European Regions During a Period of Economic Instability. *Journal of Education Finance*, 46(4), 477-495. [CrossRef]

Kafkas, E. Timur, (2014), "Avrupa Birliği İşsizlikle Mücadele Stratejisi Işığında Türkiye İçin İşsizlik Sorununda Yeni Bir Paradigma: Çalışma Kredisi", *Çalışma ve Sosyal Güvenlik Bakanlığı Yurtdışı Hizmetleri, Uzmanlık Tezi*. [CrossRef]

Kettunen, J. (1997). Education and unemployment duration. *Economics of education review*, 16(2), 163-170. [CrossRef]

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of econometrics*, 108(1), 1-24. [CrossRef]

Li, S., Whalley, J., & Xing, C. (2014). China's higher education expansion and unemployment of college graduates. *China Economic Review*, 30, 567-582. [CrossRef]

Moreau, M., & Leathwood, C. (2006). Graduates' employment and the

discourse of employability: a critical analysis. *Journal of Education and Work*, 19(4), 305–324. [CrossRef]

Núñez, I., & Livanos, I. (2010). Higher education and unemployment in Europe: an analysis of the academic subject and national effects. *Higher Education*, 59(4), 475–487. [CrossRef]

Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. SSRN. 572504. [CrossRef]

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, 74(4), 967-1012. [CrossRef]

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of applied econometrics*, 22(2), 265-312. [CrossRef]

Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. Journal of econometrics, 142(1), 50-93. [CrossRef]

Pesaran, M. H., Ullah, A., & Yamagata, T. (2008). A bias-adjusted LM test of error cross-section independence. *The econometrics journal*, 11(1), 105-127. [CrossRef]

Qazi, W., Raza, S. A., & Sharif, A. (2017). Higher education development and unemployment in Pakistan: Evidence from structural break testing. *Global Business Review*, 18(5), 1089-1110. [CrossRef]

Schomburg, H. (2000). Higher education and graduate employment in Germany. *European Journal of Education*, 35(2), 189-200. [CrossRef]

Schumpeter, J. A., (1994). Capitalism, Socialism And Democracy. *Routledge*. ISBN 0-203-26611-0.

Shahbaz, M., Shahzad, S. J. H., Mahalik, M. K., & Sadorsky, P. (2018). How strong is the causal relationship between globalization and energy consumption in developed economies? A country-specific time-series and panel analysis. *Applied Economics*, 50(13), 1479-1494.

THEC, Turkish Higher Education Council, https://istatistik.yok.gov.tr/ accessed 02.12.2023

Plümper T. & Christina J. Schneider (2007) Too much to die, too little to live: unemployment, higher education policies and university budgets in Germany, *Journal of European Public Policy*, 14:4, 631-653, [CrossRef]

TurkStat, Labor Statistics, https://www.tuik.gov.tr/, Accessed: 02.12.2023

TurkStat2, İşgücü İstatistikleri Haber Bülteni, 2022, https://data.tuik.gov.tr/Bulten/Index?p=Isgucu-Istatistikleri-2022-49390 accesed: 04.12.2023

Valero, A., & Van Reenen, J. (2019). The economic impact of universities: Evidence from across the globe. *Economics of Education Review*, 68, 53-67. [CrossRef]

Westerlund, J. (2005). New Simple Tests for Panel Cointegration. *Econometric Reviews*, 24(3), 297–316. [CrossRef]

Woodley, A., & Brennan, J. (2000). Higher education and graduate employment in the United Kingdom. *European Journal of Education*, 35(2), 239-249. [CrossRef]

Xia, W., Doğan, B., Shahzad, U., Adedoyin, F. F., Popoola, A., & Bashir, M. A. (2022). An empirical investigation of tourism-led growth hypothesis in the european countries: evidence from augmented mean group estimator. *Portuguese Economic Journal*, 1-28. [CrossRef]

Xing, C., Yang, P., & Li, Z. (2018). The medium-run effect of China's higher education expansion on the unemployment of college graduates. *China Economic Review*, 51, 181-193. [CrossRef]

Appendix 1: *Total Number of Students and Graduates in Turkey*

	Total Number of Students				Total Number of Graduates			
Years	**Voc. Sch**	**Underg.**	**Masters**	**PhD**	**Voc. Sch**	**Underg.**	**Masters**	**PhD**
1983	34873	287447	9059	4336	7523	27621	1099	676
1984	45642	352543	11215	5577	8920	30960	1473	805
1985	53076	396338	12285	5443	10964	32900	1831	522
1986	55767	425883	14078	6702	14551	43297	2184	504
1987	59195	435986	16884	7732	17560	51000	3449	812
1988	66785	484933	18171	8887	17418	54732	3397	626
1989	62255	573574	22456	10593	12470	61124	3327	787
1990	71399	624311	25006	11705	14785	64066	3839	1006
1991	75828	673022	30615	12838	16570	65215	4189	1437
1992	132571	716249	33442	13949	18590	66556	4318	1351
1993	260196	812116	35797	14752	23669	70374	4611	1358
1994	294358	801712	41012	16025	35989	78323	5051	1456
1995	326116	824021	49853	19673	50820	82142	5409	1614
1996	355984	857181	51320	19427	57556	88753	8050	2094
1997	382208	940137	49123	19996	69696	96001	7529	1870
1998	375099	999358	50979	20367	75059	112978	8318	2356
1999	366260	1045988	53547	19543	74261	124393	8515	2567
2000	382491	1117740	65068	21739	79408	130954	7939	2113
2001	401277	1158761	73466	22514	87018	145553	9554	1975
2002	564610	1215121	82277	23176	98689	167233	13713	2458
2003	549981	1271013	90057	24835	104105	178806	16367	2805
2004	597586	1345409	92566	27335	102345	186474	21747	2664
2005	666808	1488362	111814	32503	109855	195330	23892	2827
2006	698283	1566653	108683	33711	128257	201181	27642	2581
2007	729884	1616003	104028	34879	145532	221831	31805	3339
2008	855465	1876363	109281	35669	154532	243352	28681	3744
2009	1023228	2273145	139463	44407	176028	260076	33571	4235
2010	1078489	2521095	125690	42938	222139	287557	42603	4659
2011	1249227	2834699	168156	51468	202881	283059	27489	4617
2012	1505754	3140835	217588	59763	222980	338902	25704	4462
2013	1502067	2977211	265895	67157	242574	406215	35097	4551
2014	2013762	3628800	342101	78223	287830	399049	41842	4516
2015	2285406	3900601	417084	86094	294029	458564	43713	5192
2016	2555926	4071579	480215	91267	316034	437446	43290	6052
2017	2768757	4241841	454673	95100	295500	454207	48683	6045
2018	2829430	4420699	394174	96199	316465	454995	67067	7332
2019	3002964	4538926	297001	101242	310938	486200	86251	8069
2020	3114623	4676657	343569	106148	474619	569702	60828	7598
2021	3250101	4579047	358271	109540	512212	575654	70396	8857
2022	2647054	3754095	434485	114508	335060	477253	80634	10726

Source: (THEC)

GENİŞLETİLMİŞ ÖZET

Türkiye'de 2000'li yıllardan itibaren açılmakta olan çok sayıdaki üniversiteyle birlikte yükseköğretimdeki öğrenci ve mezun sayılarında önemli bir artış yaşanmaktadır. Yükseköğrenimdeki bu yükselişin yanında, işsiz yükseköğretim mezunlarının sayısında da önemli bir artış gözlemlenmektedir. Literatür incelendiğinde bu konuyla ilgili araştırılması gereken önemli boşluklar olduğu gözlemlenmiştir ki, bu durum çalışmanın temel motivasyonunu oluşturmaktadır. Öyle ki, ne global düzeyde, ne de Türkiye için yükseköğretim ile işsizlik arasındaki ilişkiyi bölgesel düzeyde inceleyen kayda değer çalışma gözlenememiştir. Ayrıca literatürdeki çalışmaların önemli bir kısmı mikro veri analizine dayanmaktadır. Fakat mikro düzeydeki çalışmalar, özellikle az gelişmiş ve gelişmekte olan bölgelerde, makro düzeydeki talep yetersizliği gibi sorunlardan kaynaklı ilişkileri anlayabilmek için yetersizdir. Zira, bir ülkedeki tüm nüfusa mümkün olan en yüksek eğitim imkanları sağlansa dahi, eğer o ülkede tüm emek arzını karşılayabilecek güçlü ve sürdürülebilir bir büyüme ve sanayi iklimi yoksa, işsizlik problemi yaygın bir şekilde görülebilir. Dolayısıyla, bu çalışmada yükseköğretim ve işsizlik arasındaki ilişki makro panel veri analiz yöntemleriyle incelenmiştir. Son olarak literatürde yükseköğretimin lisans, yüksek lisans ve doktora gibi farklı düzeyleri için yapılan kayda değer çalışma bulunamamıştır. Dolayısıyla, bu önemli eksikliği giderebilmek için, bu çalışmada yükseköğretimdeki lisans, yüksek lisans ve doktora gibi farklı mezuniyet düzeyleriyle, işsizlik oranı arasındaki ilişki kapsamlı bir şekilde incelenmiştir.

Çalışma, 2008-2021 yıllarını kapsayan TÜİK'in Düzey iki bölgesel veri tabanını kullanmakta ve Türkiye'nin 26 bölgesini içermektedir. Bu maksatla kullanılan değişkenler, tümü logaritmik formda olmak üzere, bölgesel işsizlik oranları, 2009 yılı sabit fiyatlarıyla tarımsal gayri safi yurt içi hasıla, hizmet sektörü için gayri safi yurt içi hasıla, sanayi sektörü için gayri safi yurt içi hasıla, toplam lisans mezun sayısı, toplam yüksek lisans mezun sayısı ve toplam doktora (PhD) mezun sayısı yer almaktadır. Ayrıca, toplam GSYİH ve istihdam değişkenleriyle hesaplanan verimlilik katsayısı kullanılmıştır. Katsayı analizine geçmeden önce potansiyel ilişkinin nedensellik yönünü tespit etmek ve doğru bir model kurabilmek için Dumitrescu ve Hurlin (2012) panel nedensellik testi uygulanmıştır ve bulgular her düzeyde (lisans, yüksek lisans ve doktora) yükseköğretim mezunluğundan işsizlik oranına doğru tek yönlü bir potansiyel nedenselliğe işaret etmektedir. Ayrıca, işsizlik oranı ile tarımsal ve sanayiye dayalı GSYİH arasında çift yönlü nedensellik izlenirken, işsizlik oranından hizmet sektörüne dayalı GSYİH ile verimlilik katsayısına doğru tek yönlü bir nedensellik ilişkisi tespit edilmiştir.

Nedensellik bulguları ışığında bu ilişkiyi daha derinlemesine incelemek için Panel Genişletilmiş Ortalama Grup tahmincisi (AMG) kullanılmıştır. Chi2 testi sonuçlarından izleneceği üzere kurulan model tümüyle istatistiksel olarak anlamlıdır. Sonuçlar, lisans mezunlarının toplam sayısındaki %1'lik bir artışın işsizlik oranındaki %1,16'lık bir artışa neden olabileceğine işaret etmektedir. Diğer yandan, yüksek lisans mezuniyeti ile işsizlik oranı arasında pozitif yönlü ve doktora mezuniyeti ile işsizlik oranı arasında ise negatif yönlü bulgular tespit edilse de sonuçlar istatistiksel olarak anlamlı değildir. Ayrıca bulgulara göre verimlilik düzeyinde %1lik bir artışın işsizlik oranı üzerinde %1,76 düzeyinde artış yaratabileceğine işaret etmektedir. Yine Panel AMG modeli bulgularına göre tarımsal, sanayi ve hizmet sektörlerindeki GSYHİ oranlarında %1'lik bir artış, işsizlik oranlarında sırasıyla %0,27, %0,49 ve %1,26'lık düşüşe işaret etmektedir. GSYİH'deki bir artışın işsizlik oranlarını azaltması beklenen bir sonuçtur. Özelikle hizmet sektöründeki etkinin diğerlerine kıyasla daha büyük olması hizmet sektörünün emek yoğun doğasından kaynaklanabileceği söylenebilir. Tüm bu bulgular temel alındığında, yükseköğretime daha fazla yatırım yapmak yerine, meslek lisesi odaklı ara eleman ve teknik eleman eğitimine yönelen bir politikanın işsizlikle mücadele ve kaynakların verimli kullanımı bağlamında daha etkin olabileceği değerlendirilmektedir.